KINGSINE

KS833 Standard Power & Calibrator

Instruction Manual

Version 2.0



KINGSINE ELECTRIC AUTOMATIONCO., LTD.

Attention

1. For higher output precision, DC voltage output is four-wire output, the wiring is as follows, and see Fig 1 for the definitions of o, p, q, r.

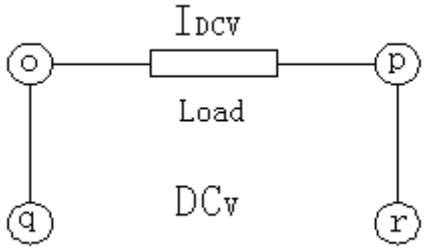


Fig 1

2. Self-locking will be activated for AC/DC Current/Voltage overload, if the system gives a prompt of Overload Warning, you will hear alarm sound at the same time. Press OK, the alarm sound will be stopped. You can restart the test after correcting the fault. If the system is self-locked, please turn it off and reboot it.

3. When measuring 2-element active, reactive and power, Ub and Uo should be shorted.

4. No non-technical person should be allowed to enter the place when conducting calibration using the standard source, or the instrument output precision will be affected.

5. Number key can realize stepping function which same as rotary encoder, details as follows

1:+10% 2:+1% 3:+0.1% 4:+0.01% 5:+0.001%

6:-10% 7:-1% 8:-0.1% 9:-0.01% 0:-0.001%

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1. Brief Introduction

KS833 Standard Power & Calibrator applies the latest embedded system, DSP Very Large Scale field programmable FPGA, advanced software system, high-power PAM (power amplifier module), large LCD displayer, and imported components and ICs. With its advanced technology, multi-function, small and portable size, with its superb performance and strong function, KS833 has been welcomed by our customers.

2. Functions

a） Used for calibrating indicating instruments, AC acquisition units, multimeters, FTU, RTU, electrical measuring transducers.

b） Built-in Grade 0.05 high precision voltage, current, phase, power, power factor, harmonic meters;

c） Standard output (Grade 0.05) of voltage, ampere, phase, active power, cross-phase reactive power and real reactive power.

d） Output current, voltage, power, phase and harmonic for closed-loop control, to ensure low wandering & annual stability rate.

e） Calibrating electrical energy meters (Grade 0.1)

f） Standard output at Grade 0.1 for 1^{st} -19^{th} harmonics, and standard output of Grade 0.2 for 20^{th} -31^{st} harmonics;

g） Work mode: instrument calibration output mode and standard source output mode;

h） Built-in RS232 interfaces, software upgrading and data transfer can be done without opening the box;

i） The software can perform self-calibration, and can calibrate the electrical measuring parameters without opening the box;

j） The software can perform auto fault detector and indicate the defect location;

k） Large LCD display, all Chinese pop-up menus for these operations: 1. rotary encoder operation, 2. soft touch keyboard operation, and 3. operation under Windows on PC;

l） Storage capacity up to 1,000 calibrated meters' data.

m） Through software you can round off the calibrated data, print verification report and calibration data.

3. Main Technical Parameters of KS833 Series

3.1 Main Technical Parameters of KS833 (Class 0.05) Products

a) Output & measure AC voltage

Available steps: 10 V, 30 V, 100 V, 300 V, 750 V; automatic switch is possible between the steps.

Adjustment range: Step x (0 … 120) %

Adjustment fineness: Step x 0.01%

Resolving power: Step x 0.01%

Accuracy: 0.05%RG

Stability: 0.01% / 1min

b) Output & measure AC current

Available steps: 100 mA, 1 A, 5 A, 10 A, 25 A; automatic switch is possible between the steps.

Adjustment range: Step x (0 … 120) %

Adjustment fineness: Step x 0.01%

Resolving power: Step x 0.01%

Accuracy: 0.05%RG

Stability: 0.01% / 1min

c) Output & measure AC power

Adjustment fineness: Step x 0.01%

Resolving power: Step x 0.01%

Accuracy: 0.05%RG (F>0.5)

Stability: 0.01% / 1min

d) Output & measure AC voltage and current frequency

Frequency range: 45,000 … 65,000 Hz

Adjustment fineness: 0.001 Hz

Accuracy: 0.01%RD

e) Output & measure AC phase

Phase shift range: 0.00º …359.99º

Resolving power: 0.01º

Adjustment fineness: 0.01

Accuracy: 0.05º

f) Output & measure AC power factor

Output range: －1…0…＋1

Measuring accuracy: 0.0005

Adjustment fineness: 0.0001

g) Output & measure harmonic

Harmonic setting: 2…31

Harmonic content: voltage, current ≤30% (as against fundamental)

Harmonic output precision: 0.1% (1^{st}…19^{th}, as against fundamental)

0.2% (20^{th} …31^{st} ， as against fundamental)

Harmonic phase: 0…360º, adjustable

h) Distortion in AC voltage & current output

< 0.2% (non-capacitance load)

i) Max output load capacity of AC voltage & current

Voltage output 25 VA, current output 25 VA

j) Output & measure DC voltage

Steps available: 100 mV, 1 V, 10 V, 30 V, 100 V, 300 V, 750 V

Adjustment range: Step x (0 … 120) %, (0%...110% output range at Step 750 V)

Resolving power: Step x 0.01%

Adjustment fineness: Step x 0.01%

Accuracy: 0.05%RG

Stability: 0.01% / 1min

k) Output & measure DC current

Steps available: 1 mA, 10 mA, 100 mA, 1 A, 5 A, 10 A, 25 A

Adjustment range: Step x (0 … 120) %

Resolving power: Step x 0.01%

Adjustment fineness: Step x 0.01%

Accuracy: 0.05%RG

Stability: 0.01% / 1min

l) Max output load capacity of DC voltage & current

Voltage output 20 VA, current output 25 VA

m) Reference conditions for parameter test:

Ambient temperature: 22 ºC± 1 ºC

Working temperature: 0 ºC… 40 ºC, humidity: ≤85%

Working voltage range: 220 VAC±15%，50 Hz

3.2 Main Technical Parameters of KS833 (Class 0.1) Products

a) Output & measure AC voltage

Available steps: 10 V, 30 V, 100 V, 300 V, 750 V; automatic switch is possible between the steps.

Adjustment range: Step x (0 …120) %

Adjustment fineness: Step x 0.01%

Resolving power: Step x 0.01%

Accuracy: 0.1%RG

Stability: 0.02% / 1min

b) Output & measure AC current

Available steps: 100 mA, 1 A, 5 A, 10 A, 25 A; automatic switch is possible between the steps.

Adjustment range: Step x (0 … 120) %

Adjustment fineness: Step x 0.01%

Resolving power: Step x 0.01%

Accuracy: 0.1%RG

Stability: 0.02% / 1min

c) Output & measure AC power

Adjustment fineness: Step x 0.01%

Resolving power: Step x 0.01%

Accuracy: 0.1%RG (PF≥0.5)

Stability: 0.02% / 1min

d) Output & measure AC voltage and current frequency

Frequency range: 45.000 … 65.000 Hz

Adjustment fineness: 0.001 Hz

Accuracy: 0.02%RD

e) Output & measure AC phase

Phase shift range: 0.00º… 359.99º

Resolving power: 0.01º

Adjustment fineness: 0.01

Accuracy: 0.1º

f) Output & measure AC power factor

Output range: －1…0…＋1

Measuring accuracy: 0.001

Adjustment fineness: 0.0001

g) Output & measure harmonic

Harmonic setting: 2^{nd} …31^{st}

Harmonic content: voltage, current ≤30% (as against fundamental)

Harmonic output precision: 0.2% (as against fundamental)

Harmonic phase: 0…360º adjustable

h) Distortion in AC voltage & current output

< 0.5% (non-capacitance load)

i) Max output load capacity of AC voltage & current

Voltage output 25 VA, current output 25 VA

j) Output & measure DC voltage

Steps available: 100 mV, 1 V, 10 V, 30 V, 100 V, 300 V, 750 V

Adjustment range: Step x (0 … 120) %, (0%...110% output range at Step 750 V)
Resolving power: Step x 0.01%

Adjustment fineness: Step x 0.01%

Accuracy: 0.1%RG

Stability: 0.02% / 1 min

k) Output & measure DC current

Steps available: 1 mA, 10 mA, 100 mA, 1 A, 5 A, 10 A, 25 A

Adjustment range: Step x (0 … 120) %

Resolving power: Step x 0.01%

Adjustment fineness: Step x 0.01%

Accuracy: 0.1%RG

Stability: 0.02% / 1min

l) Max output load capacity of DC voltage & current

Voltage output 20 VA, current output 25 VA

m) Reference conditions for parameter test:

Ambient temperature: 22 ºC ± 1 ºC

Working temperature: 0 ºC… 40 ºC, humidity: ≤85%

Working voltage range: 220 VAC±15%，50 Hz

n) Size:

450 mm×380 mm×180 mm

o) Weight:

20 kg

3.3 KS833 Operation Panel

a —— Phase A - AC current output terminal - positive
b —— Phase A - AC current output terminal - negative

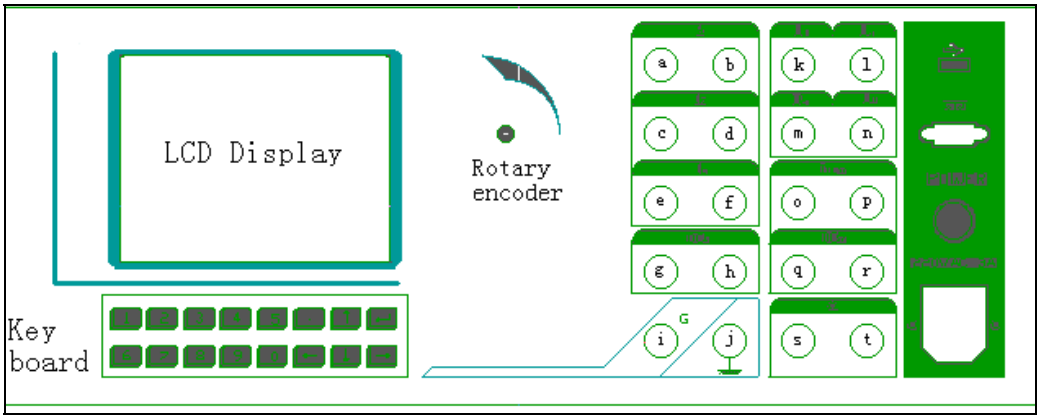


Fig.1 KS833 Operation Panel Interface

c —— Phase B - AC current output terminal - positive
d —— Phase B - AC current output terminal - negative
e —— Phase C - AC current output terminal - positive

f	——	Phase C - AC current output terminal - negative
g	——	DC current output terminal - positive
h	——	DC current output terminal – negative
i	——	Photo-electronic socket for calibrating electrical energy meters
j	——	Grounding port
k	——	Phase A - AC voltage output terminal - positive
l	——	Phase B - AC current output terminal - positive
m	——	Phase C - AC voltage output terminal - positive
n	——	Common low terminal for three-phase AC voltage
o	——	DC voltage input terminal - positive
p	——	DC voltage input terminal - negative
q	——	DC voltage output terminal - positive
r	——	DC voltage output terminal - negative
s、t	——	Transducer (DC input measuring)

3.4 System Configuration

KS833 Standard Power & Calibrator Instruments host	1 unit
Operating software for KS833 Standard Power & Calibrator	1 set
Cable	1 cable
Test wire for power industry	1 parcel
Special serial port cable	1 cable
Operating Instruction	1 copy
Al-alloy package	1
Portable computer (optional)	1 set
Matrix printer and printer cable (optional)	1 set
Computer software for instrument calibration (optional)	1 set

3.5 Maintenance & Service

Three-year guarantee of free repair of the host unit, and life-long maintenance for the equipment. Free software update and free training. Please refer to the printer manual for printer operation instructions.

4. Operation Interface

4.1 Welcome Interface

The following welcome interface will be displayed on start, press ENTER to go to the main menu.

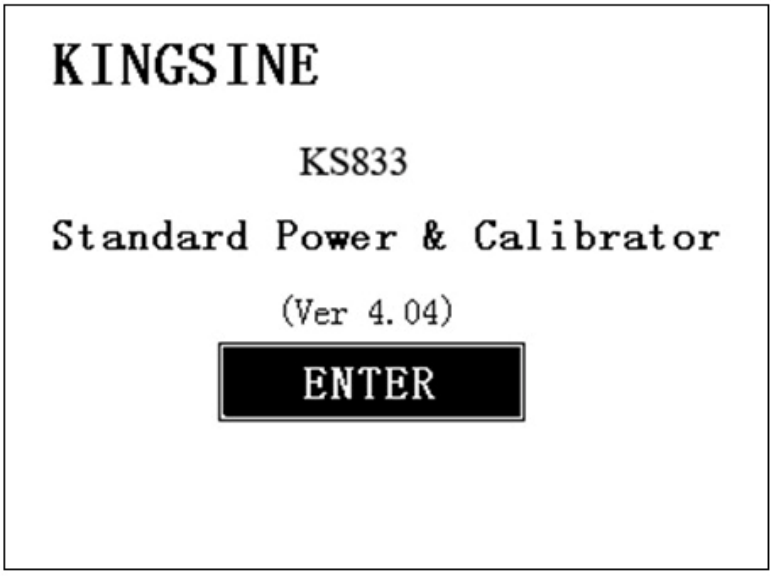


Fig. 4-1 Welcome interface

4.2 Main Menu

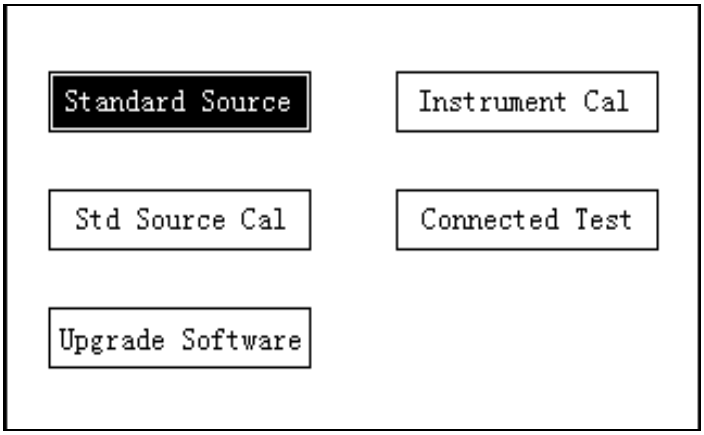


Fig. 4-2 Main menu

4.2.1 Brief Introduction

Six items are displayed on the main menu, you can select them by the following steps: press direction keys or turn the Rotary Encoder to move the cursor on the button you want, then press ENTER or press down the Rotary Encoder to enter corresponding menu; henceforward the above operations will be referred to as “press down xx button” in short.

Press down “Instrument Cal” button to enter KS833’s function module of instrument calibration; press down “Std Source Cal” button to enter KS833 standard source calibration; press down “Standard Source” button to enter KS833 standard source; press down “Connected test” to connect to host computer, which then controls the unit; press down “Upgrade Software” button to upgrade the software.

5. Multifunction Standard Source

5.1 Brief Introduction

KS833 multifunction standard source is composed of six parts: DC Standard Source, Single Phase Standard Source, Phase Standard Source, Three-phase Standard Source, Power Standard Source and Harmonic Standard Source; the interface is shown as below in Figure 5-1:

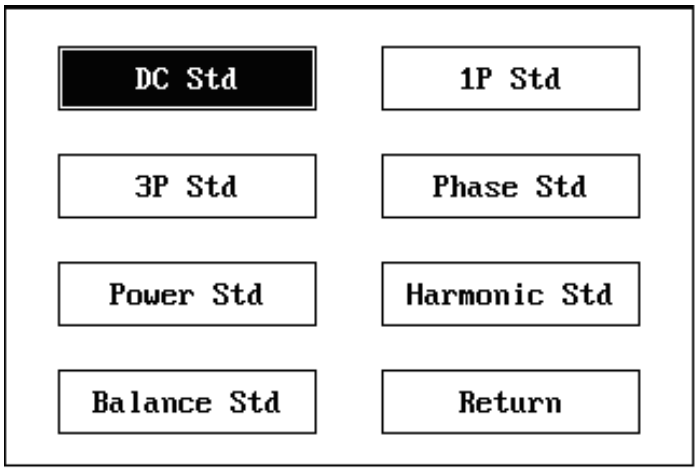


Fig. 5-1 KS833 Standard Source main interface

5.2 Operation Flow

Select Standard Source in the Main Menu to enter selections, click the button to select standard sources, or click Return to go back to Main Menu

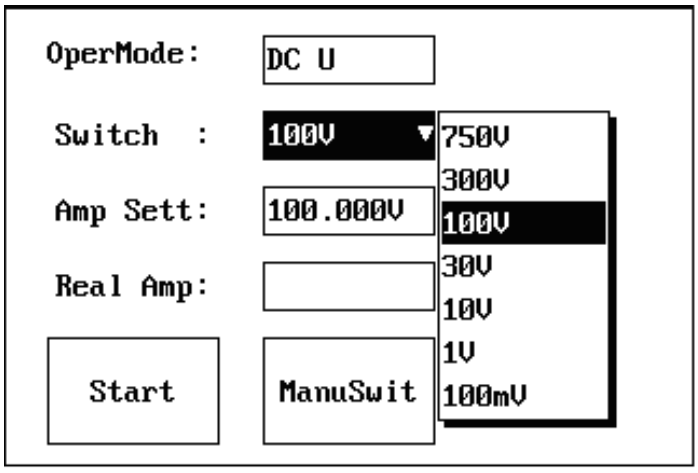


Fig. 5-2 KS833 DC Standard Source interface

5.2.1 DC Standard Source: see Figure 5-2 for its interface

5.2.1.1 Select output mode

Click the “OperMode” dropdown box, select “DC Voltage” or “DC Current.” When you select

"DC Voltage" or "DC Current", the output amplitude tagtext will automatically switch into output voltage or output current. The working amplitude tagtext will automatically switch into actual output voltage or output current. Working Step can switch between volt steps and amp steps according to different operation modes.

5.2.1.2 Select Working Step

Click on volt steps or amp steps (depending on different operation modes) and select the step you want, take into mind to select the step value closest to output value so that you can get higher output precision. Or turn on the Auto Switch to let the system select the step with highest precision according to output amplitude.

5.2.1.3 Set Voltage & Amp amplitude

In the edit box of Output Voltage or Output Current, input the volt or amp value you want the instrument to output. The applicable volt and amp range is 0%...120% (0%...110% output range at DC Voltage – Step 750 V), anything exceeding the range will be automatically truncated by the system.

5.2.1.4 Auto Switch & Manual Switch

Click Auto Switch button to toggle between auto switch and manual switch. When you enter Manual Switch, you can select working step by the Working Step dropdown box. When you enter Auto Switch, the Working Step dropdown box will be inaccessible, the system will automatically select working step for the user according to the input amplitude value.

5.2.1.5 Instrument Output

Click on "Start" button, a dialogue box will pop up, click OK to confirm and start test. After test starts, the button's tag text changes into Stop Test; the cursor's input center moves to Stop Test button. The system will, according to the Step amplitude, increase 1% progressively until it reaches the output value. During the output increasing process, you can click Enter to stop test at any time; the detailed procedure is the same as that of Stop Test.

5.2.1.6 Real-time Closed Loop Calibration

During the test, the instrument can automatically calibrate the output according to the load connected into it.

5.2.1.7 Actual Output Display

During test, the system can automatically collect actual output data and display it as it is at the moment in the text box for actual voltage (or actual current).

5.2.1.8 Overload Warning

During test, the instrument can automatically check its own load and the load connected into it, if the connection load exceeds its output load, the system will close all output and then give an overload warning; at the same time it will prompt the user with overload phase and sound alarm. You can click OK in the dialogue box to stop the alarm. You can restart the test after eliminating the fault.

5.2.1.9 Stop Test

When output is not needed from the instrument, you can click Stop Test button to stop, and the tagtext on the button will change into Start Test, a prompt for starting next test; meanwhile, the cursor's input focus changes to Start Test button. The system will according to the Step amplitude, decrease 1% progressively until the output becomes zero. During the process to stop test, the user cannot click Enter to cancel Stop Test; if you want to output

again, you have to wait till after test stops and then click Start Test button to restart test output.

5.2.1.10 On-line Adjustment

During test, the user can change output value at any time according to needs. Steps: move the cursor to Volt amplitude (Amp amplitude), click Enter to modify the amplitude, click Enter again, the instrument will step change the output to new amplitude. After that the same as Start Test, start closed loop calibration.

5.2.1.11 Return

Click Return to return to the upper page.

5.2.2 Single Phase AC Standard Source, see Figure 5-3 for its interface (Phase A output)

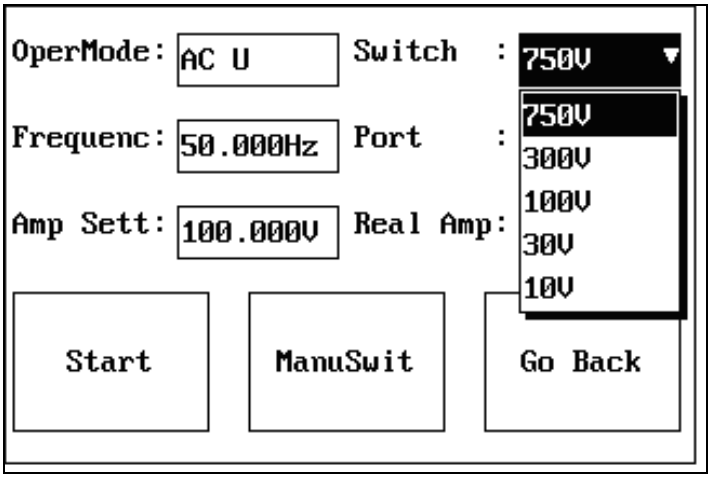


Fig. 5-3 KS833 Single Phase AC Standard Source interface

5.2.2.1 Same test procedure as that of DC Standard Source.

5.2.2.2 The text box of Output Port will display the amplitude of output voltage or current.

5.2.2.3 Set Working Frequency

You can set working frequency before test starts or during test. The frequency may change between 45Hz and 65Hz. The actual output amplitude will not be affected when you set the frequency.

5.2.3 Phase Standard Source: see Figure 5-4 for its interface

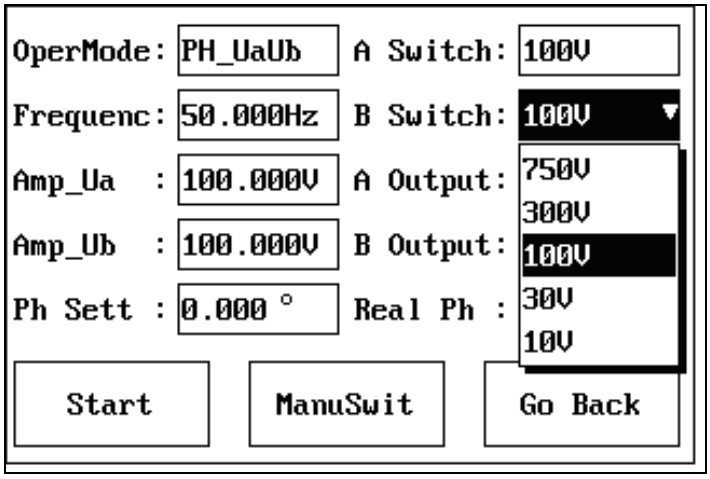


Fig. 5-4 KS833 AC Phase Standard Source interface

5.2.3.1 Select Operation Mode

Click the “OperMode” dropdown box, select UaUb Phase, Uala Phase or Ialb Phase positions. The instrument will output the voltage or ampere at the corresponding output terminal, the difference between two phases will be the phase value you need.

5.2.3.2 Select Working Step

Click Phase A Step and Phase B Step or volt step or amp step (depending on different operation modes) and select the step you want, take into mind to select the step value closest to output value so that you can get higher output precision. Or switch on the Auto Switch to let the system select the step with highest precision according to output amplitude.

