ZXDJ-1 Single Phase
Energy Meter Field Calibrator

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Ⅰ.spare parts

1.1 List of parts（50Aclamp meter）

Name	Qty.	Remark
Host	1 set	Standard configuration
50A current clamp	1 pcs	Standard configuration
Voltage test line	1 pcs	Standard configuration
Current test line	1 pcs	Standard configuration
Voltage and current clip	1 set	Standard configuration
Pulse test line	1 pcs	Standard configuration
Photoelectric head	1 pcs	Standard configuration
220V external power supply cable	1 pcs	Standard configuration
PC communication line (RS232 serial port)	1 pcs	Standard configuration
Manual	1 pcs	Standard configuration

Name	Qty.	Remark
PC background management software	1 set	Standard configuration（CD）
U disk	1 pcs	Optional configuration
100A clamp meter	1 pcs	Optional configuration
500A clamp meter	1 pcs	Optional configuration
1000A clamp meter	1 pcs	Optional configuration

Ⅱ. Introduction to single-phase energy meter multi-function calibrator

2.1 Main functions

- **Single phase field calibration**

The single-phase energy meter calibrator is a set of 0.1-magnitude high precision field calibration instrument, but it is qualitatively different from the single-phase field calibration made of energy meter chip. Where there is no load on the spot, its current

output can be used as a virtual load, which is greatly convenient for field testing of single-phase energy meter.

● **Storage and query**

can store at least 6000 calibration records, which can be searched according to different ways and support for fuzzy queries, and you can inquire the calibration record data stored in the instrument.

● **Calibration plan**

Before work, users can make task plans on the, which is beneficial to orderly working. Calibration plan can be downloaded via PEC management software through serial port into the instrument.

● **Input**: the instrument supports for Chinese characters, English case and Arabic number input.

● **Harmonic measurement**: shows the content of 2^{nd} ~ 51^{st} harmonics in the form of histogram.

● **Counter**: check the accuracy of meter counter.

● **U disk**: upload and download data by connecting U disk

● **Timing**: calibrate the instrument time

● **Waveform display**: shows U and I waveforms directly.

● **User functionality**: view the uploaded user information and do corresponding tests.

2.2 Main characteristics

- With the basic functions of portable calibration device; its own simulated load is used for calibration of energy meter at the scene without load, and the accuracy is up to 0.1%;
- It can measure the voltage and current of 2^{nd} ~ 51st harmonics, and all of the harmonic data can be stored;
- Settings, errors, electrical parameters and voltage and current waveforms are displayed on one screen;
- All measurement data of at least 6000 meters can be stored, including working parameters, convenient for future analysis;
- Support for U disk, and calibration data can be downloaded by U disk and serial port upgrade software;

- It can communicate with PC, and it is very convenient to connect with the original database and management system. It can match the *PEC energy meter management system* software to realize paperless office;
- With high brightness, high resolution, and high-resolution 4.4-inch (320 * 240) TFT color LCD display;
- Chinese characters, English case and Arabic numbers can be input;
- A wide range of operating power supply AC 90 ~ 265V;
- The system adopts a high speed and high precision digital multiplier, and all parameters can be corrected by software;
- The instrument has no potentiometer, and can completely prevent the instrument's error change due to external causes such as transportation, thus greatly improving the stability and reliability of the system;
- A domestic pioneering digital true reactive power measurement technology is adopted for the system;
- The accuracy of electric energy is ensured within the temperature range of - 20℃ ~ + 40℃;
- With 0.3- magnitude 50A clamp optional (including opening and closing non-repeatability error, contact error, interference error of outside magnetic field and angle error, etc.).
- With 50A, 100A, 500A and 1000A clamps optional, used for direct measurement and low voltage measurement of comprehensive errors;
- Automatic voltage shift 30 ~ 265V, and 1-10A direct current input;
- With high precision plastic mold chassis design, lightweight and beautiful;

2.3 Operating and using points for attention

Warning: as this instrument belongs to electric working equipment, for the sake of your safety, please abide by the national regulations on production safety, and operate strictly according to the field calibration procedures of electric power metering devices.

- Connect the power supply properly (Note: the power supply range is AC90V ~ 265V);
- Please read this manual before operating to set the measuring parameters correctly;
- Don't clip the pulse line clip to the energy meter's voltage terminal;

- Don't insert the voltage terminal onto the current terminal;
- Don't insert the current terminal onto the voltage terminal;
- Choose the current range correctly, and the current range generally does not exceed 220% of the rating;
- Each clamp meter has positive and negative ends: "+" is the current input and "-" is the current output;
- The clamp meters of different instruments are not used interchangeably, or else it will affect the accuracy of measurement;
- The instrument belongs to a precision meter, so please handle with care.
- The jaw of the clamp meter should be kept clean, because oil dirt and scale may affect the measuring accuracy;
- Using corrosive organic solvents to wipe the instrument is strictly prohibited;

2.3 Operating process of the instrument

The instrument is used in strict accordance with the operating processes.