5.2.3.3 Set Phase Value

In the edit box for output phase you can input the phase value you the instrument to output. Phase range: 0°...360°, the system automatically switch it into 0°...360° according to the user’s input.

5.2.3.4 Auto Switch & Manual Switch

Click Auto Switch button to toggle between auto switch and manual switch. When you enter Manual Switch, you can select step switch by the Working Step dropdown box, at the same time the edit box for inputting amplitude will be shielded. When you enter Auto Switch, the Working Step dropdown box will be inaccessible, the system will automatically select working step for the user according to the input amplitude value.

5.2.3.5 Instrument Output

Click Start Test button. Then Start Test button becomes unavailable, the tagtext changes into Testing; at the same time Stop & Void button becomes available, the tagtext changes into Stop Test. The system will step increase by 10° progressively until it reaches the output value.

5.2.3.6 Real-time Closed Loop Calibration

During the test, the instrument can automatically calibrate the output according to the load connected into it.

5.2.3.7 Actual Output Display

During test, the system can automatically collect actual output data and display it as it is at the moment in the text box for actual phase.

5.2.3.8 Overload warning: identical as 5.2.2.8

5.2.3.9 Stop Test: identical as 5.2.2.9

5.2.3.10 On-line Adjustment

During test, the user can change output value at any time according to needs. Steps: move the cursor to output phase, click Enter to modify the amplitude, click Enter again, the instrument will step change the output to new amplitude. After that the same as Start Test, start closed loop calibration.

5.2.3.11 Return

Click Return to return to the upper page.

5.2.4 Three-phase Standard Source: see Figure 5-5 for its interface

5.2.4.1 Select Output Port

Click Enter of your selection button, when the selected button displays “Yes”, which indicates the corresponding output port is effective, the instrument will be able to output voltage or current at that output port. When a “No” displayed, it indicates ineffectiveness of

that output port and hence no output at that port. Of which the Ua output port cannot be changed, and it is always effective.

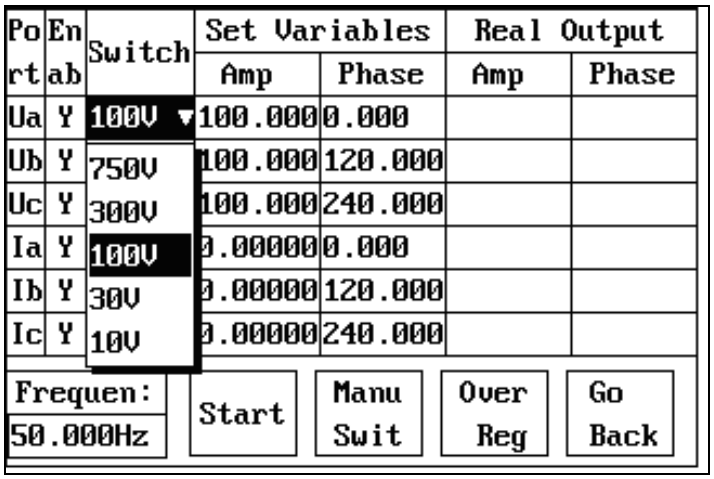


Fig. 5-5 KS833 Three-phase AC Standard Source interface

5.2.4.2 Change Working Step

Click Enter on the dropdown box of Working Step to select the working step you want, the selected Step is effective only for the corresponding output port, and different output ports and output simultaneously under different working steps.

5.2.4.3 Set Output Amplitude and Phase Of Voltage & Current

Input the amplitude and phase you want in the columns under variable output (in the same way as that of Single Phase Standard Source and Phase Standard Source). You may also use dropdown menu to input the amplitude and phase preset by the program (Remark: Ua's amplitude cannot be zero). Take the amplitude of Ub as an example:

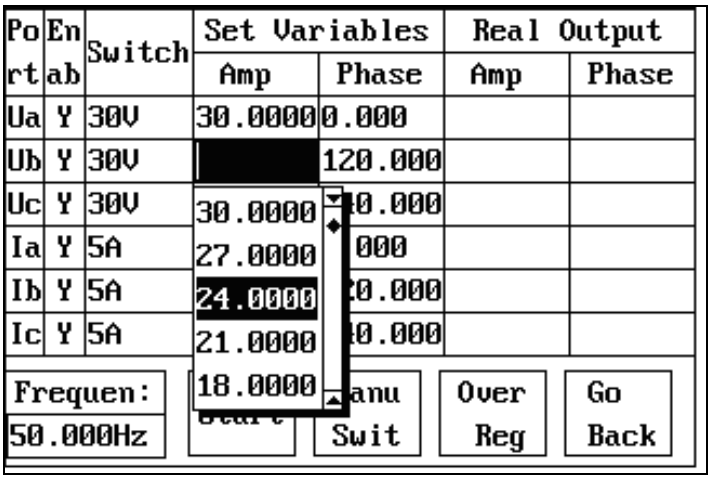


Fig. 5-6 Input variable under Three-Phase Standard Source

Move cursor to the set place and click Enter, then click "DOWN" of the direction keys, you'll see a dropdown menu as Fig. 5-6; select the value you want by using the direction keys and click Enter to confirm.

5.2.4.4 Set Working Frequency

Set the working frequency you want in the edit box of Working Frequency (45 Hz...65 Hz).

5.2.4.5 Auto Switch & Manual Switch

Click Manual Switch button to toggle between manual switch and auto switch. When you enter Manual Switch, you can switch working steps in the dropdown box of Working Step column; when you enter Auto Switch, the dropdown box of Working Step will not be usable, the system will automatically switch working steps according to the amplitudes set by the user. Manual Switch & Auto Switch are effective to all output ports simultaneously.

5.2.4.6 Overall Regulating & Phase Regulating

When the system displays Overall Regulating, the voltage & amp amplitudes of the three phases are equal. For instance, if you change Ua amplitude in Figure 5-6 into 20 V, then Ub and Uc amplitudes will automatically changed into 20 V. Click “Overall Regulating”, the key will turn into “Phase Regulating.” In Phase Regulating, there can be different amplitude for different phases. (Remark: in Overall Regulating, the phases will automatically have a difference of 120 degrees between them.)

5.2.4.7 Start Test

Click Start Test button, the instrument will output the voltage and current of each port in sequence according to step length. And the output value at the moment will be displayed in the text boxes of the amplitude and phase columns under Actual Output.

5.2.4.8 Real-time Closed Loop Calibration

During the test, the instrument can automatically calibrate the output according to the load connected into it.

5.2.4.9 On-line Adjustment: identical as 5.2.4.10

5.2.4.10 Fine Adjustment

Move cursor to the edit boxes of amplitude or phases, then turn the selection encoder, the figures will increase or decrease by step length of its minimum position.

5.2.4.11 Overload Warning

During test, the instrument can automatically check its own load and the load connected into it, if the connection load exceeds its output load, the system will close all output and then give an overload warning; at the same time it will prompt the user with overload phase and sound alarm. You can click OK in the dialogue box to stop the alarm. You can restart the test after eliminating the fault.

5.2.5 Power Standard Source: see Fig5-7 for its interface

5.2.5.1 Select Operation Mode

Click the dropdown box of Operation Mode to select different power output modes, which are available in seven modes: “3P4W Active Power” (3P4W short for “3 Phase 4 Wire”), “3P3W Active Power”, “1P Active Power”, “3P4W Real Reactive Power”, “3P3W Real Reactive Power”, “3 Element 90° Reactive Power”, “2 Element 90° Reactive Power.”

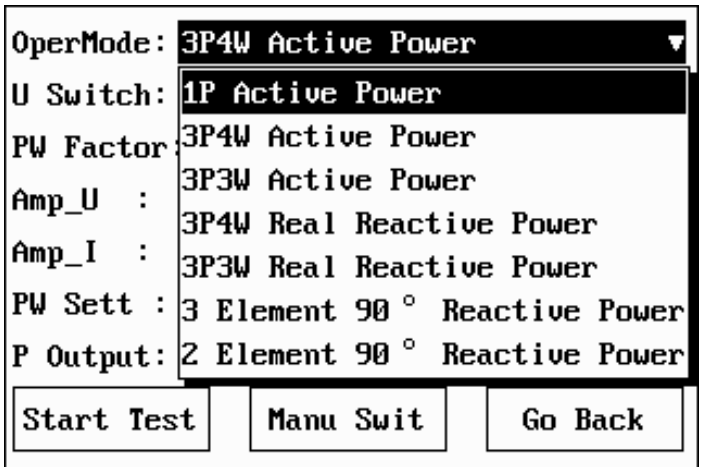


Fig. 5-7 KS833 Power Standard Source interface

5.2.5.2 Change Working Step

Click enter on the dropdown box of Volt step and Amp step, select the working step you want (the standard source provides 3 volt steps: 750 V, 300 V, 100 V; and 5 amp steps: 25 A, 10 A, 5 A, 1 A, 100 mA.)

5.2.5.3 Select Power Factor

Click enter on the dropdown box of Power Factor, press "↓" of the direction keys to select the power factors you want (5 power factors are available in the standard source: 1.0, 0.5, 0.8L, 0.5C, 0.8C.) You can also use the built-in small keyboard to input other power factors, refer to the appendix for instructions on how to use the small keyboard.

5.2.5.4 Toggle Between Power Factor and Phase Angle

Move cursor to the Power Factor dialogue box, click rotary encoder to toggle to Power Phase Angle, you can input value by using the numerical keyboard. (Remark: Power Factor and Phase Angle may have different corresponding relation under different operation modes.)

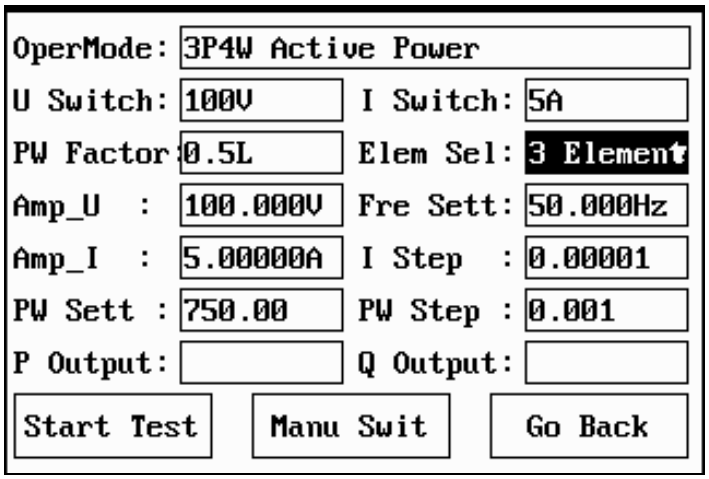


Fig. 5-8 Power Phase Angle toggle interface

5.2.5.5 Element Selection

When the users select operation modes other than 1P Active Power, then Element Selection is available; when 1P Active Power is selected, Element Selection will not be applicable. When Element Selection is activated, the user may select different output elements (default

is Combined Element Output)

5.2.5.6 Select Volt Amplitude

When the user selects a volt step, the standard source provides three output voltages under the step, which are: 380 V, 600 V and 750 V output under Step 750 V; 150 V, 220 V and 300V output under Step 300 V; 57.735 V, 75 V and 100 V under Step 100 V. The user may also manually input the value by using the numerical keyboard in the instrument panel.

5.2.5.7 Set Frequency

The user may change the working frequency in the frequency input edit box. The frequency may change between 45 Hz and 65 Hz.

5.2.5.8 Set Current

When the user select a amp step, the standard source provides 10 output currents under the step, which are: 25 A，22.5 A，20 A，17.5 A，15 A，12.5 A，10 A，7.5 A，5 A and 2.5 A output under Step 25 A; 0 A，9 A，8 A，7 A，6 A，5 A，4 A，3 A，2 A and 1 A under Step 10 A; 5 A，4.5 A，4 A，3.5 A，3 A，2.5 A，2 A，1.5 A，1 A and 0.5 A output under Step 5 A; 1 A，0.9 A，0.8 A，0.7 A，0.6 A，0.5 A，0.4 A，0.3 A，0.2 A and 0.1 under Step 1 A; 100 mA，90 mA，80 mA，70 mA，60 mA，50 mA，40 mA，30 mA，20 mA and 10 mA output under Step 100 mA. The user may also manually input the value by using the numerical keyboard in the instrument panel.

5.2.5.9 Power Setting

Set the output power in the power input edit box. The maximum value for power setting is, under the corresponding output voltage, the actual output power when the current output is 120% of the Amp step; the exceeded part will be truncated by the system automatically. When you have selected element test, due to the effect of power factor, the element's power will be zero under all voltage and current. Therefore when the user inputs the element's power, the display is zero, which only implies that it is zero under the effect of power factor, voltage and current outputs are still there during test, so you can only modify the amplitudes of current or voltage but you cannot modify power.

5.2.5.10 Set Stepping

Set Stepping is divided into Amp step Length and Power Step Length, each has 4 steps, whose value is determined by the Volt step and Amp step. The figure shows the Amp step Length under 100 V & 25 A.

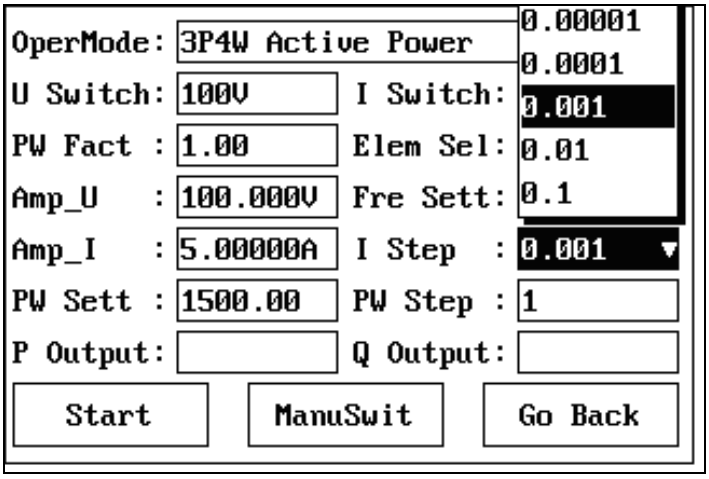


Fig. 5-9 Set Stepping in Power Standard Source

Click Start Test and turn the rotary encoder during test, as it turns cell by cell, the changed amplitude will set the step length.

5.2.5.11 Instrument Output Display

Click enter on the Output Display button, the system will display the actual output amplitudes and phases of all ports at the moment, as well as the active power & reactive power of all elements.

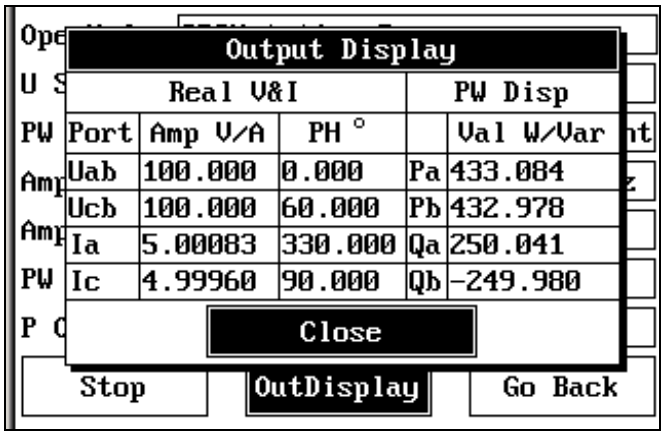


Fig. 5-10 KS833 Output Power Display Interface

5.2.5.12 Auto Switch & Manual Switch

Click Auto Switch button to toggle between manual switch and auto switch. When you enter Manual Switch, you need to switch amp steps to enhance the precision of power output. When you enter Auto Switch, the Amp Step dropdown box will be unavailable, the system will automatically switch amp steps according to the power set by you, while at the same time you have to switch the volt step and volt amplitude.

5.2.5.13 Start Test

Click the Start Test button; the instrument will directly output volt amplitude & phase as well as current phase. The amp amplitude will increase by 1% of the amp step progressive until it reaches the power value needed.

5.2.5.14 Real-time Closed Loop Calibration

During the test, the instrument can automatically calibrate the output according to the load connected into it.

5.2.5.15 On-line adjustment

During test, the user can change output value, power factor or volt amplitude at any time according to needs. Procedure: move the cursor center to Power Input edit box, Power Factor dropdown box or Volt Amplitude dropdown box, click Enter to modify power input, power factor or volt amplitude, click Enter again, the instrument will change the output to the new power. After that the same as Start Test, start closed loop calibration.

5.2.5.16 Power Output Display

During test, the system can automatically collect actual output data and display the output power as it is at the moment in the text boxes of active power and reactive power.

5.2.6.17 Fine Tuning (take amp amplitude as an example)

After test starts, move cursor to Amp Amplitude and turn the rotary encoder, the amp amplitude will increase or decrease on the step length, and power will also change accordingly. Take similar steps to fine tune the power. (Note: You can only fine tune current

and power)

5.2.6 Harmonic Overlapping Standard Source: see Figure 5-11 for its interface

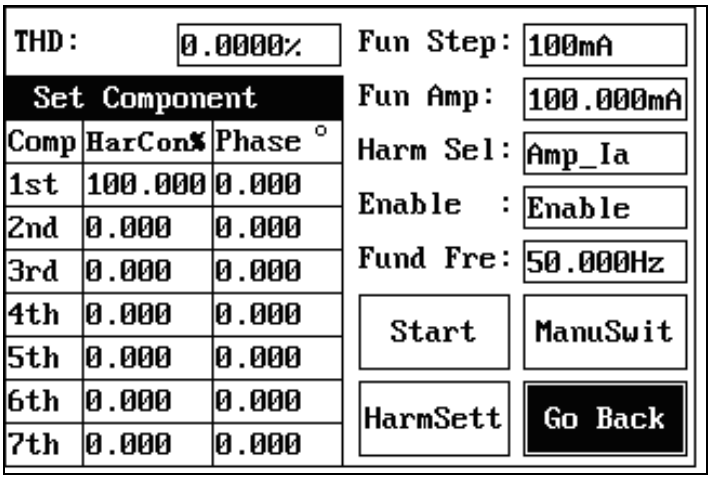


Fig. 5-11 KS833 Harmonic Overlapping Standard Source interface

5.2.6.1 Select Fundamental Step

Click Fundamental dropdown box to select from the steps, the standard source provides five volt steps: 750 V, 300 V, 100 V, 30 V and 10 V; and five amp steps 25 A, 10 A, 5 A, 1 A and 100 mA.

5.2.6.2 Set Fundamental Amplitude

Click fundamental amplitude edit box to set the output fundamental amplitude for corresponding ports, different output ports may have different fundamental amplitudes.

5.2.6.3 Select output port

Select the harmonic port you want to modify under the dropdown box of Select Harmonic. When it switches to new output port, all the setting in the interface will be the setting of that output port. You have to switch output port to view other output port.

5.2.6.4 Select output function

Click the dropdown box of Enable Output to enable or disable output, it's only effective on the corresponding harmonic output port, and different harmonic output ports have separate Enable Output status. To output harmonic in different output ports, you need to select corresponding harmonics, at the same time enable each port's output (by default the system disables all output except Ua.)

5.2.6.5 Set Harmonic Component

The standard source provides harmonics from fundamental to the 31st, move curse to enter Harmonic Component line and set the corresponding values in the edit boxes under Harmonic Content and Phase (the same as that of Three Phase Standard Source); of which the Content ratio refers to the percentage of harmonic amplitude over fundamental amplitude and the added ratio of all the non-fundamental harmonics shall not exceed 30% of the fundamental component, the exceeded part will be truncated automatically by the system; the Harmonic Phase refers to the phase difference with the fundamental phase position of the phase (Fundamental Phase is the phase position of the fundamental in relation to the fundamental of Phase A voltage), the range is 0°...360°. Due to space limit, only seven harmonics can be displayed for component, you can move up and down by using the direction keys to select the harmonic you want. Of which the content of

fundamental component cannot be changed. The system sets its default value at 100%.

5.2.6.6 Auto Switch & Manual Switch

Click Manual Switch button to toggle between manual switch and auto switch. When you enter Manual Switch, you can select fundamental steps through the dropdown box; when you enter Auto Switch, the system will automatically switch fundamental step according to the fundamental amplitude input by the user.

5.2.6.7 Start Test

Click Start Test to start, the instrument will output harmonic at all the output-enabled ports; and there will be no harmonic output at the disabled ports (Note: except Phase A voltage, the default values of all the Enable Output value are set at Disable.) At the same time, Set Harmonic will be switched to output display; the harmonic component table will become harmonic overlapping output component table and display the actual output value of each harmonic component at the selected harmonic output port.

5.2.6.8 Stop Test

Click Stop Test during test, the instrument will close output. At the same time, output display will be switched to Set Harmonic, the harmonic component table will become harmonic overlapping input component table and display the set value of each harmonic component of the selected harmonic output port.

6. Instrument Calibration

Select meter calibration in the main interface to enter the module, shown as Fig.6-1

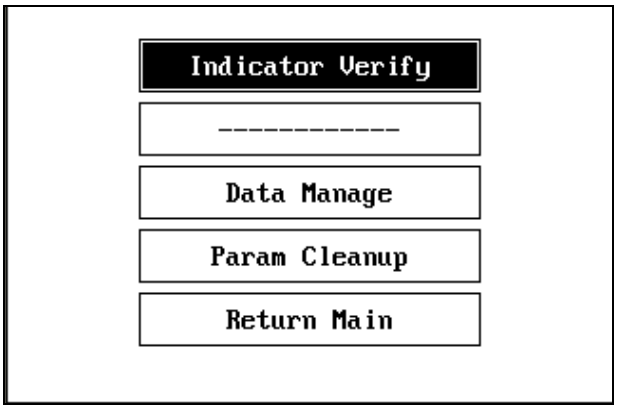


Fig.6-1 Main interface

6.1 Brief instruction of inspection working process

When you enter this module, you'll see the basic parameters setting in this interface, which you can select the required inspection meter type, meter type, meter number, etc. You can also select the test items, shown as Fig. 6-2

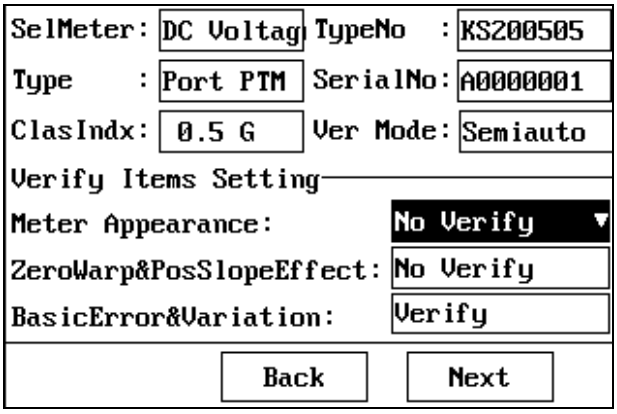


Fig.6-2 Basic parameter setting of pointer meter

i. Meter type selection

Instruments can only inspect the eight types of meter, shown as Fig.6-3：

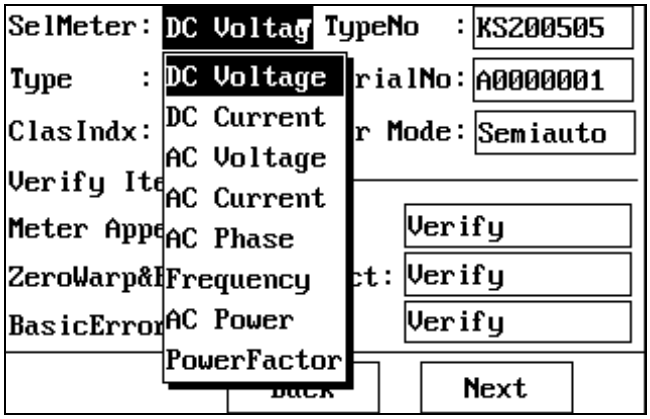


Fig.6-3 Meter type setting

ii. Meter type selection.

It offers four types of instruments, shown as Fig.6-4. The inspection method of the portable needle meter and the on-site needle meter is the same, and the inspection method of the test meter and the testing field meter is the same.

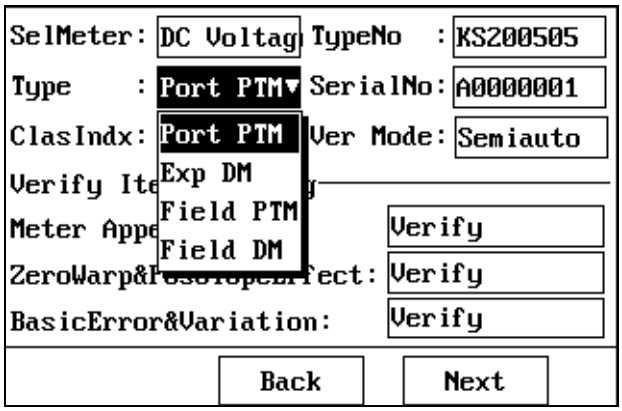


Fig.6-4 Meter type setting

iii. Accuracy grade selection.

Users select the precision class according to the grade of the meter, it is the reference item of inspecting the meter by system automatically. Precision class options are shown as Fig.6-5:

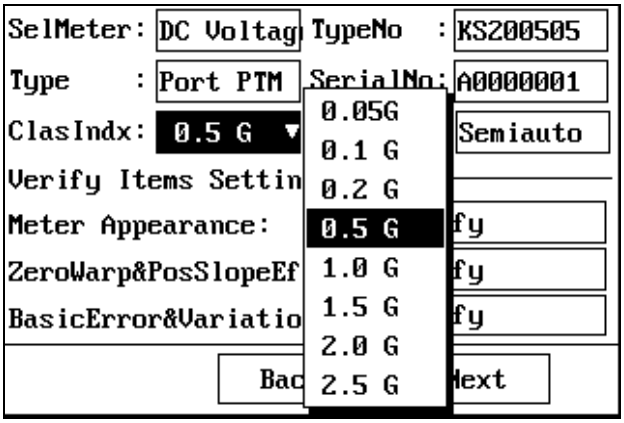


Fig.6-5 Meter precision grade

iv. Instrument model and instrument number setting.

Users fill in this two items according to the actual model name and number, then begin to edit this option, press the arrow keys ↓, pop-up soft keyboard according to choose the right characters or letters.

Note: If the selected instrument number has been verified and the test data has been saved, then all interfaces (such as quantity is limited to the setting interface) of default parameter is the number of the saved parameters, only the experiment was completed and select storage (covered storage) when the new parameters in order to be saved.

v. Test mode.

The fixed way of the instruments is semi-automatic.

6.2 Meter range-limited setting

6.2.1 Overall description of meter range-limited setting

a) Only when the instrument type is needle meter or on-site meter, it can set the coefficient of mutual inductance, other types as a default coefficient of mutual inductance. In the actual setting interface, it'll limits the amount of the second case of the mutual inductance setting. As for the DC meter, it does not bring any type of mutual inductance.

b) Error method is fixed mode, system binds according to the basic parameters setting of meter type. The needle meter uses fixed reference error, and the digital meter uses fixed relative error. Any limited set checklist of error means the amounts of the above methods are bound.

c) The unit of preheat time is seconds (S), users select the appropriate warm-up time, and achieve the most accurate test results.

The following checklist is the description of meter range-limited setting.

6.2.2 AC & DC range-limited setting

AC, DC and its sub-items of the amount of current and voltage limited setting is almost the same. Take AC voltage portable needle meter for example, the setting interface is shown in Fig.6-6:

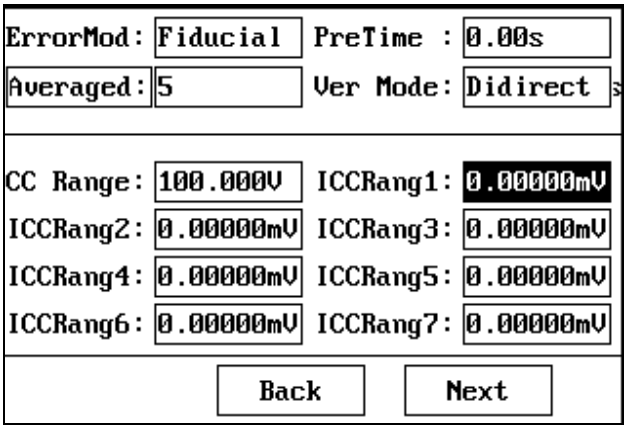


Fig.6-6 Setting interface of AC voltage portable needle meter

Error method is fixed form, and the needle meter is fixed to reference error. It's not on-site meter, so there is no mutual inductance settings.

The difference between AC and DC: DC meter of any type does not set the coefficient of mutual inductance, and the frequency can not be located. You can see the difference from Fig. 6-7, the setting interface of DC voltage portable needle meter.

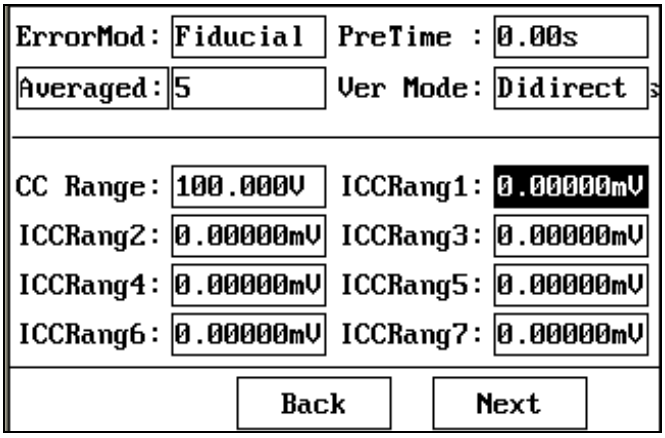


Fig.6-7 Setting interface of DC voltage portable needle meter

6.2.3 AC phase range-limited settings

Set phase range-limited in two pages, one is for the phase parameter setting, and the other is phase meter range-limited setting.

- Phase parameter setting

  Shown as Fig.6-8：

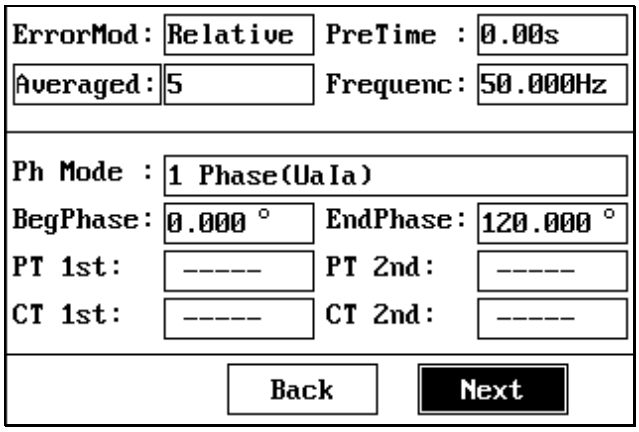


Fig.6-8 Parameter setting of AC phase portable needle meter

Not on-site meter, coefficient of mutual inductance is disabled.

a) Phase approach. Approach is divided into single-phase mode (UaIa), three-phase mode (UabIa), the user works under the meter corresponds to the way of the right choice.

b) Verification phase angle range. Initial phase angle and the termination of the phase angle can be 0 °... 360 ° between the options, based on the actual amount of meter range-limited, the terminate phase angle should lager than the initial phase angle.

- Phase range-limited setting

Shown as Fig.6-9：

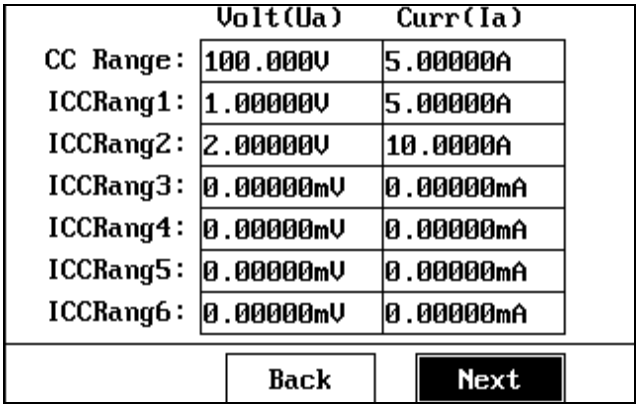


Fig.6-9 Range-limited setting of AC phase portable needle meter

Fill in the amount of the corresponding range-limited value according to the different phase voltage and current

6.2.4 Frequency range-limited setting of power frequency

Take voltage measurement as object, measurement value is the frequency of voltage, range-limited is working voltage.

6.2.5 AC power range-limited setting

Set AC power range-limited in two pages, one is for the AC power parameter setting, and the other is AC power range-limited setting.

Limit the amount of AC power to set in two pages, one for the exchange of power meter parameter setting, next to limit the amount of AC power to set the table.

- Parameter setting of AC power

  Shown as Fig.6-10：

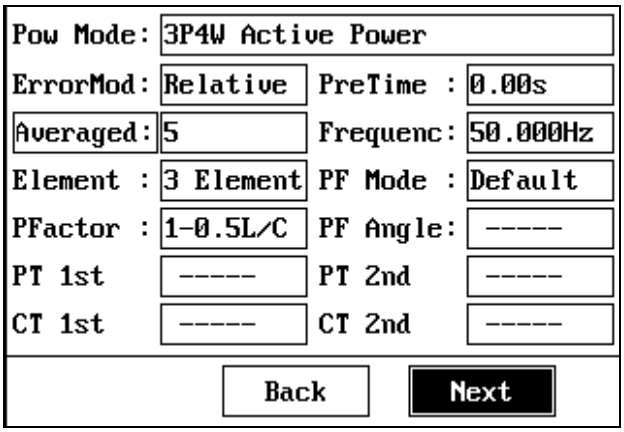


Fig. 6-10 AC Power Handheld Analog Meter parameter settings

a) Power mode: as shown in Fig. 6-11, the user choice the relative mode corresponding to the working way.

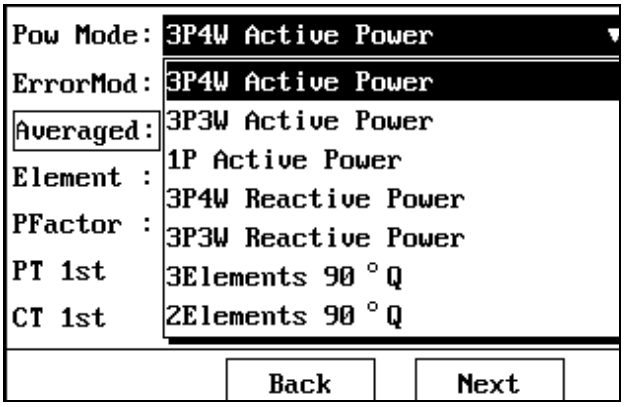


Fig. 6-11 AC Power modes setting

b) Component selection: Component selection has four options: All components, A component, B component and C components. Single-phase active power is only for the A component.

c) Test setting: There are default mode and customized mode; for default mode, power factor can not be set, the system automatically test the power under 1, 0.5 L, 0.5C. For customized mode, the user can set the power factor as the range of -1 ... 0L ... 1 ... 0C ... -1.

d) Power phase angle: phase angle and power factor is relative corresponds for the facilitate setting of power factor, but only the test method on the customized was activated.

AC Power limited quantity setting

fill in the amount of the corresponding limits according to different working voltage and current of Power meter

Settings the Limit amount of power factor.

Which is in two pages, one for the power factor meter parameter setting, next for the limit amount of power factor table setting?

Power Factor parameter settings.

Fig. 6-12:

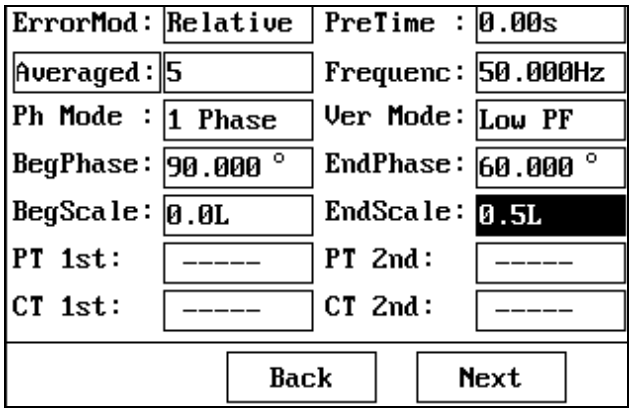


Fig. 6-12 setting the Power Factor parameter of Handheld Analog Meter

a) Phase mode: the same way as the AC phase meter.

b) Test methods. Fig. 6-13:

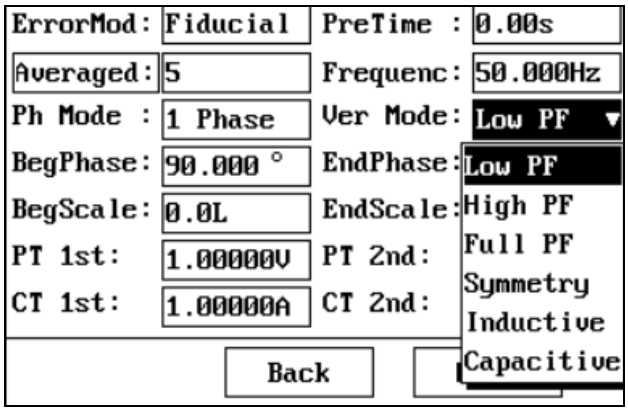


Fig. 6-13 power factor testing mode setting

Low Factor Meter mode. Set the range of -1 ... 0L ... 1.

High Factor Meter mode: For a fixed range of 0.5L ... 1 ... 0.5C.

All factors Meter model: for the fixed range 0L ... 1 ... 0C.

Symmetry factor mode: Set the range of -1 ... 0L ... 1 ... 0C ... -1. Because of the symmetry of power factor of the, so only setting the starting scale (or initial phase angle) is OK.

Emotional factor mode: Set the range of -1 ... 0L ... 1.

Capacitive factor mode: Set the range of -1 ... 0C ... 1.

Based on the actual range of the meter, User select the corresponding test methods, then set the correct limit amount.

c) The starting phase angle and ending phase angle. In order to facilitate setting of the power factor, and correspondence to the power factor one by one.

Settings the Limit amount of power-factor

According to the different voltage and current of the power-factor Meter fill in the corresponding limits amount.

6.3 Meter Appearance Inspection

when Visual inspection of Meter is selected, and the limited quantity of instrument is set up, click next, and enters the meter visual inspection. As shown in Fig. 6-14.

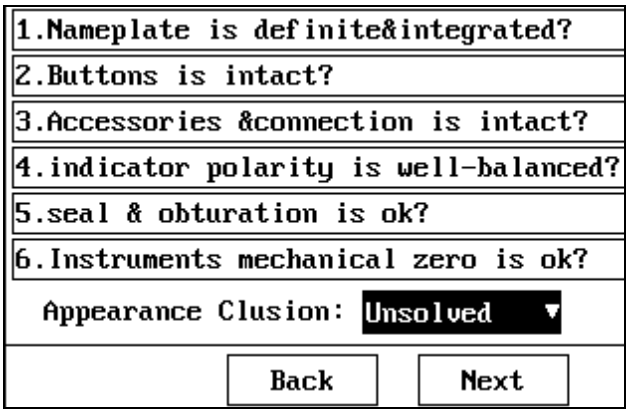


Fig. 6-14 Shape inspection of Handheld Analog Meter

After the right instrument checking, user manually set the test result is pass or not.

6.4 Stability Error Test of Digital Meter

6.4.1 Stability Error Test Theory of Digital Meter

Stability Error Test of Digital Meter means that, while outputting steadily within setting time, a percentage shows between max deviation value (the max value of the difference between readings and instrument check-point in the meter) and full-scale value. The users adjust to the readings of max deviation by adjustment rotary encoder. Pushing the rotary encoder, and according to the values on Grid & Inspection point, calculated the stability error of meters automatically.

6.4.2 Stability Error Test of Digital Meter

Stability Error of Digital Meter is optional test item, User test it or not according to the actual situation .

Shown in Fig. 6-15, during the Stability Error Test, choose start point (or Zero point) and Termination point (or full offset point) of the meter. Only time stability and accuracy adjustment is settable. User could set the proper parameter due to actual meter.

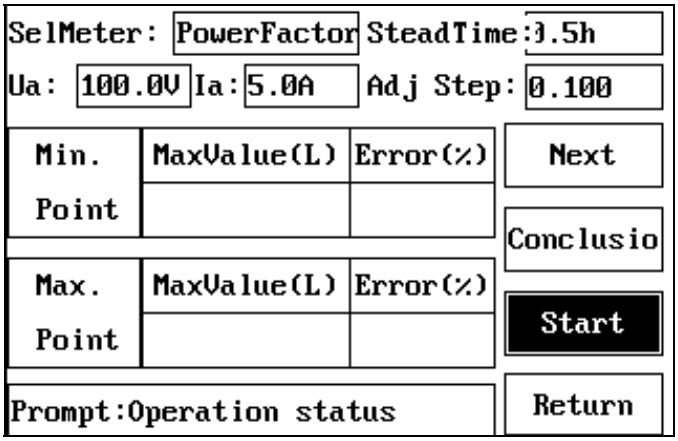


Fig.6-15 Stability error calibration of AC voltage test digital meter

a) Time Stability：the unit is hour (h).

b) Accuracy Adjustment：the value is multiplied value, which adjust step length to

present range-change, and multiplied by the percentage of accuracy adjustment. All the manual adjustment step length calculated by this way. e.g. Fig. 6-16, the manual adjustment step length is 100*0.1% which is equal to 0.1V.

c) Test Result: the system calculate the error automatically due to measured data, and compare with accuracy class chosen by user, then come to a conclusion of the instrument pass or not. Shows in Fig. 6-16:

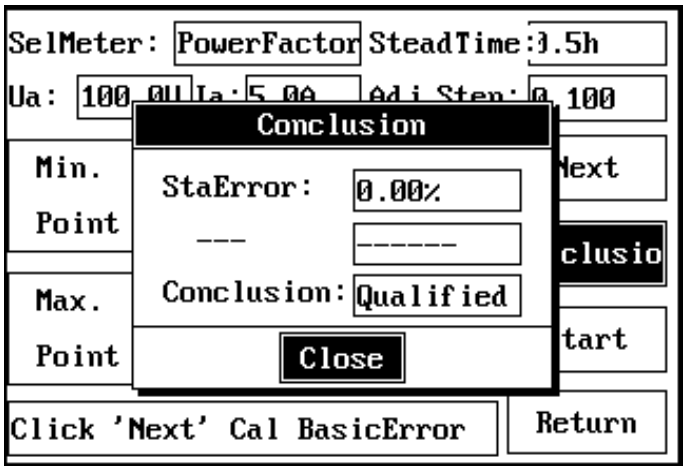


Fig.6-16 Result of stability error calibration of AC voltage test digital meter

6.5 Zero Drift and Slant Effect

6.5.1 Zero Drift and Slant Effect Specification

The Test is optional test item, User test it or not according to the actual situation.

Shows in Fig. 6-17, for the most of Slant Effect, choose the mid scale (or mid point value) and Termination point (or full value). Only some of meters are different in power factor sublist. Such as the slant effect of high power factor sublist, choosing the left avertence full value (start scale) and right avertence full value (final scale). Only the accuracy adjustment is settable, and others are the parameter spec. for the meter.

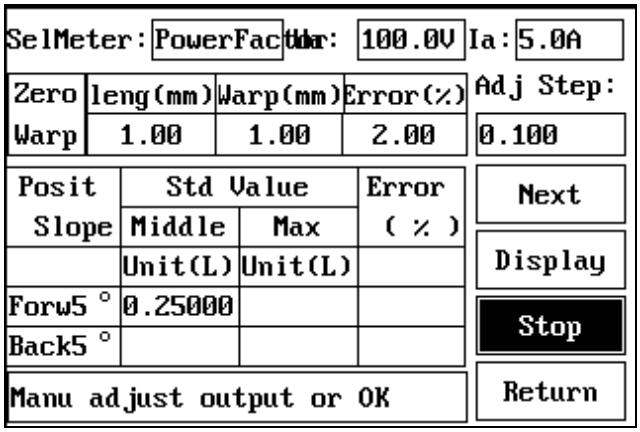


Fig.6-17 Zero drift and slant effect measurement

6.5.2 Zero Drift Test

Click to start the test, a message box appear for typing footage & deviation length manually. Shows as 6-18. The system could calculate error automatically according to the data.

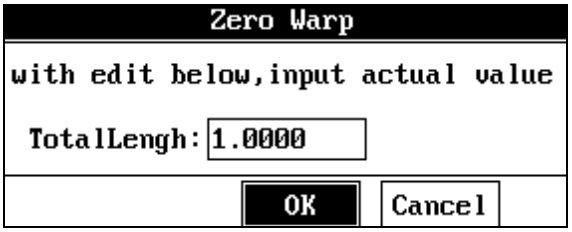


Fig.6-18 Zero drift input

6.5.3 Incline effect test

The system will automatically test the incline effect, users prompt proper operation according to the system. Users can press the rotary encoder at any time, and set the appropriate regulation fineness (step of adjustment equals to that of effective range times the percentage of adjustment fineness), revolve the rotary encoder manually to adjust the output according to the actual needs. At the same time you can click the "Output Display" to view the test details. After the experiment, the "Output display" button will automatically turn to "show conclusion", then click on "Show conclusions", you'll see the experimental results.

6.6 Pointer meter range calibration

6.6.1 Pointer meter full test range instruction

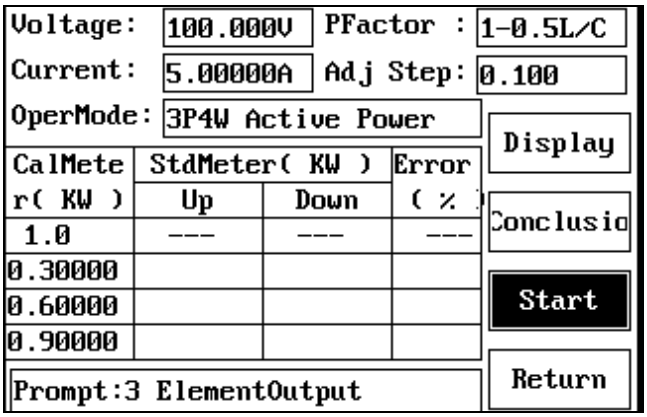


Fig. 6-19 AC voltage full range calibration with pointer meter

a) Pointer meter request calibration pointer to go up and go down, and adopt the relative testing value, system will calculate the relative errors automatically and variation (the difference between go up value and go down value in the same balance), come out the max variation and max error automatically in order to judges the testing result. It finished by system automatically, user only need to operate properly according to guide direction.

b) Relative testing point, system assign automatically according to testing point number, meter range and testing range of user setting. If the testing point is set inconsequently, please re-set the testing point number and the range of meter as well as testing range.

c) Only adjustment fineness is programmable, others option is only explanation for testing parameter.

6.6.2 Pointer meter full test range calibration

After entered full testing interface and finished initialization, click “begin to test” button to begin the testing, the device (it finished automatically go up or go down gradually by system) will send out the relative testing value (in order to avoid overshoot impulse of pointer meter) stably, and output the appointed value at last. In this process, user can press rotary encoder to stop it at any time, use direction key to select adjustment fineness (adjustment step is the percentage of current range multiply by adjustment fineness), and use rotary encoder to adjust manually. When adjustment value coincident with testing value, press rotary encoder to adopt real value, system will show automatically in the relative grid of standard meter, user can click “output display” to view the data synchronously and then, system will calibrate next point automatically. System will automatically test the points of go up and go down, user need to operate carefully according to guide direction. After finished testing, user can click “display result” to view testing result. Because of interface restrictions, it can not show out all the tabulation, user can use rotary encoder to turn up and down to read the data.

After the testing, if the non-full range all finish tested, press “output display” to “save data” automatically, then save the data and finish the testing. Otherwise, the button “output display” will change to “next step”, press “next step” to enter non-full verification .

6.6.3 Pointer meter non-full test range instruction

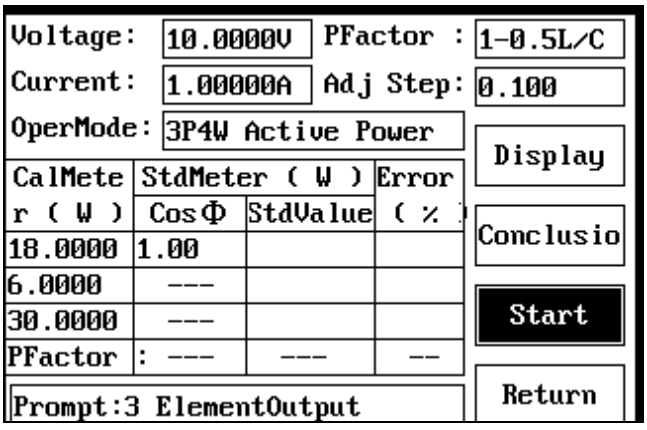


Fig.6-20 AC voltage non-full range verification with pointer meter

a) Pointer meter non-full verification only need pointer to scan once, system will calculate the relative error automatically, no need to calculate variation and it come out the max error automatically in order to adjust testing result. All of this will be finished by system, user only need operate correctly.

b) System will assign automatically according to the data of current non-full range and full range verification.

c) Only adjustment fineness is programmable, others option is only explanation for testing parameter.

6.6.4 Pointer meter non-full test range calibration

After enter non-full testing interface and finished initialization, pointer meter only test 10% of endscale value, full test range max error and endscale point. Click “begin to test” button and begin to test, the operation step is same as full range. After finished testing, user can click “display result” to view testing result. Because of interface restrictions, it can not show out all the tabulation, user can use rotary encoder to turn up and down to read the data.

After the testing, if the non-full range all finish tested, press “output display” to “save data” automatically, then save the data and finish the testing. Otherwise, the button “output display” will change to “next step”, press “next step” to enter non-full verification

6.7 Data meter range calibration

6.7.1 Data meter full test range instruction

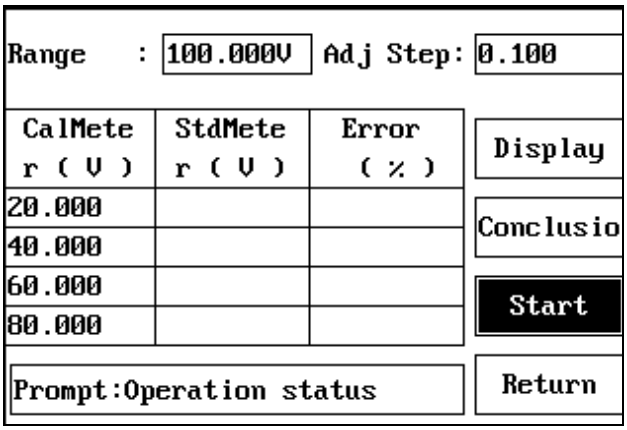


Fig.6-21 Full range-limited inspection of AC voltage test meter

a) The digital meter needed to be ensure once again, and sampling the corresponding detection point value, the system will automatically calculate the corresponding error, automatically come to the greatest error, and determine test conclusions. This is done automatically by the system, users only need to operate correctly.

b) The corresponding detection point is set based on user test points, test range instrumentation and the quantity, it is limited by the system automatically assigned. If the test point is set unreasonable, please re-set the test limits the amount of points and instrumentation, and test range.

c) Only the fineness adjustment is available to set, other options are the meter

inspection parameter instruction.

6.7.2 Digital meter full range-limited calibration

Click the "Start" button to start the experiment. The operation of digital meter is the same as the needle meter. Just send the appropriate verification system directly specify a value, no longer need for a smooth output. After the experiment, users can click "Show conclusions" to see experimental results. Due to interface constraints, it can not list all the tables, users can rotate the rotary encoder to read up and down the grid, read the data.

After the Experiment, if nothing more than the amount of the whole inspection limits the button "Output display" automatically become "Save data", save the data, end of the trial. Otherwise, the button "Output display" automatically become the "Next", click the button "Next" to enter non-full inspection test.

6.7.3 Instruction of non-range-limited of digital meter

Shown as Fig.6-22

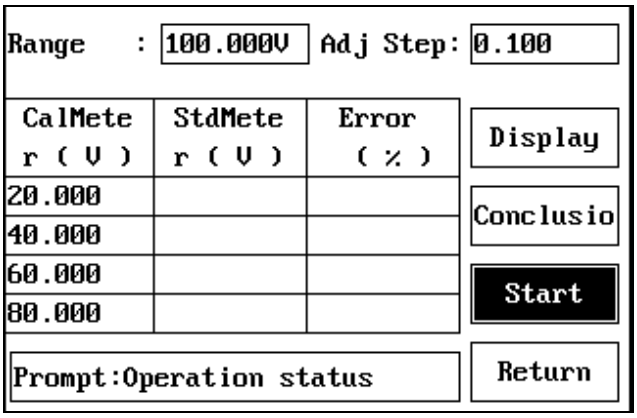


Fig.6-22 Non-range-limited inspection of AC voltage test meter

a) Only need to scan the non-range-limited inspection of digital meter once, the system will automatically calculate the corresponding error, automatically come to the greatest error, and determine test conclusions. This is done automatically by the system, users only need to operate correctly.

b) Detection point based on the current limited amount of non-range-limited inspection automatically assigned by the system.

c) Only the fineness adjustment is available to set, other options are the description of meter parameter.

6.7.4 Non-limited-range of digital meter calibration

Access to non-range-limited inspection interface, and initialize finished. Digital sheet test is only 10% of full scale value, mid-point value and full-scale point. Click the "Start Experiment" button to start the experiment, the operation with all the same seized quantity is limited. After the experiment, if the quantity is limited all non-range-limited inspection certification is completed, the button "Output display" automatically become "Save data", save the data, end of the trial. Otherwise, the button "Output display" automatically become the "Next", click the button "Next" to the next non-range-limited inspection test quantity is limited.

6.8 Saving test data

Click “saving data” to enter the interface, shown as Fig. 6-23

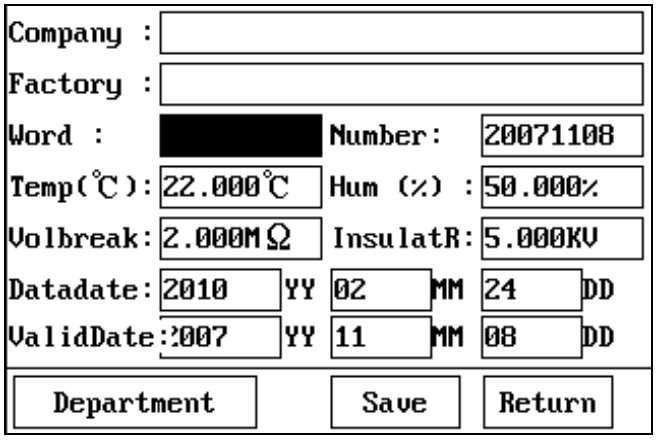


Fig.6-23 Inspection report information setting

Fill the user based on the actual information, click the button "Save", the system automatically save the data and conclusion of the trial. Save the data and then returned to the instructions set the basic parameters of instrument (start the first page), start a new experiment.

Note: If the current meter number has been saved, the system and pop-up dialog box will be prompted to enter a new instrument number, click "OK" to save the data, click on "Cancel" Cancel Save.

6.9 Meter inspection example

1. Example of power meter inspection

Direct instrument of basic parameter settings, set up shown in Fig.6-24, click Next, enter the quantity is limited set of parameters.

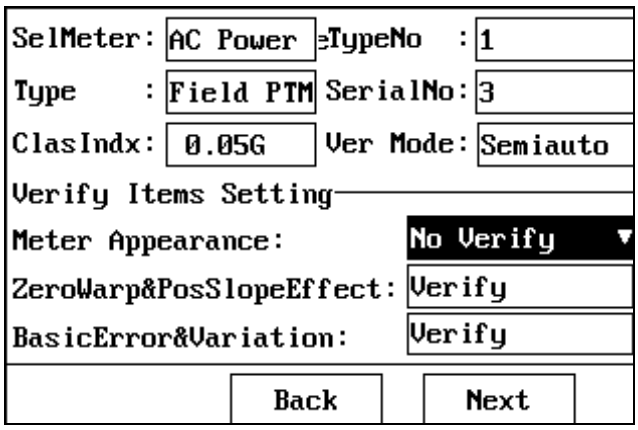


Fig.6-24 Basic parameter setting of power meter

2. Parameter setting of AC power field needle meter shows in Fig.6-25, click next to set the range-limited.

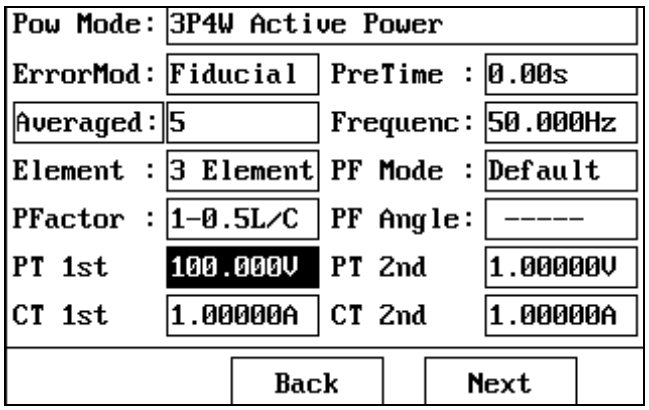


Fig.6-25 Parameter setting AC power on-site needle meter

3. Range-limited setting of AC power field needle meter shows in Fig. 6-26, click next to inspect the appearance.

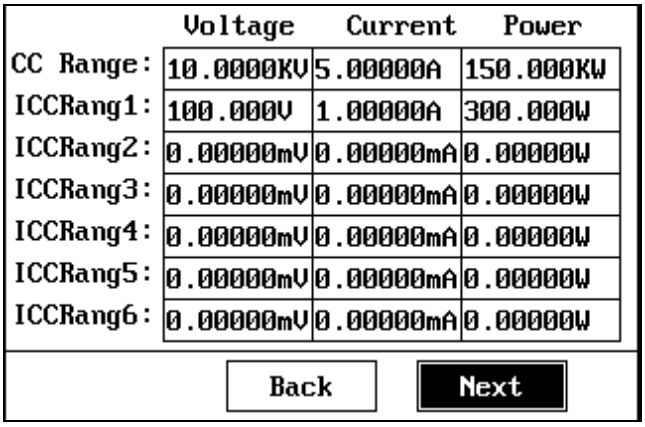


Fig.6-26 Range-limited setting of AC power field needle meter

4. To check the appearance of field needle meter according to the actual situation and choose the right option, click Next to enter the zero offset and inclined impact test (in the first step in this for the test above).

5. As shown in Fig.6-27, due to set the preheat time, after the experiment began, the first warm and then began to test. Click Next after the completion of the experiment-wide inspection test quantity is limited.

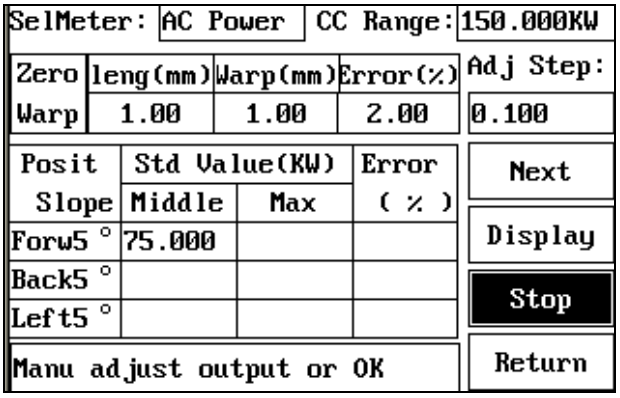


Fig.6-27 Zero offset and incline effect inspection of AC power field needle

6. As shown in Fig.6-28, it has been warmed in the fifth step, so it do not have to heat again, (if the user forced to skip the fifth step, the system automatically preheating at this step). As the power factor has 1,0.5 L, 0.5C 3, the system will automatically power factor under the power of three full-inspection. After the test, click stop experiment, as shown in Fig.6-29, "Output Display" button to automatically become the "Next", because quantity is limited settings, set the amount of non-full inspection limits. Click Next, enter the amount of non-full inspection test limits.

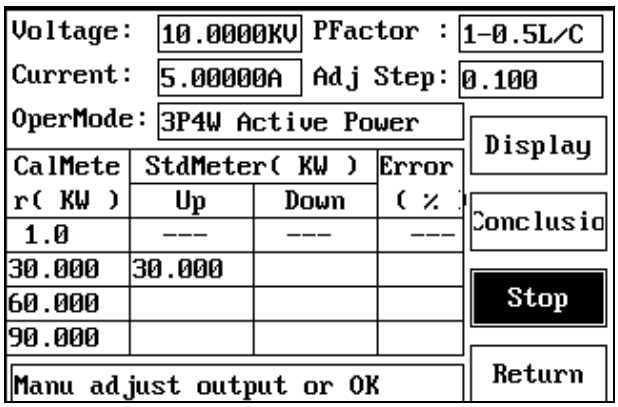


Fig.6-28 Full range-limited inspection of AC power field needle meter

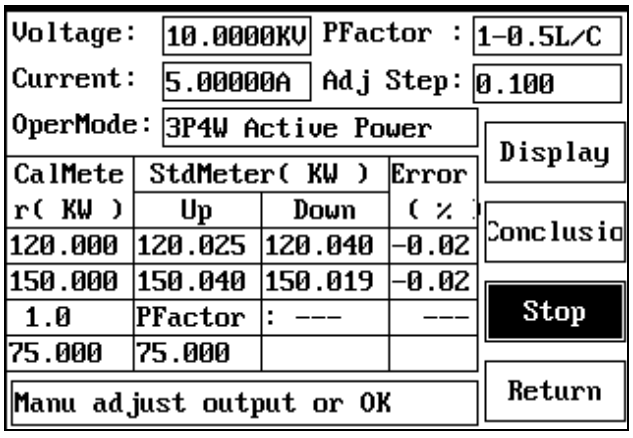


Fig.6-29 Full range-limited inspection of AC power field needle meter

7. As shown in Fig.6-30, the entire inspection is the same as non-range-limited inspection, it should also test three power factor corresponds to power. Until all the quantity is limited certification, the output display button can save the data into the text, click on "Save data" that can save test data.

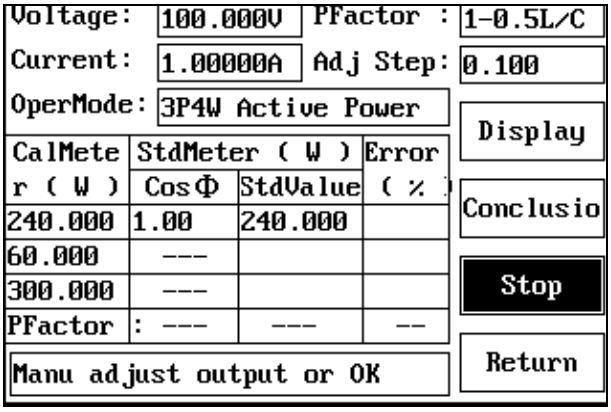


Fig.6-30 Non-range-limited inspection of AC power field needle meter

8. As shown in Fig.6-31, set the appropriate parameters, click the "Save", all data will be saved to a file, users can test data management, view and manage all the data.

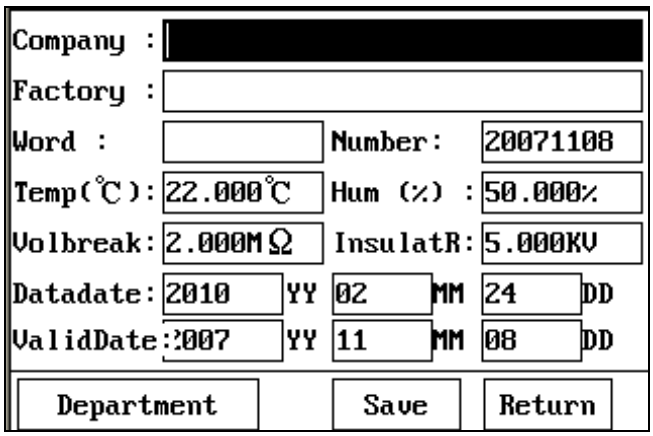


Fig.6-31 Data saving of AC power field needle meter inspection

7. KS833 Meter calibration

Select the AC power meter calibration on the main interface, click to the entry, as shown in Figure 7-1 meter parameter entry interface. (Note: The model number must be filled in) Note: This feature is only available in KS833.

7.1 Meter input parameters

7.1.1 Input Parameters

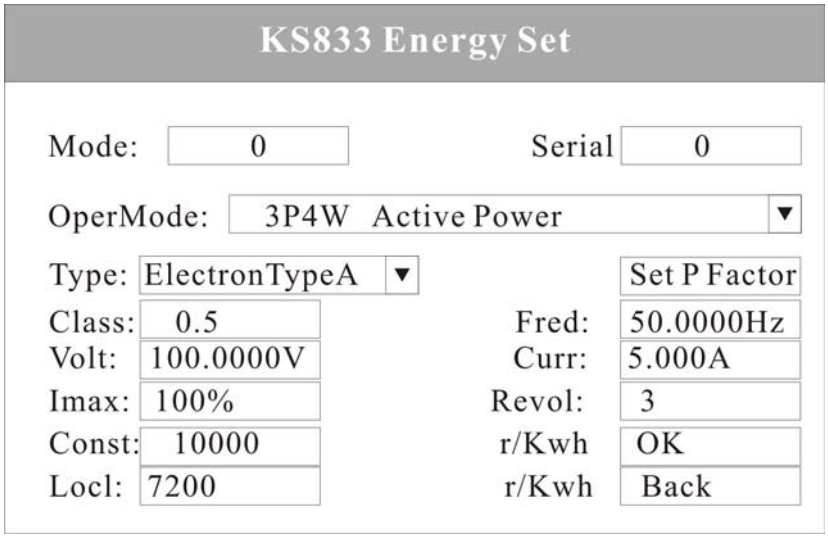


Fig.7-1 Meter parameter input

After set-up the voltage and current values, select the constant according to energy meter's own characteristics, it is recommended to set rotary speed is more than 2 (which requires calculating error time is more than 3s). The system will automatically save the corresponding parameters according to the serial number. For example, the number is 003002, after experiment finished, Experiments in the next column input 003002 in the number column, and it will present the parameters set-up last time.

Click to the combo box for working style, drop-down menu shown in Figure 7-2, is divided into 3P4W active energy meter, 3P3W active energy meter single-phase energy meter, 3P4W true reactive energy meter, 3P3W True reactive energy meter, three-element 90 degree reactive energy meter, two-element 90 degree reactive energy meter. Click the Type in combo box, the drop-down menu as shown in Figure 7-3, is divided into induction portable meter, induction installed meter, electronic type-A meter, electronic type-B meter, electronic installed meter, user can select work mode and type according to actual needs.

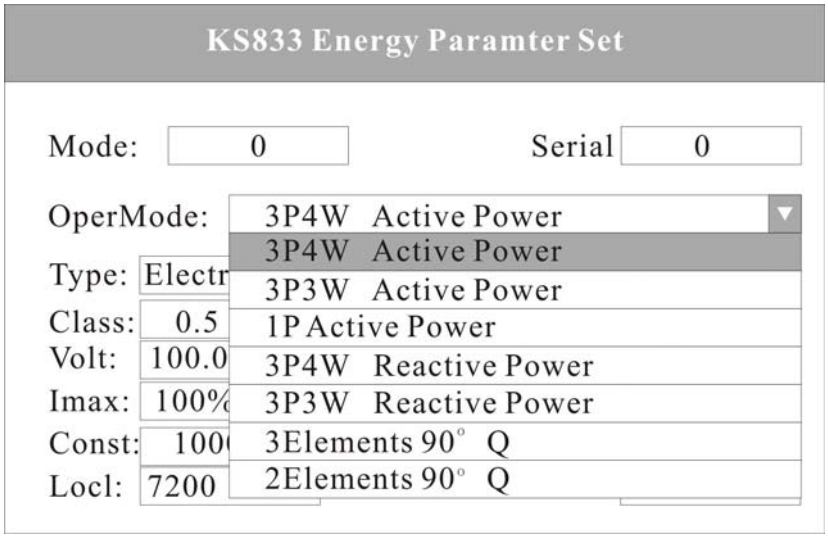


Fig. 7-2 combo box for work mode

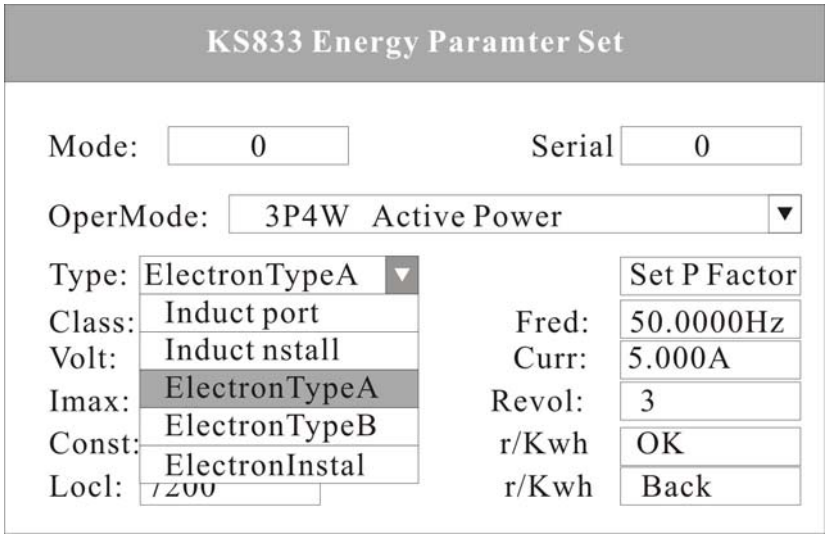


Fig. 7-3 combo box for type

Take example for 3P4W active electronic type-A, click “power factor to be calibrated”, the interface will be sprung out as shown Fig. 7-4:

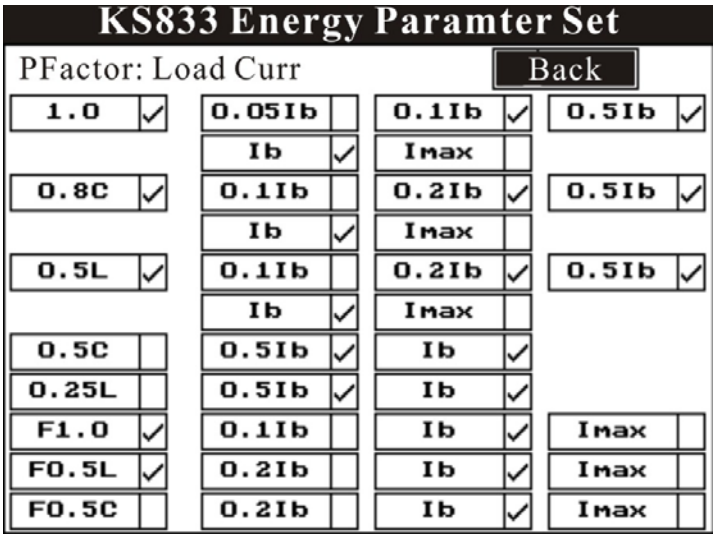


Fig. 7-4 the selection for power factor to be calibrated of energy meter

Power factor has been ticked off, if necessary user can also add other power factors. In this dialog box, user can use the arrow keys to move the selection box to the left side or right side. After some power factor has been chosen, press ENTER key to return.

In Figure 7-1, to set the required parameters, click OK, enter the power meter calibration dialog box, as shown in Figure 7-5, user can choose any one of the items to enter.

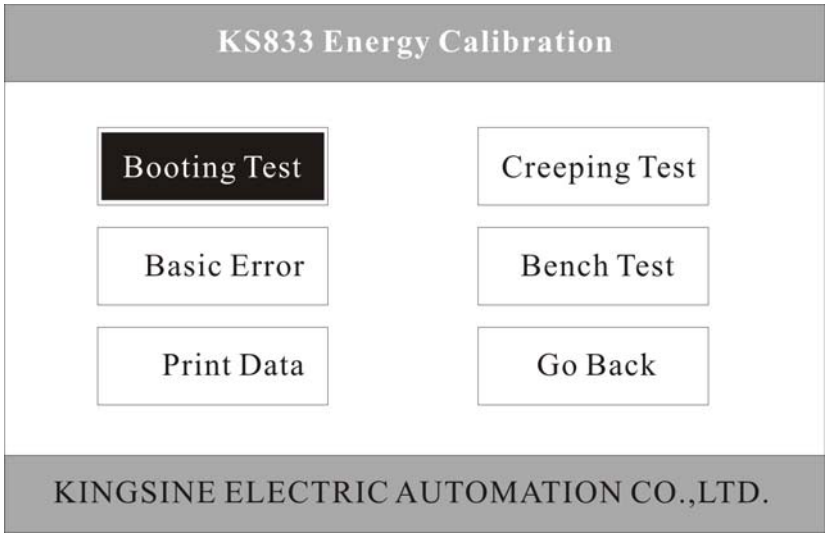


Fig. 7-5 Calibration of energy meter

7.2 Test for running energy meter

In Figure 7-5, select Start test, press the Enter key to start test. Enter the dialog box, shown in Figure 7-5.

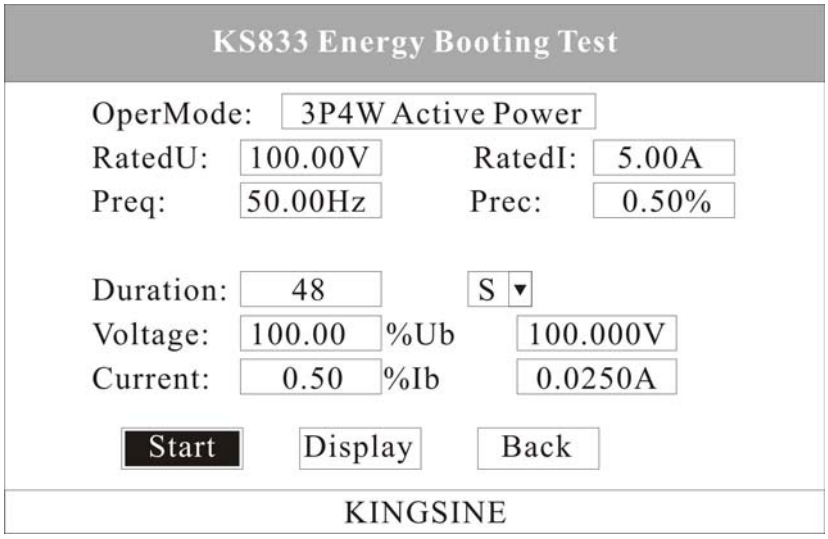


Fig. 7-6 test for running energy meter

The dialog box for running test is to move the arrow keys, and then user will have to select the working current, start and return to start the experiment. Work mode, rated voltage, rated current, frequency and accuracy grade as shown in Figure 7-1 (parameters input from energy meter) . The test time can be changed by way of the change of initial current, for example, Figure 7-6 working current is changed from 0.50% Ib to 1% Ib, test time becomes 545 seconds. Click to start test and Yes, after the test it will be prompted if the running test of the energy meter is qualified.

7.3 Energy meter creep test

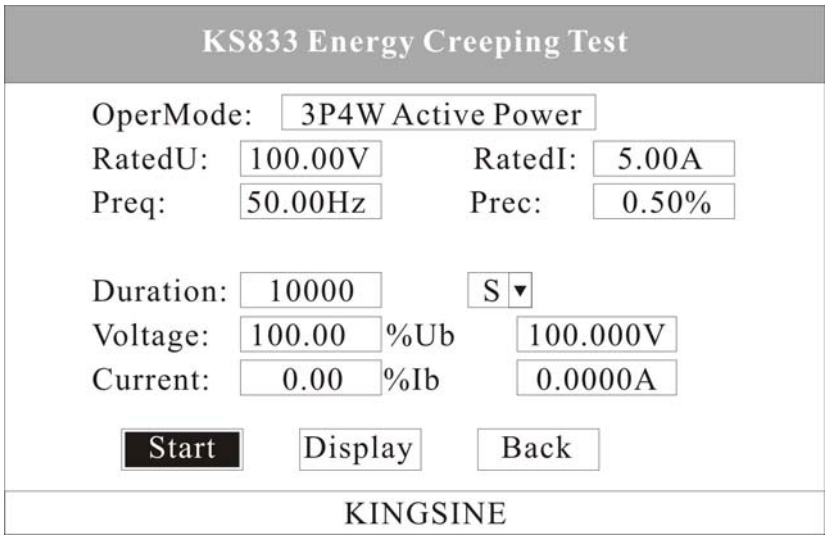


Fig. 7-7 Creep motion test for energy meter

Creeping motion test interface showed as Fig.7-7., it only change test time and working voltage, the working voltage range shall be 80％～120％, which similar with start-up test, other parameters can be set in the parameter entering of energy meter

7.4 Energy meter basic error test

Divide into balance overload test and unbalance overload test

7.4.1 Energy meter balance overload test

Select basic error (showed as Fig.7-4), press [enter key] to enter energy meter balance overload test, interface showed as Fig. 7-8. The power factor can be set in option box (select power factor in energy meter), showed as Fig.7-4

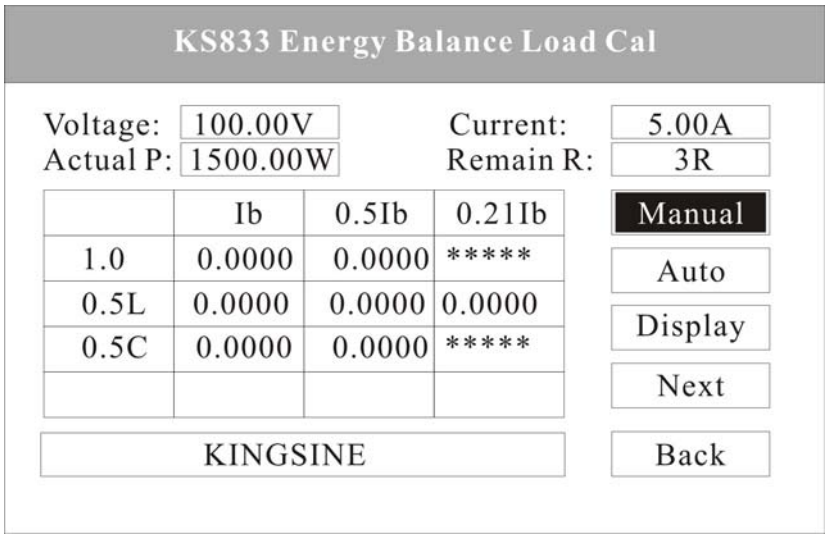


Fig.7-8 energy meter balance overload test

- **Auto-test**

Select auto test and press [enter] to confirm. The KS833 device will test automatically. The surplus revolution in system will minus 1 when every closed loop once, and it will finish one time inspection if minus to 0. The asterisk area is non-test point, system will skip automatically, refer to Fig（1.0,02Ib）point. It can display status key to check the status during testing. After finished testing, the interface of Fig.7-8 can not display all result if select many testing point, please turn the rotary encoder and cursor will move in the table, it will display all testing points.

- **Manual Test**

Select manual test, showed as 7-9. press [enter] key to enter test box, move selection box to needed test point by direction key. Press rotary encoder, system will begin to test from this point, after finished test, it will display all relative results, press [enter] key to return, it will skip to manual test interface, showed as Fig. 7-8

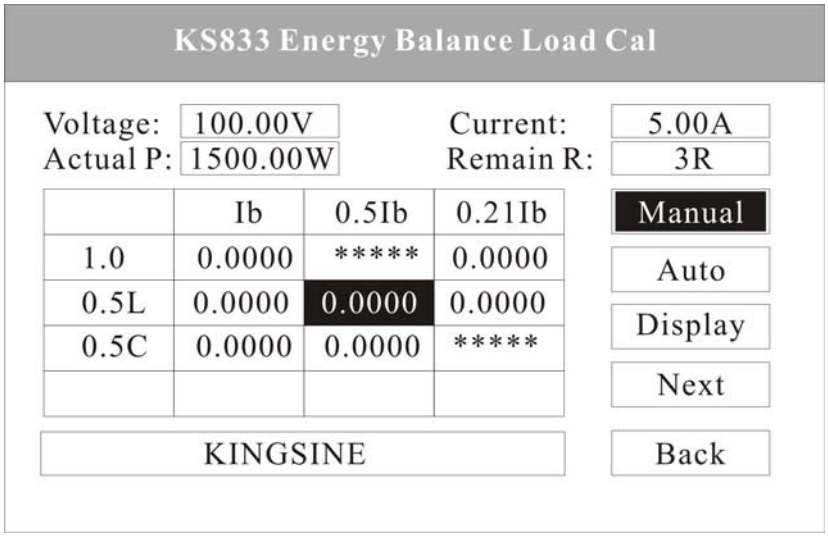


Fig 7-9 Energy meter balance overload test (manual test)

7.4.2 Energy meter unbalance overload test

After finished energy meter balance overload test, select next step to enter unbalance overload test interface, the test step and operation is similar with balance overload test.
Note: Single-phase active energy meter do not have unbalance overload test.

7.5 Energy meter Benchmarking test

Please note that any setting can not be modify in this dialog box, all parameters can be set in the parameter entering setting of energy meter, select start test, press [enter] key to confirm ,system will notice closing loop and test time reduce synchronously, system will display test result when all setting time finished. Showed as Fig. 7-10.

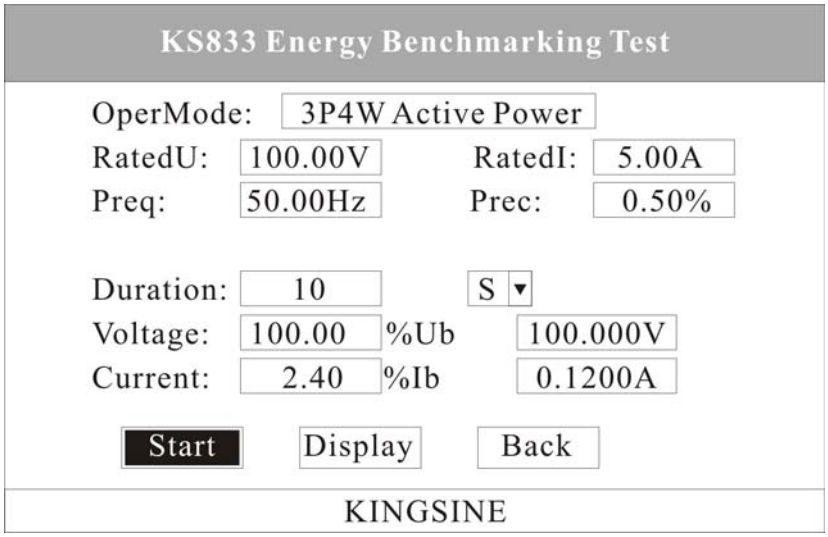


Fig.7-10 Energy meter benchmarking test

7.6 Data processing

Only basic error of energy meter has data processing function. Select auto test of balance overload in basic error test, after finished test, press next step, select auto test of unbalance overload, it will return after finished test. The interface of balance overload test will appear “save” key, press “save”, the key will change to “print” automatically, connect the printer well and print out the test report. (Note: the test results by manual test are unable to save and print.

8. Calibration data management

Note: only KS823 and KS833 provide this function model

8.1 Data view

Select inspect data management in main interface and set current interface parameters, refer as Fig.6-32.

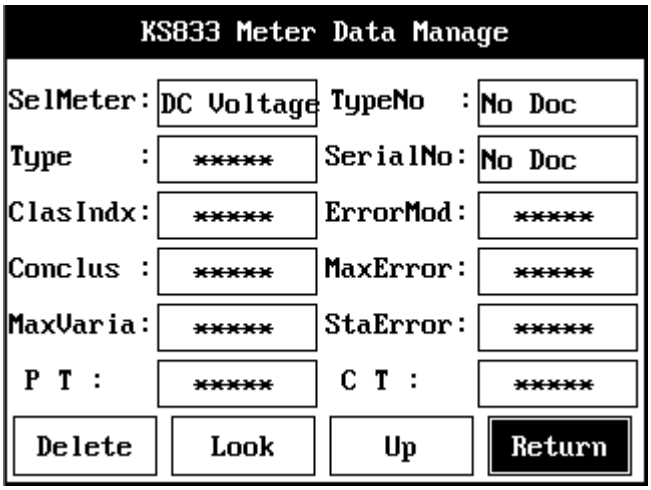


Fig 8-1 main interface of inspect data view

Click instrument number, manually enter number (must be correct number), it is better to press direction key↓, select saved instrument number. Select instrument type, instrument model and instrument number, click to view report data which had finished and saved.

8.2 Data deletion

Showed as 8-2, select “delete current” to delete current selected report, or select “delete all” to clear all reports.

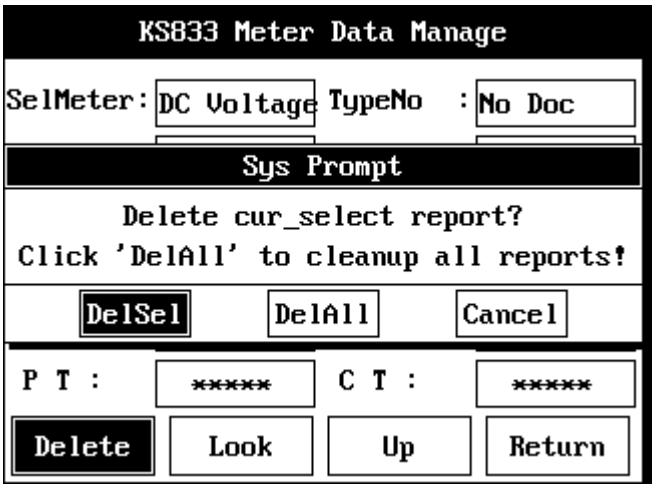


Fig 8-2 Deletion interface of inspect report

8.3 Report uploading

Refer to Figure 8-3, reports uploading need PC connection as PC operating procedures.

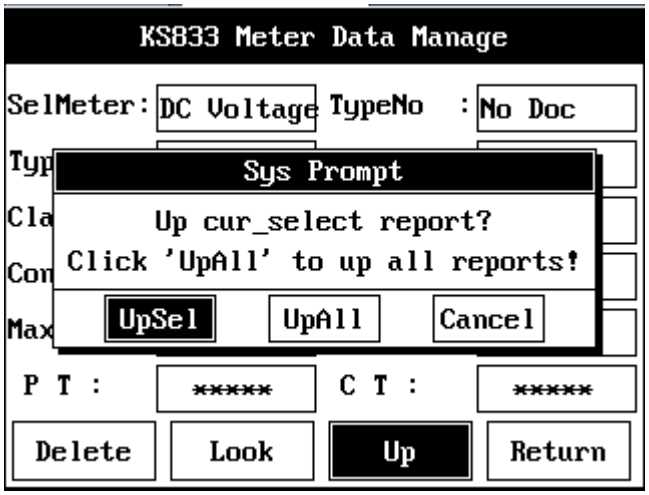


Figure 8-3 Test Report uploading

Select the report upload and then click OK on the prompt window.

Note:

1. Select the report uploading in the Tester, Power on the PC, select the software upgrade and upload the report -> report upload.
2. After finished, the file name: data.exe is generated under the root directory in C, double-click to unzip the files on default path is: C: \ report.
3. Here's the all report uploading including instrument calibration and the transducer section.
4. If selecting the report clear, it will delete all reports including instrument calibration and test transducer (Note: This procedure does not reversible)

9. KS833 Transducers calibration

9.1 Operation process

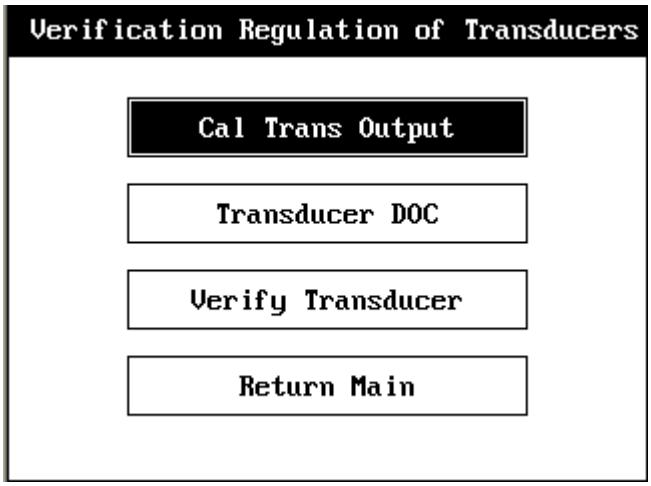


Figure 9-1 Transducer Calibration menu

In Transducer Calibration menu, click “output calibration" to enter the nominal sub-menu of the transducer output calibration; Click the "transducer inspection" to enter the meter testing; Click the "document retrieval” into files searching page. (Note: This function module is only available in KS833).

Transducer document retrieval

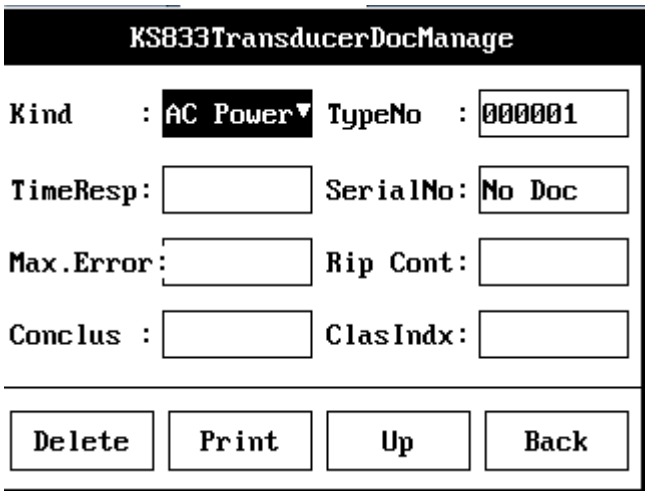


Figure 9-2 Transducer document retrieval

Choose the relative instrument type, instrument type and instrument number to call up the corresponding document, then you can be "delete", "Print" it. Click to remove as below the page display, you can choose to remove or delete the document type: Remove the document to delete the current document only, that is remove the meter number; deleted

type will delete all the tables under this model.

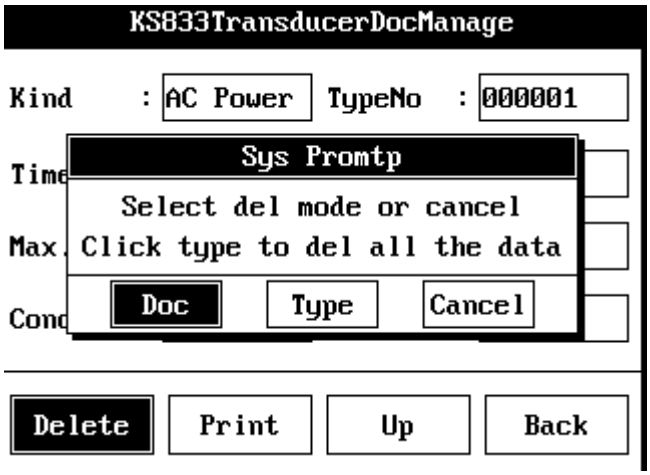


Figure 9-3 Remove the transducer document

Delete Instrument Type (Note: the corresponding parameter library will also be deleted.)

9.2 The Nominal value calibration of the transducer outputting

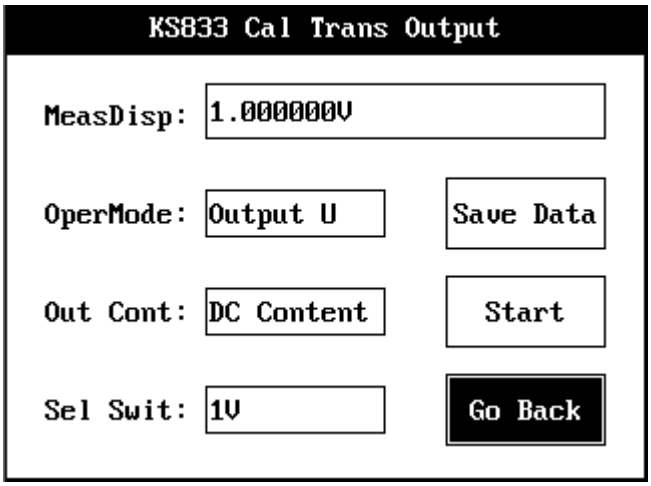


Figure 9-4 Transducer Output Calibration Menu

Note:

1. If this data has not been calibrated, measurements show may be not accurate;
2. The measurement should be accuracy after a time delay if Work mode or threshold changed.

9.2.1 Basic Settings

Click the "work mode" to calibrate the nominal outputting value such as "DC voltage" or "DC current."

Click the "output content" for select the "DC content" or "ripple content" calibration

Click the "working threshold" to select the desired calibration work stalls:

DC voltage is divided into three positions: 1V, 5V and 10V;

DC current is divided into three positions: 1mA, 10mA and 20mA.
(Note: Each stall needs to calibrate the corresponding DC content and ripple content)

9.2.2 Tester Calibration

Click the "Start " and link the calibrating DC signal in the Tester measurement port, which requires two calibration points, so after finishing first point calibration, it need to change the signal value in order to generate a second calibration point. (Note: basically the difference of two calibration points is greater than the instrument resolution and the default proposed value of 20% and 100% is recommended)

After inputting signal stabilization, the standard value is filled into the dialog box.
Click enter and wait for the system sampling finished, then click OK after confirming the correct inputting, (If the standard value of the input is incorrect, press the arrow keys to move the cursor to the standard value, and then enter the correct values, Finally press Enter to confirm.)

The instrument will then enter the second point calibration. Changing the difference value of signal, wait for the input signal stable as same as the first point calibration.
After 2-point calibration is complete, click Close to stop the experiment instrument output.

9.3 Continuous Calibration

Select other calibration terms to continue calibration. After any calibration term finished, you can click the saving button to save the calibration data. When leaving the page, the system will automatically save all calibration data (Note: this is forced saving, no saving tips)

9.4 Transducer Measurement Test

9.4.1 Instrument parameters Setting

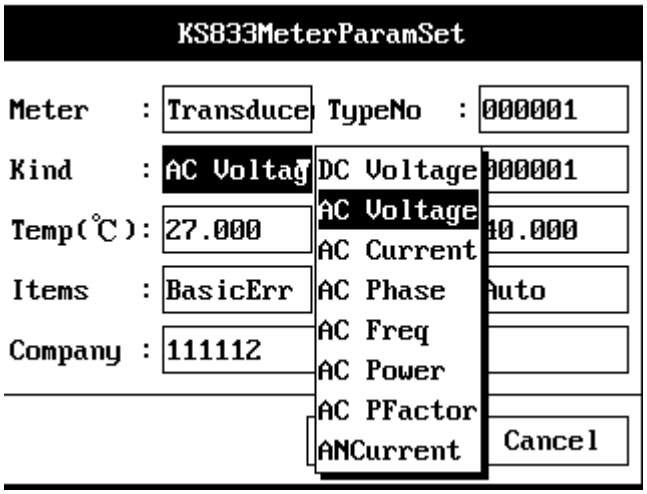


Figure 9-5 KS833 Instrument Parameter Setting

Click "transducer measurement test", the system enters the instrument parameters setting page. In this page the category, type, model number and serial number etc will be confirmed. Then input the parameter of instrument into the corresponding edit box.

Select "Auto Test" or "Manual Test" in calibration model box. If Automatic Test is selected, the system will enter the closed-loop full automatic test mode, the user can not arbitrarily change the test parameters during the testing process. If Manual Test is selected, the user can select any test point to test.

9.4.2 Tested Instrument Parameter Setting

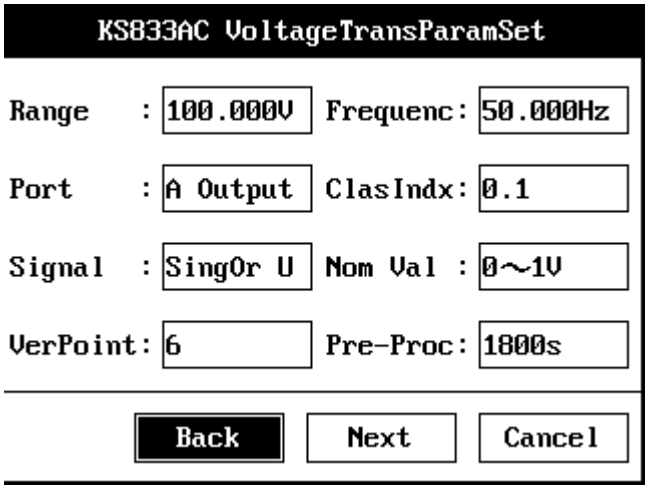


Figure 9-6 KS833 Parameter Setting of AC Voltage Transducer

In the instrument parameter settings page, click "Next" and enter the corresponding instrument parameter setting of tested instrument. When the selected instrument type is transducer, the intrinsic parameters of the transducer (output signal, output nominal value, test points and pretreatment time) need to be set. If test model is manual test, the test points and pretreatment time is invalid.

According to the selected instrument type (type of transducer: DC voltage, AC voltage, AC current, frequency phase, power frequency, AC power, power factor and the negative sequence current), there are different parameter options in the parameter setting page of tested instrument, then set the corresponding parameters according to the available setting options.

If need to choose other tested instruments, click the "Back" to return the instrument parameters setting page. Click "Next" to enter the page of the transducer response time measurement to test response time. Click "Cancel" button to cancel the test of transducer and back page directly.

9.4.3 Response Time Measurement of Transducer

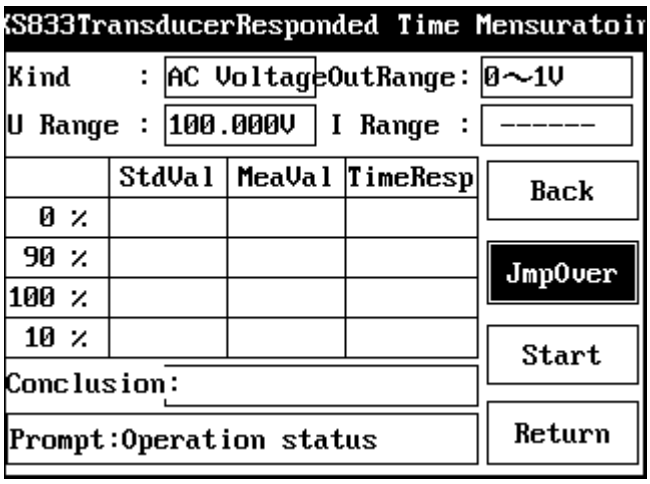


Figure 9-7 Response Time Measurement of Transducer

Click the "Back" or "Return" to return the instrument parameters setting page, then click "skip" to enter the transducer test directly, and then click "Start test" to measure the response time. When the response time is less "400ms", the test conclusion is Qualified; when the response time is unqualified, the display is error, and the test conclusion is failure. After completion of the experiment, "Start Test" will become "Stop Test", click this button to stop the test; also "Jump Over or skip" will become "Next", click this button to enter the transducer measurement test.

9.4.4 Transducer Test

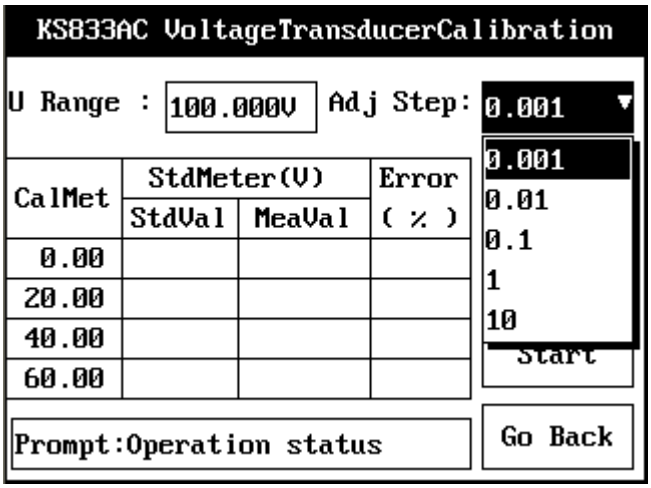


Figure 9-8 KS833 AC Voltage Transducer Test

After entering transducer test, the test page as shown will be different slightly because of different instruments (mostly display parameters of different instruments types)

Example 1: AC voltage transducer testing: set the output signal to be single-phase voltage, 9 as test point; test point of tested instrument: 0、12.5、25、37.5、50、62.5、75、87.5、100

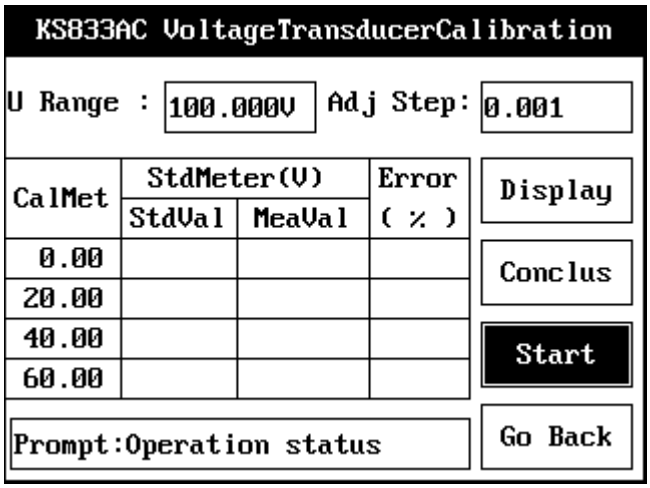


Figure 9-9 Example 1

Example 2: power frequency transducer test: set the output signal to bidirectional voltage, 7 as test point; test point of tested instrument: -100,-66.67, -33.33, 0.00, 33.33, 66.67, 100

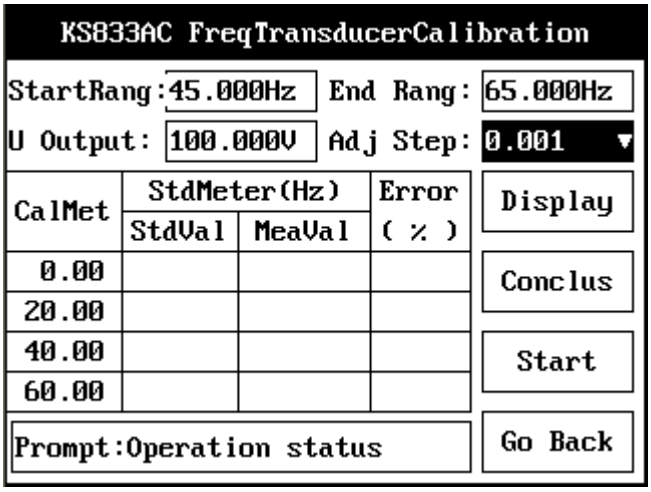


Figure 9-10 Examples 2

Click “Run” to start the test. The test values of transducer are input through the DC measurement interface (DC 20mA/10V), so the system will enter the whole-course closed-loop automatic test. During this test, unnecessary for the user to control or set the value. While tested by manual, the user has to set the current tested point before testing. Take 50% for instance: click “start or run”, and then rotate the encoder to change the standard value, and press the encoder when it reaches 15V (50% point) to start the test.

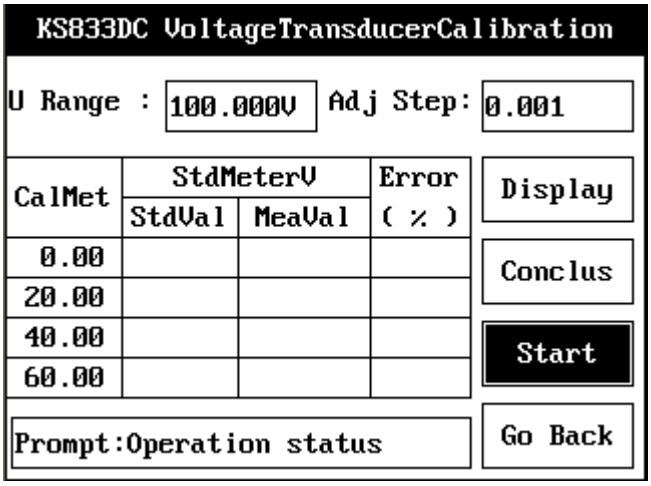


Figure 9-11, Test of DC Voltage Transducer

Change the step value of encoder by selecting different “adjustment fineness”. When finishes test of each point, the initial value of next point will be subjected to the value of previous point. Notes:

1. adjustment fitness is only available for manual test;
2. content of ripple wave will only be tested while testing the max. value.

● Power Transducer Test

Select the "AC power" as the meter type in the Instrument parameter settings in Figure 9-5, that is, and then enter Figure 9-12 of the parameter setting interface of Power Transducer. Input the needed voltage, current measure range, tested points and pre-treatment time and select other parameters; Tested points is 12, it means each power factor checks 12 points. Note: pre-treatment time is only available for the automatic test mode.

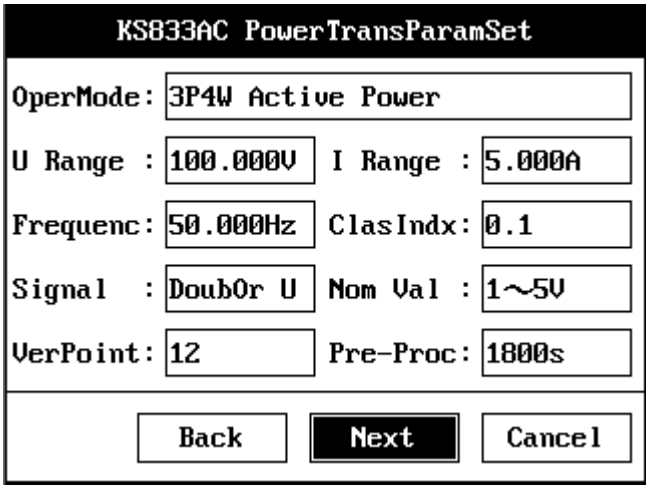


Figure 9-12 Parameter Setting of Power Transducer

Click “Next” to enter measure interface of transducer response time shown in Figure 9-7, click “skip” to enter the interface of Power Transducer Test shown in Figure 9-13.

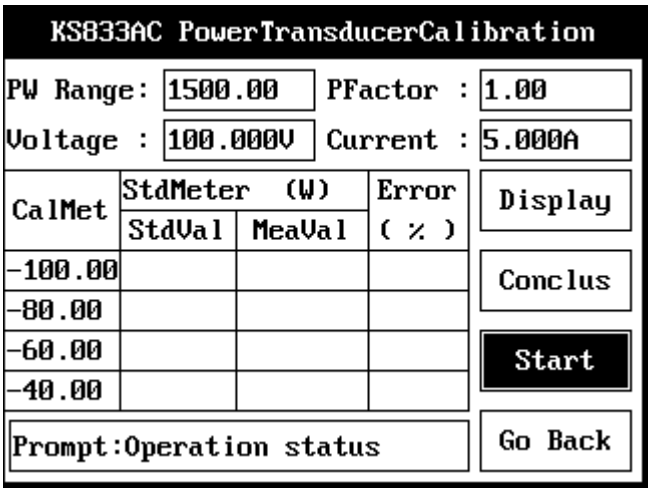


Figure 9-13 Power Transducer Test

Power factor optional: 1.0、0.5L、0.5C. For the automatic test, power factor is not available to be selected. When the test begins, the system will set it as 1.0 automatically, and then test for 0.5L and 0.5C. For the manual test, can select one factor to test. When the output signal is two-way, the column of tested meter will come with ＋0 and －0, which means the current now is 0 and the factors are ±1, ±0.5L and ±0.5C respectively.

- **Power Factor Transducer Test**

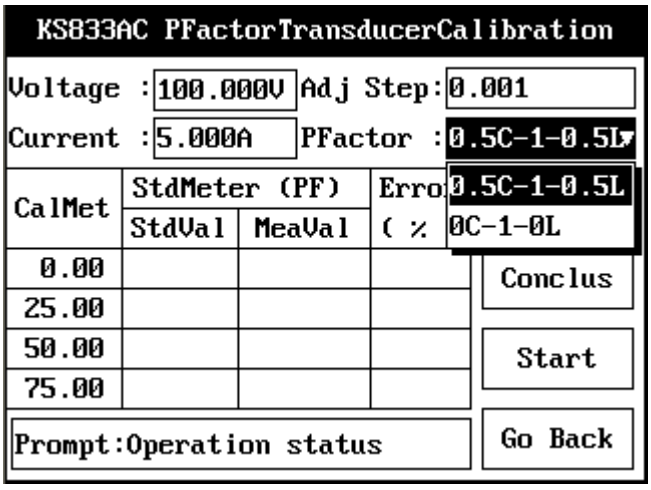


Figure 9-14 Automatic Test of Power Factor Transducer

Under automatic test, power factor range could be 0.5C-1-0.5L or 0C-1-0L, and the test steps are the same with DC voltage transducer.

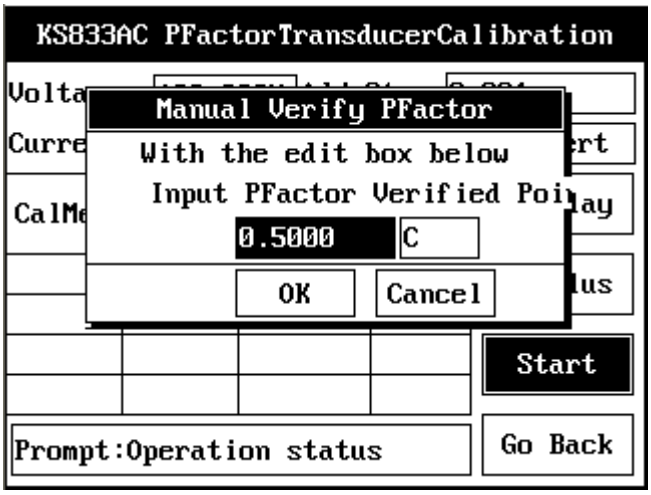


Figure 9-15 Automatic Test of Power Factor Transducer

Under manual test, test point of power factor can be input by manual, with same steps as automatic test.

- **Negative sequence current transducer test**

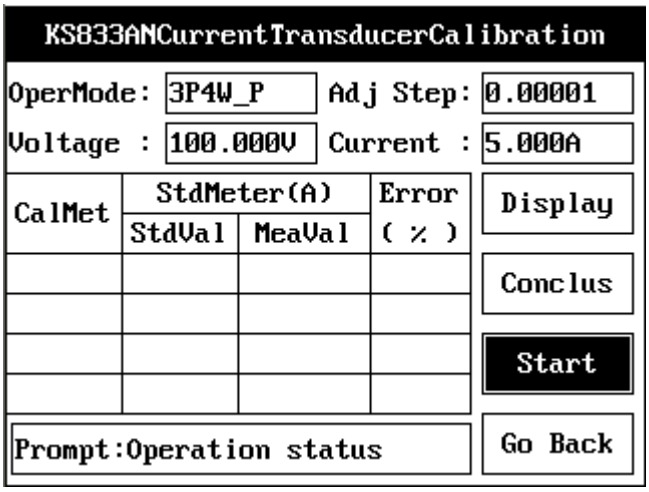


Figure 9-16 Negative sequence current transducer test

Output signal of negative sequence current transducer includes: Unidirectional current, unidirectional voltage, two-way voltage; Test steps are the same with DC current transducer.

9.5 Test Result

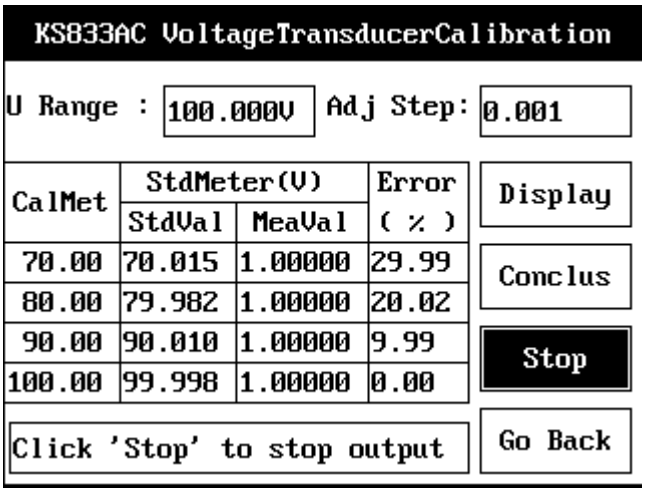


Figure 9-17 Interface of Calibration of AC voltage transducers

When the test finishes, user can click “Result” button to check the max and min. error point of this test. When the test point is full range, the system will test the ripple wave automatically for only one time. Note: when click “stop”, it will display if the final result is qualified or not.

9.6 Stop the test

For automatic test, when the user finishes all test point, it can click “stop: to shutdown all output from the instrument, and the button of “stop” switches into “save” and “output display” switches into “print”.

9.7 Data treatment

When finish the test, can click “result” to check if the tested meter is qualified or not. Click “print” for the document of tested meter, and then click “save” for the test data of this experiment.

10. Calibrate Multifunction Standard Source

10.1 Brief Introduction

KS833 multifunction standard source calibration is divided into five parts: AC standard source calibration, phase standard source calibration, DC standard source calibration, power standard source calibration and change password; the interface is shown in Figure 10-1.

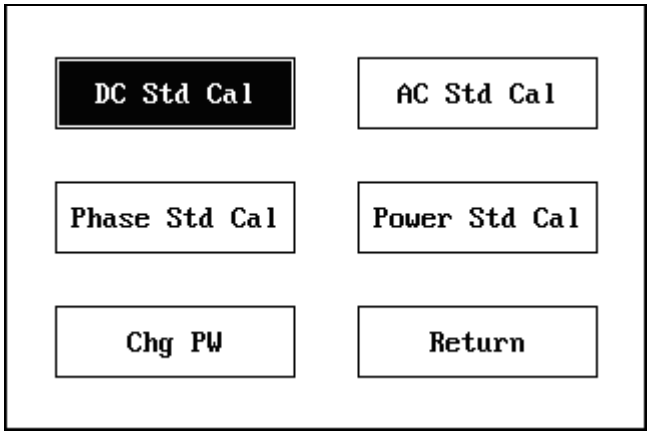


Fig. 10-1 KS833 Standard Source Calibration main menu interface

10.2 Operation Flow

In the Main Menu, select Standard Source Calibration to enter the standard source calibration page, click button the enter corresponding calibration page, you will be requested to input password on the page (as shown below), access would be denied if the password is incorrect. Click Return to return to the Main Menu. (Note: You can set the authorization password in “Change Password.”

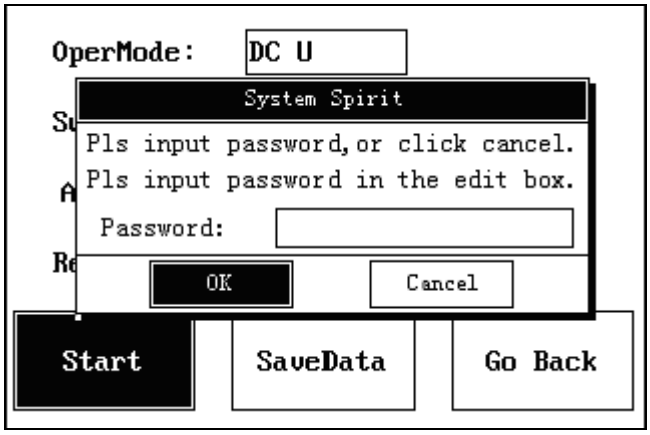


Fig. 10-2 Password Input interface

10.2.1 AC Standard Source Calibration

see Figure 10-3 for its interface

Click the “Operation Mode” dropdown box, select “AC Voltage” or “AC Current.”
In the Working Step dropdown box, select the working step you want to calibrate, if voltage is selected for the operation mode, voltage steps will be display, and current steps will be displayed if current is selected. In the Output Port dropdown box, select Phase A, B or C output. Output port and operation mode will determine the output item for calibration. For instance: calibrating Ua would require selection of both AC Voltage and Phase A output, calibrating Ia would require selection of both AC Current and Phase A output. Select the voltage and current steps in Working Step dropdown box.

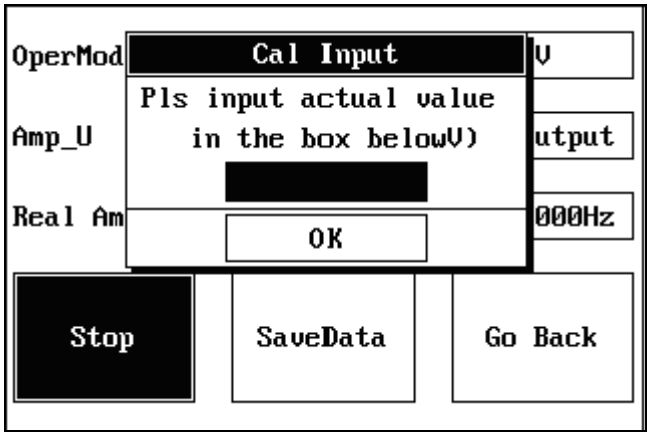


Fig. 10-3 KS833 AC Standard Source Calibration interface

Connect the standard source meter to the selected the output port.
Click Start Test button, wait till system output is stable, then input the indicating value of the standard source in the edit box of the popup dialogue box. Click enter, wait till the completion of system sampling, make sure the input is correct, then click OK. At this time the calibration of the step of the output terminal is over, click Stop Test to close instrument output.

Repeat the first step; select other calibration items to continue. After the completion of any calibration item, you can click Save to save data. After calibration, before exit this page, the system will automatically save all the unsaved calibration data of the cession. (Note: there will be no prompt to save.)

Phase Standard Source Calibration: see Fig 10-4 for its interface

When calibrating phase standard source, you need to calibrate the corresponding AC standard source. That is, you have to calibrate amplitude first, then calibrate phase, but you can re-calibrate amplitude without re-calibrate phase.
When calibrating phase standard source, select the phase output terminal in the dropdown box of Operation Mode,

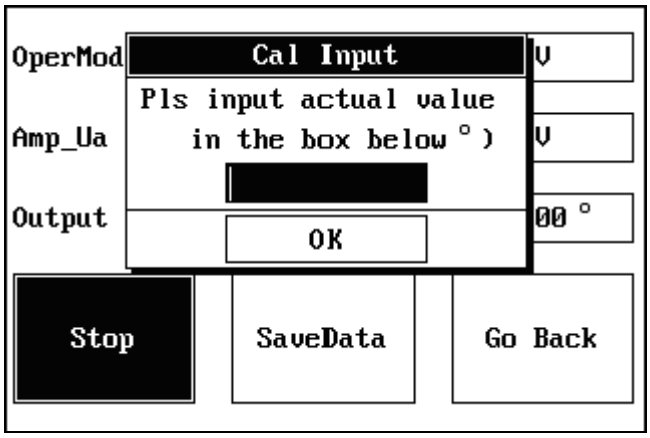


Fig. 10-4 KS833 AC Phase Standard Source Calibration interface

Select all voltage steps in Working Step dropdown box.

Connect the phase meter to the corresponding output port, if the test phases are those or Ua and Ub or Uc, then the two phases' rated voltage is the voltage of the selected working step; if the test phases are those of Ua and Ia, Ib or Ic, then Ua's rated voltage is the selected working voltage, while the rated current of the current phase is 5A.

Click Start Test button, wait till system output is stable, then input the indicating value of the standard source in the edit box of the popup dialogue box. Click enter, wait till the completion of system sampling, make sure the input is correct, then click OK. At this time the calibration of the step of the output terminal is over, click Stop Test to close instrument output.

DC Standard Source Calibration: see Fig10-5 for its interface, When calibrating a DC standard source, if you want to calibrate DC voltage, that must wait till after calibrating the steps of 300V and 100V AC under voltage Ua and Ub. After re-calibrating Phases A & B voltage, generally there's no need to re-calibrate DC voltage. You don't have to calibrate Phase A and Phase B voltage before calibrating DC current.

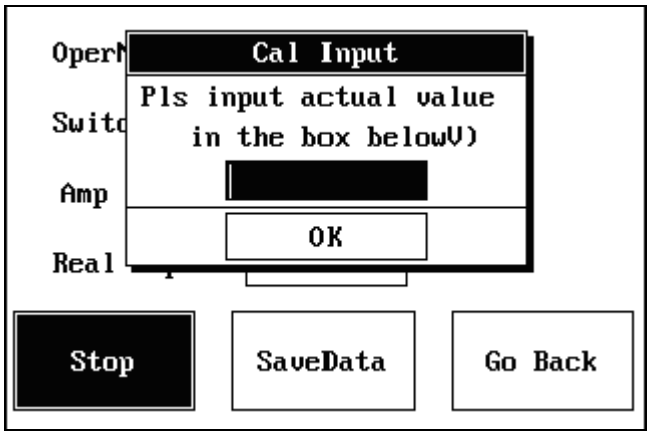


Fig. 10-5 KS833 DC Standard Source Calibration interface

Click the "Oper Mode" dropdown box, select "DC Voltage" or "DC Current." In the Working Step dropdown box, select the working step you want to calibrate, if voltage is selected for the operation mode, voltage steps will be display, and current steps will be displayed if

current is selected. Select the voltage and current steps in Working Step dropdown box. Connect the standard source meter to the selected the output port. Click Start Test button, the instrument will output the first calibration point, wait till system output is stable, then input the indicating value of the standard source meter in the edit box of the popup dialogue box. Click enter, wait till the completion of system sampling, make sure the input is correct, then click OK. At this time the instrument will output the second calibration point, as the first calibration point, you input the indicating value of the standard meter. Confirm that, then the calibration of the step of the output terminal is over; click Stop Test to close instrument output.

Power Standard Source Calibration: see Figure 10-6 for its interface.
Calibration of power standard source must come after the completion of calibrating AC standard source and phase standard source, meanwhile, after re-calibration of AC standard source and phase standard source, you need to re-calibrate power standard source.

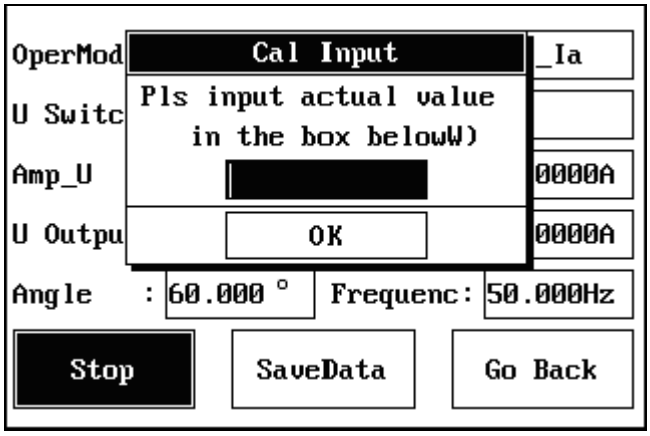


Fig. 10-6 KS833 AC Phase Power Standard Source Calibration interface

Select the calibration options in the dropdown box of Operation Mode: 3P4W, 3P3W or Cross Phase Input; select the calibration voltage step in the Voltage Step dropdown box and select the current step in the dropdown box of Current Step; select Phase A, B or C current output in the dropdown box of Output Port. Output port and operation mode will determine the output terminal for calibration. When calibrating a power meter, connect the corresponding standard power meter (arbitrary phase angle) terminal to the output port of the instrument, when you calibrate 2 Element arbitrary phase angle power meter, Ub shorts with U0.

In the dropdown box of Voltage Step, select 750 V, 300 V and 100 V in sequence, select the current steps one by one in the dropdown box of Current Step.

Click Start Test button, the instrument will output the first calibration point, wait till system output is stable, then input the indicating value of the standard source meter in the edit box of the popup dialogue box. Click enter, wait till the completion of system sampling, make sure the input is correct, then click OK. At this time the instrument will output the second calibration point, as the first calibration point, you input the indicating value of the standard meter. Confirm that, then the instrument will output the third calibration point; the operation

process is the same of the above. The calibration of step of the output terminal is over; click Stop Test to close instrument output.

10.3 Attention：

Calibration data is the data necessary for the instrument to work normally, so in calibrating standard source, you should make sure the correctness of each calibration point.

11.On-line Setting

KS8 series host computer uses serial port communication, the default port is COM1, if the COM1 port has been occupied, you can change the serial port communication settings (Figure 11-1) or modify the operating system's serial number. Click "Config" button on the application program interface to enter the following interface to modify the on-line settings.

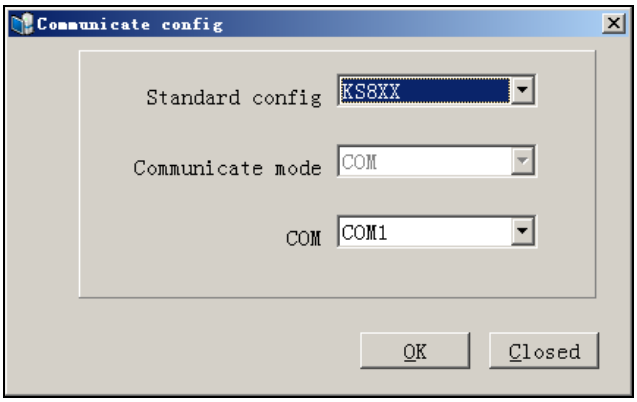


Fig. 11-1 Modify the default serial port mode

Method of modifying the operating system serial number, Click right button on “My Computer” and then choose “Manage”, then choose equipment management device in Computer Management interface. (Fig. 11-2)

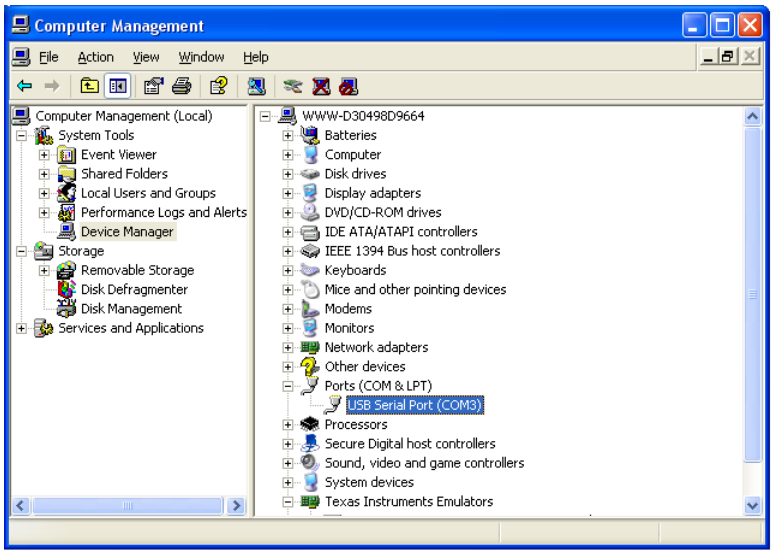


Fig. 11-2 Computer Management interface

Find the communication port in the right zone, right-click on it to select properties, switch to the properties page to the port settings tab, select "Advanced" button, modify the communication port mode in the "Com Port Num", then save it before exiting, and then restart the computer.

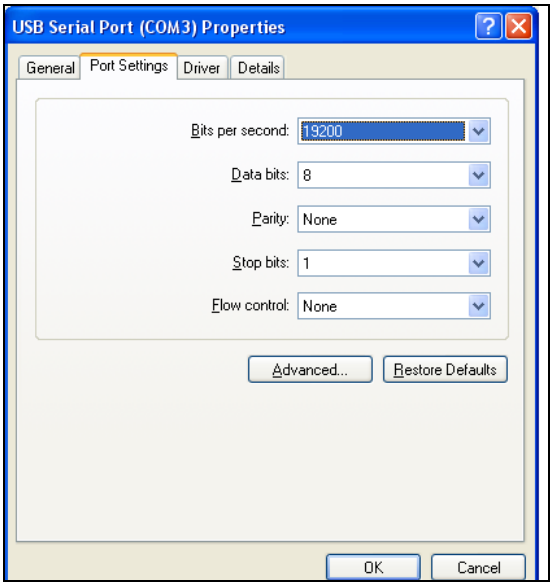


Fig. 11-3 Communication port properties interface

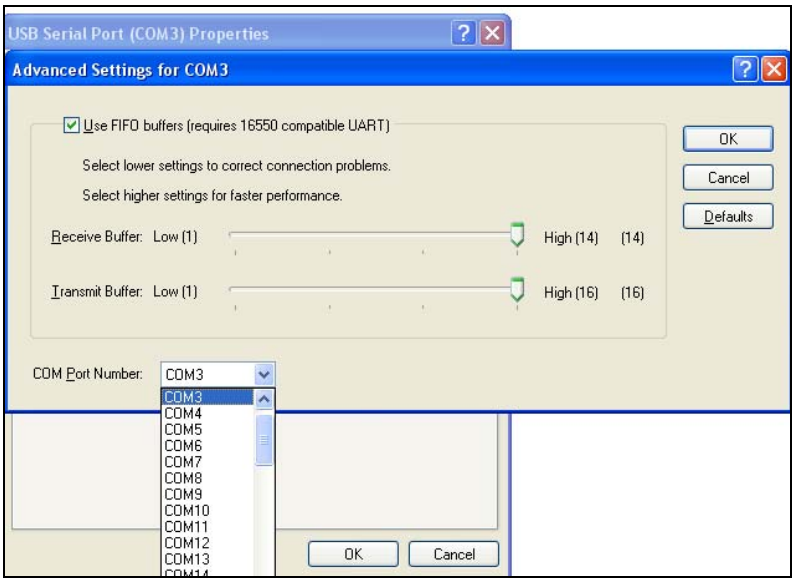


Fig 11-4 Advance setting for COM

If computer does not have serial port, you can use USB to RS232 switch port, and you need to properly install the USB to RS232 switch port before using, the system will automatically check the new hardware after plugging in the switch port, just need to follow the guide to find the driver installation.



Fig. 11-5 System found New Hardware Wizard

Click next in Fig. 11-5, it'll turn to Fig. 11-6:

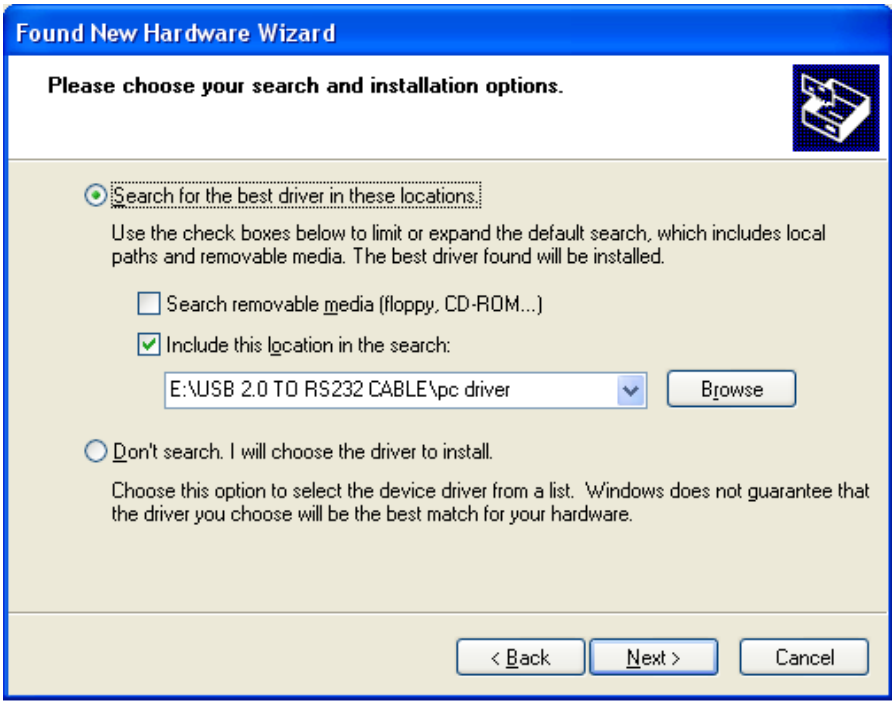


Fig.11-6 Search driver program

Then click Browse to select the assigned driver program location, shown as Fig. 11-7



Fig. 11-7 Assigned driver program location

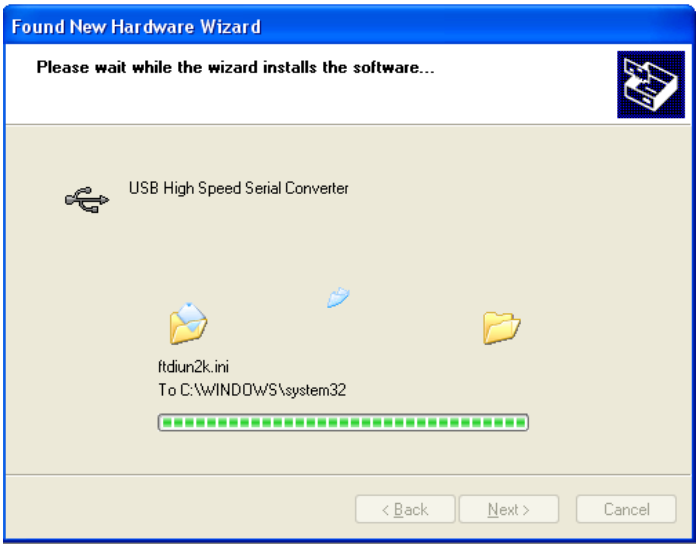


Fig. 11-8 Copy the driver files

After copying the driver program files, it will pop-up the interface as Fig.11-9, then click “Finish”, the installation is only finished a half, the system will check the driver program of switch port to finish the corresponding setting, then repeat the steps shown as Fig. 11-5, Fig. 11-6, Fig. 11-7, Fig. 11-8 to finish the installation.



Fig. 11-9 Driver program correctly installed

After the installation of driver program, you'll see "USB Serial Port" in the "Ports" item of equipment management device, then you can change the corresponding COM location in the switch port properties according to connection needs.

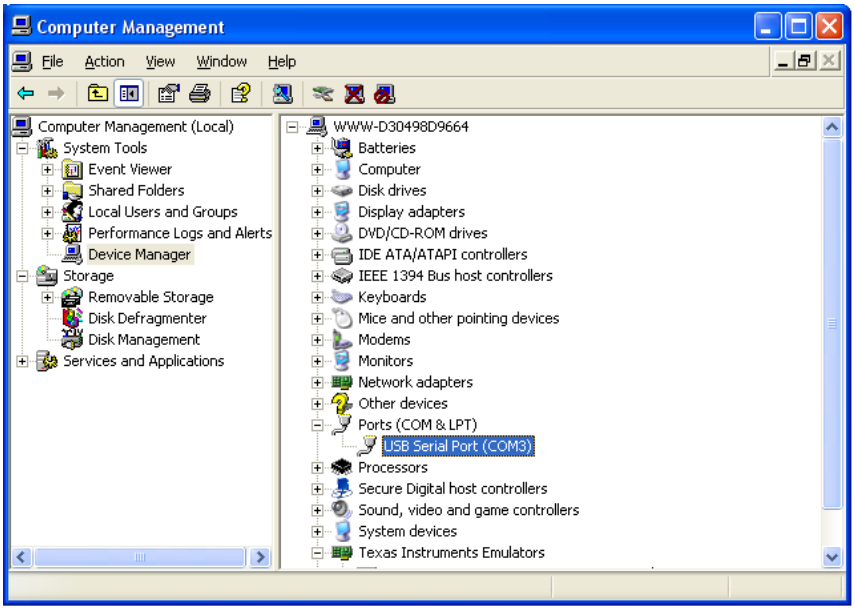


Fig. 11-10 Hardware correctly installed

Run the program of KS833 supervisor PC to enter interfacing, connect supervisor PC and KS833 with accessories of serial port wire which our company prepare for matching with device in order to complete work through supervisor PC control KS833. The method of operation for each module of supervisor PC is same as KS833, details as following instructions.

Click "connect" icon on the PC software main interface. The system will waiting for KS833 connecting.

Click on-line testing button to enter interface in on line testing interface, shows as Fig. 11-11, Fig. 11-12

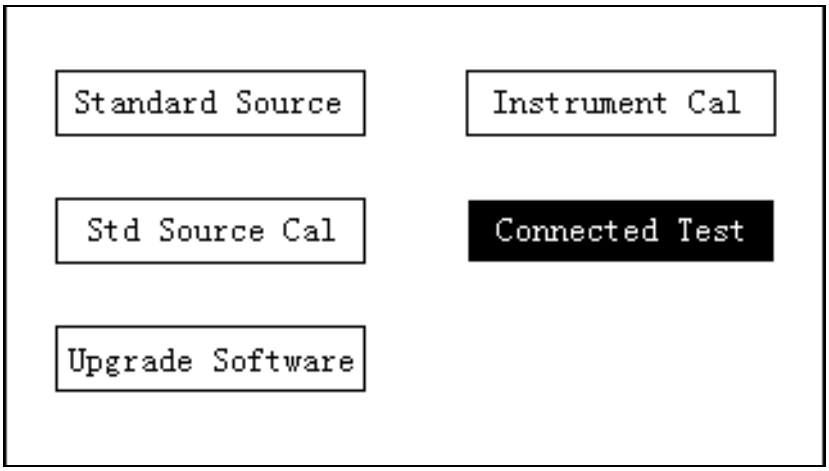


Fig. 11-11 Connect test



Fig. 11-12 KS833 on-line testing interface

Ensure connecting correctly for serial port and supervisor PC, click “connect” button, system will pop message box of startup connection and connecting genius will automatic testing serial port and supervisor PC simultaneously.

After received hand message from supervisor PC, connecting genius closed message box, meanwhile, start up label text of connecting button and change to disconnect status, serial port setting when incorrect connecting, or non-connecting serial port wire, or did not start up supervisor PC software, connecting genius won` t wait for until default recovery. During connecting, user can click cancel button of connecting genius message box to cancel connecting at any time.

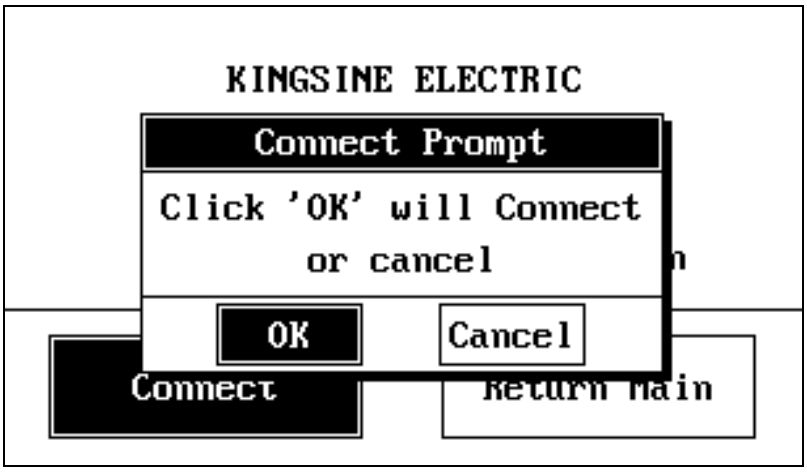


Fig. 11-13 KS833 connecting genius interface

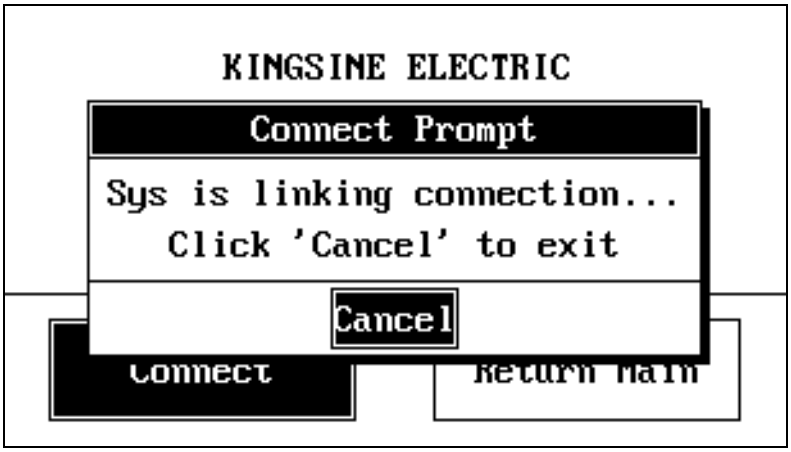


Fig. 11-14 KS833 Connecting genius interface

After system connected successfully, it control directly by supervisor PC software, no need user` s intervention.

User can click disconnect button at any time to disconnect connecting with supervisor PC. If during experiment at the same time, system will auto-closed experiment output and disconnects connection with supervisor PC. Connecting genius will auto-disconnect after latency time arrived If interrupt connecting and supervisor PC had lost in touch, no need to respond supervisor PC. Exit on-line testing interface and back to homepage.

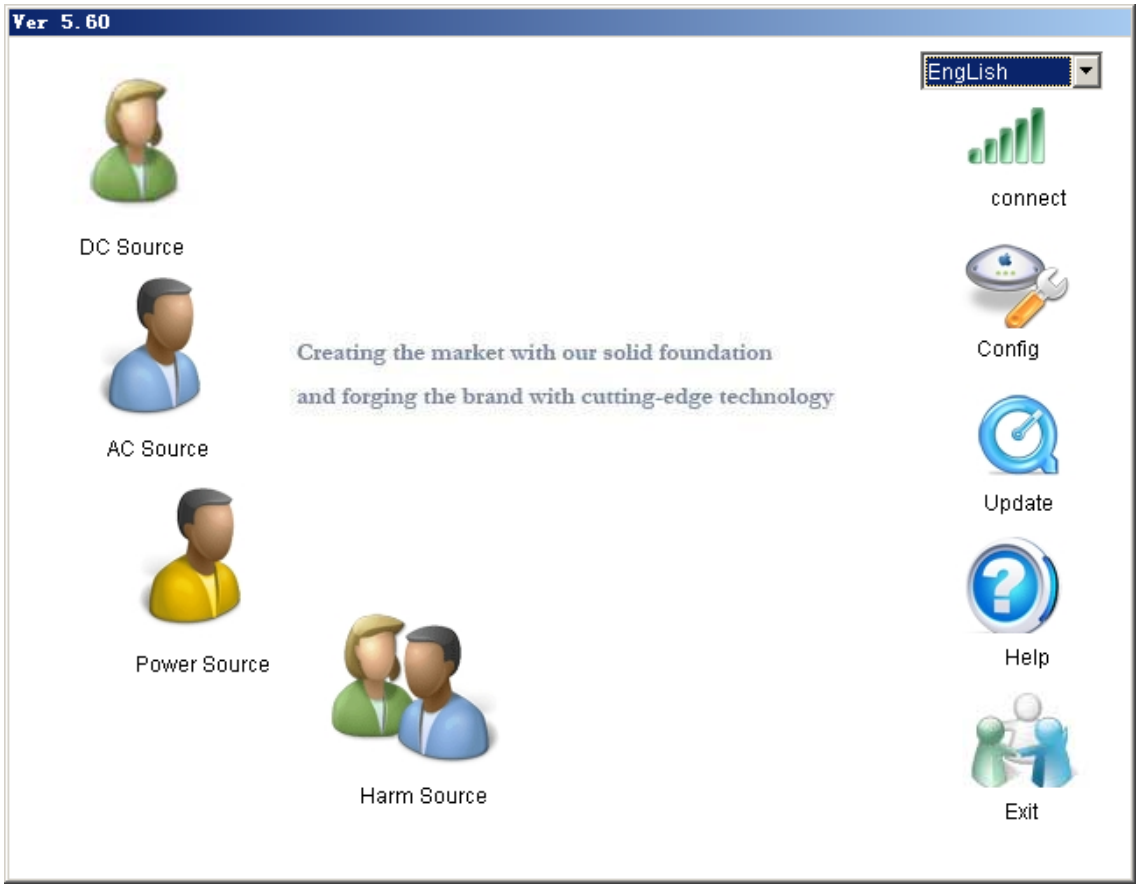


Fig. 11-15 KS833 supervisor main interface

11.1 Standard Power

Click the drop down box menu in top-left corner of main interface, shows as Fig 11-16, same as lower PC; it contains DC standard power source,3-phase AC standard power, power standard power and harmonic standard power.

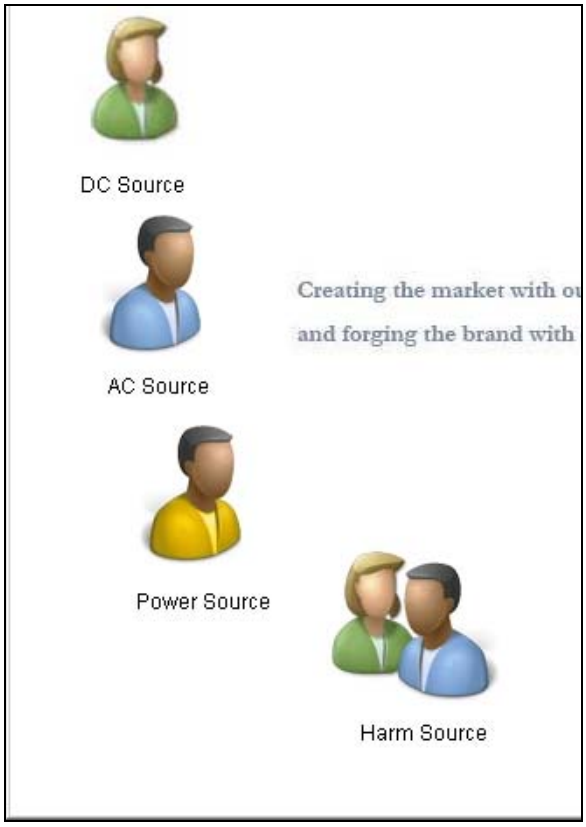


Fig. 11-16 standard power menu

11.1.1 DC standard power

Select DC standard power to enter its output interface, tick and select DC voltage or DC current , basic operation is same as KS833. If selected automatic shift, system will select suitable working shift according to amplitude selection, manual shift request shift via manual selection, if amplitude over shift output, system will set current shift to 120% output. **After change outputting value in the interface, KS833 changing outputting after clicking "Tune up" button.**

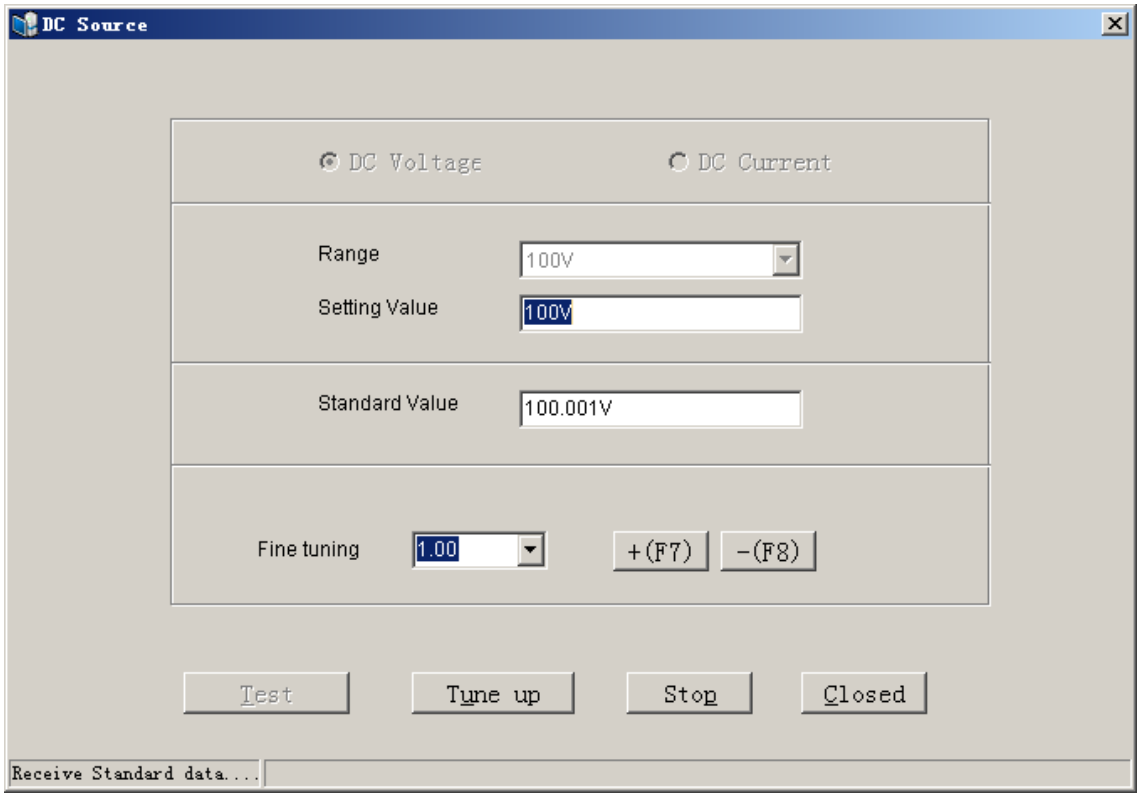


Fig. 11-17 DC Standard Power Source

11.1.2 3-phase AC standard power

Select AC standard power to enter its output interface, tick and select output port with relative output box, Ua port always has output and amplitude isn`t 0, basic operation is same as lower PC. If selected automatic shift, system will select suitable working shift according to amplitude selection, manual shift request shift via manual selection, if amplitude over shift output, system will set current shift to 120% output. When select separate adjustment, it only change 1 port output value every time, if gang adjustment, it requests to change 3 port output value. **After change outputting value in the interface, KS833 changing outputting after clicking "Tune up" button.**

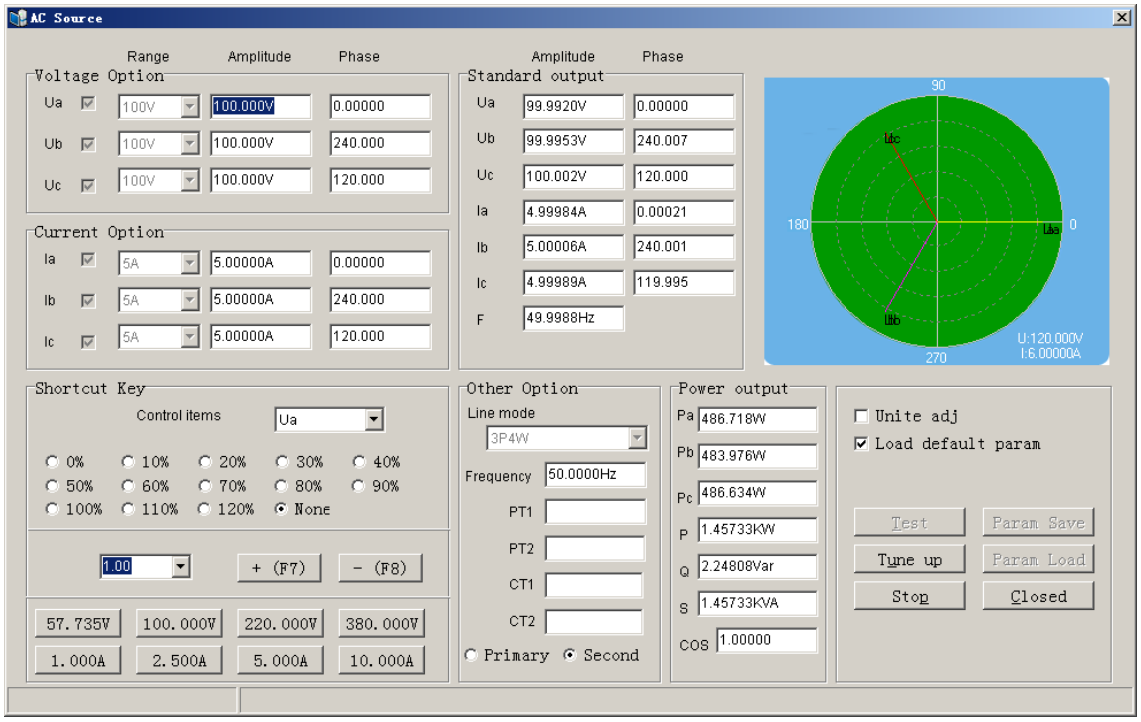


Fig. 11-18 3-phase AC standard power

11.1.3 Power standard power

Select power standard power to enter its output interface, shows as Fig 11-19. operation is same as lower PC, click PT, CT changeable setting label to set output ratio of the first value and second value, adjust voltage current amplitude of all current focus through voltage and current stepping setting in the left interface, select relative changeable multiple to adjust changeable stepping. Click output display button to see current output status during experiment. **After change outputting value in the interface, KS833 changing outputting after clicking "Tune up" button.**

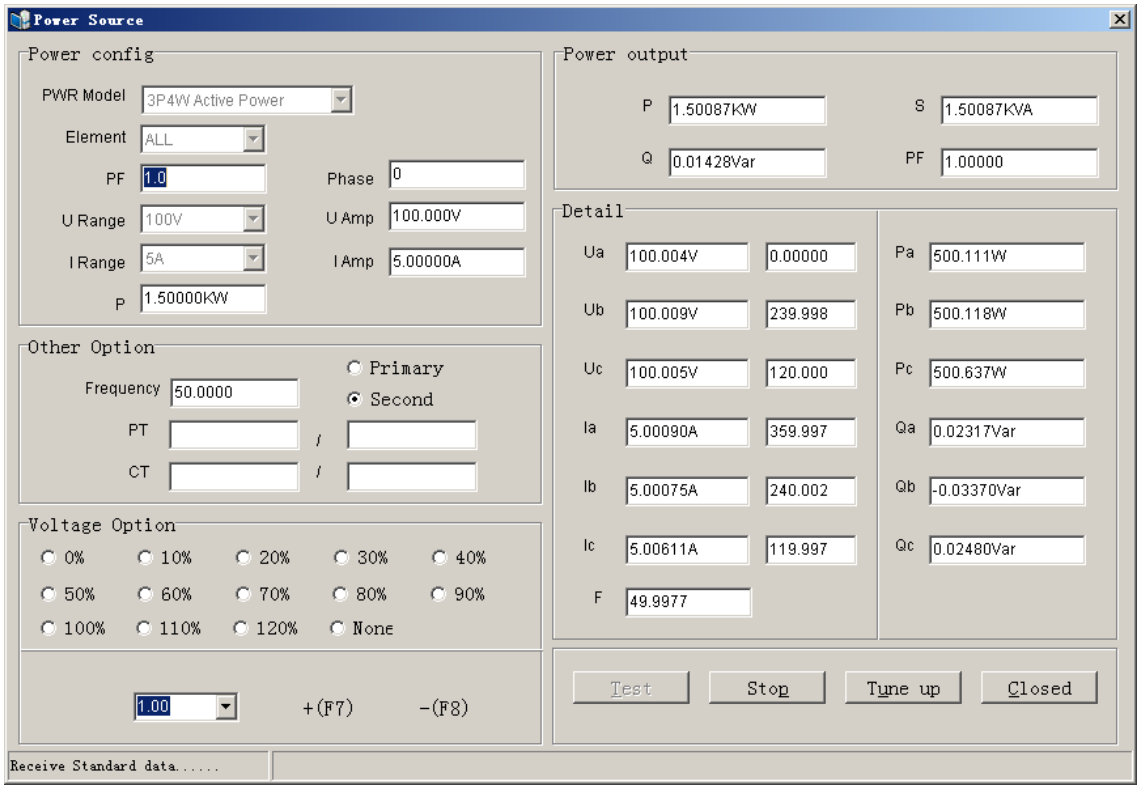


Fig. 11-19 Power standard power

11.1.4 Harmonic standard power

Select harmonic standard power to enter its output interface, operation is same as lower PC, select output port through small box in the front of tick output port, click Harmonic wave diagram to see the status during experiment, shows as Fig 11-21. **After change outputting value in the interface, KS833 changing outputting after clicking "Tune up" button.**

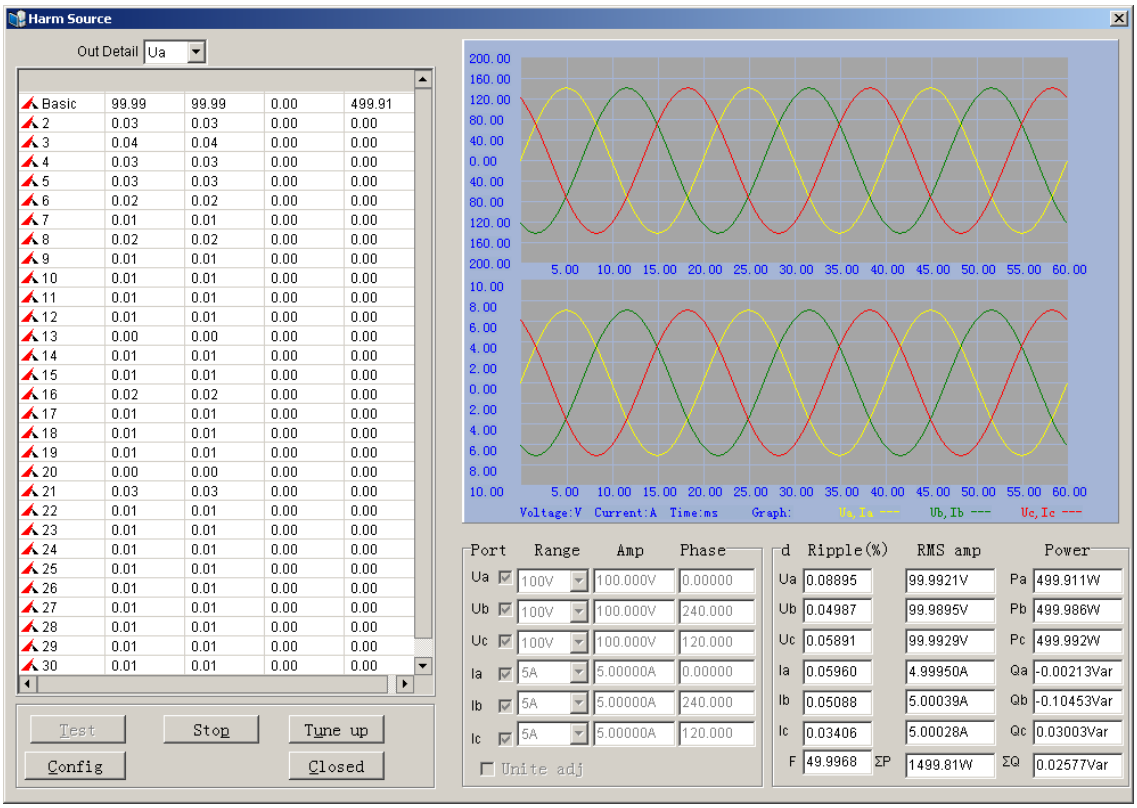


Fig. 11-20 Harmonic standard power

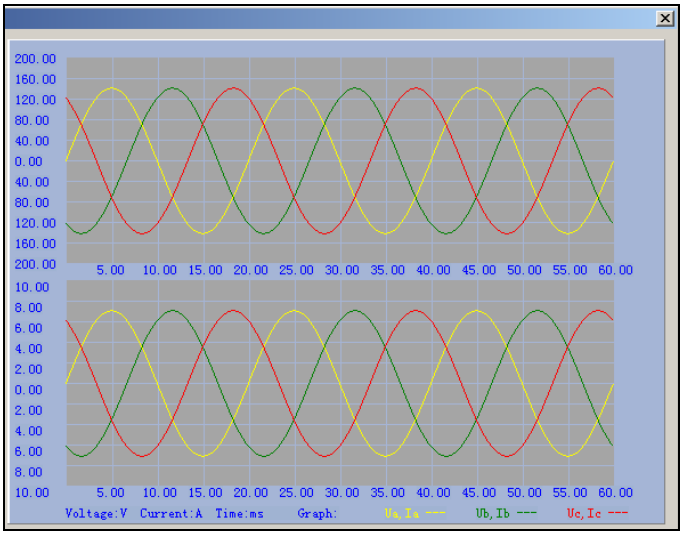


Fig. 11-21 Harmonic wave

Appendix I

Error Calculation

Fiducial error is used in indicating instrument and transducer verification:

A: Calculation of the fiducial error of indicating instrument:

$$FiducialError = \frac{S\tan dardValue - MeasuredValue}{FullScale} \times 100\%$$

Of which: Standard Value is the indicated value of the indicating instrument

Measured Value is the actual output of the source

B: Calculation of the fiducial error of transducer

$$FiducialError = \frac{MeasuredValue - S\tan dardValue}{FullScale} \times 100\%$$

Of which: Measuring Range = Full Scale – Zero Scale

Standard Value = Measuring Range x Calibration Point Percentage

Relative error is used in verifying electrical energy meter:

$$\mathrm{Re}lativeError = \frac{MeasuredValue - S\tan dardValue}{S\tan dardValue} \times 100\%$$

Harmonic Terminology in Numeric Expression

1. Voltage content of the h[th] harmonic HRU_h:

$$HRU_h = \frac{U_h}{U_1} \times 100\%$$

In which: U_h —— voltage of the h[th] harmonic (root-mean-square)

U_1 ——Voltage of the fundamental (root-mean-square)

2. Current content of the h[th] harmonic HRI_h:

$$HRI_h = \frac{I_h}{I_1} \times 100\%$$

In which: I_h—— Current of the h[th] harmonic (root-mean-square)

I_1 ——Current of the fundamental (root-mean-square)

3. Voltage content of the harmonic U_H:

$$U_H = \sqrt{\sum_{h=2}^{\infty} (U_h)^2}$$

4. Current content of the harmonic I_H:

$$I_H = \sqrt{\sum_{h=2}^{\infty} (I_h)^2}$$

5. Voltage total harmonic distortion THD_u:

$$THD_u = \frac{U_H}{U_1} \times 100\%$$

6. Current total harmonic distortion THD_i:

$$THD_i = \frac{I_H}{I_1} \times 100\%$$

Attachment I

KS833 Software Upgrading

1. Open KS833 standard power source, connect PC and KS833 standard power source reliably by series port
2. Click “update software” to update

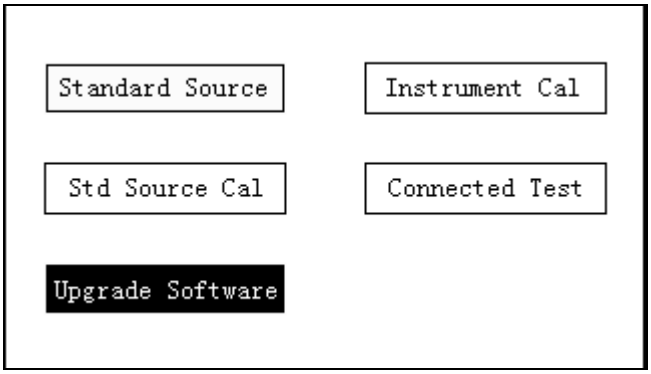


Fig. 1 choose update

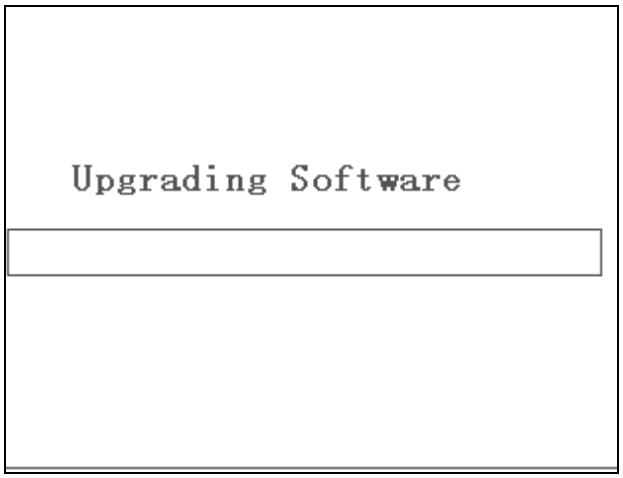


Fig. 2 updating

3. Open the software in the PC, click “update” icon on the right side, shows as Fig. 3 interface. Note: Don`t click “Connect” when you upgrade the PC, only Click “Update” directly to enter next step.



Fig. 3 Main interface of PC software



Fig. 4 Software upgrade interface

4. Click “Upgrade”, system pop out a message dialog and select update file. upgrade program in order to upgrade the KS833 standard power source, show as Fig 5

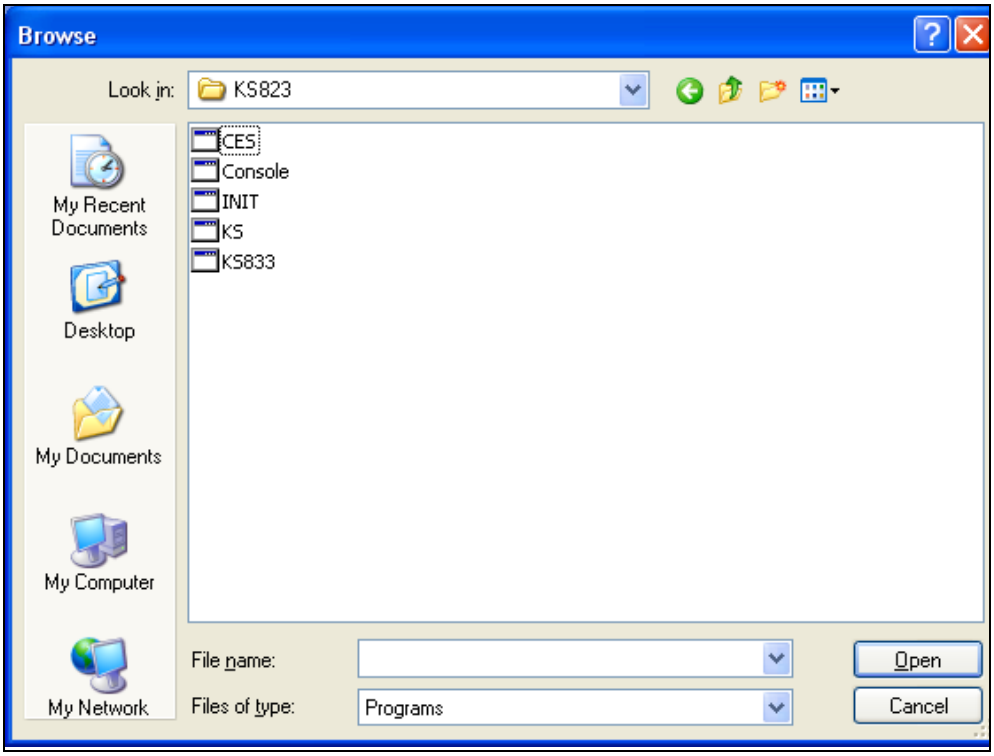


Fig. 5 Select update program

5. During software update, interface will display current upgrade progress for few minutes, please wait till it finished, KS833 will return to the main interface automatically, show as Fig 6



Fig. 6 updating

6. After finished upgrade, go on the updating progress as before, and choose other files to update one by one until updated all the files. please restart the KS833 standard power source manually

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