Open the instrument power supply →connect the test line at the instrument side → connect the test line and clamp meter on the energy meter end → set the test parameters → check →dismantle the test line at the energy meter side → shut down the instrument→ dismantle the test line at the instrument side.

Note: the clamp meter "+" is the inlet direction of current and the "-" is the outlet direction of current.

2.4 Wiring

Check the wiring methods of the single - phase energy meter:

Load on the field

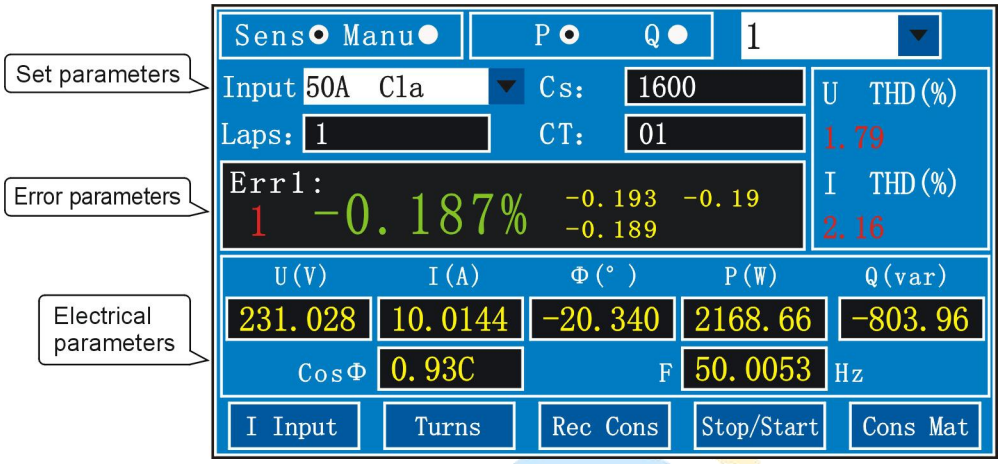
Connect the energy meter "live" wire on the instrument side to the instrument's U + port, and connect the "zero" line to the instrument's U - port; connect the clamp meter line to the instrument's "clamp meter" port; connect the pulse input device to the instrument's "pulse" port.

1. When the instrument voltage is from the live wire inlet, the clamp meter should be connected to the live wire outlet; otherwise it will affect the accuracy of calibration error;

2. When the instrument voltage is from the live wire outlet, the clamp meter should

be connected to the live wire inlet; otherwise it will affect the accuracy of calibration error.

2.5 Main screen



Field settings:

Constant refers to the measured energy meter's constant;

N: refers to error calculation at a time by the instrument within how many times of pulses. Specifically, as for a mechanical energy meter, it is error calculation at a time by black meter for how many times.

(It is noteworthy that in manual mode, the manual switch is pressed once for how many times of black meter);

Photoelectric (manual): pulse sampling way; (note: photoelectric head and pulse line are in the photoelectric sampling mode)

Input: refers to current sampling way (there is a need to input the numerical value of transformation ratio and input the transformation ratio; if it is a straight meter, the transformation ratio is 1:1 and it is input under other situations according to the transformation ratio of field TA);

Error: the error parameters generated by the energy meter during field calibration. The instrument can calculate the percentage of the values of electric quantity measured by the energy meter and the difference in electric quantity actually measured by a standard meter according to the input energy meter constant and collected energy meter power pulses).

Electrical parameter area:

The following kinds of all electrical parameters are shown:

U (V), I (A), φ(Angle), F (frequency), P (W), Q (Var), COSΦ

U (field voltage value) I (field current value) φ (phase shift angle) P (active value)

Q (reactive value) φ (power factor) F (frequency)

Input method identification: "123" means Arabic numeral input, "ABC" refers to English uppercase characters input, "ABC" means English lowercase characters input, and "Pin" is Chinese character input.

Ⅲ. How to use the functions

3.1 Calibration information setting

Calibration parameter setting:

Photoelectric and manual mode

Photoelectric refers to using the light signals or pulse signals of the measured meter. The "photoelectric" mode should be chosen by use of photoelectric sampler or when the pulse signal of the measured meter is directly sent to the instrument's photoelectric head interface.

Manual: means the "manual" should be chosen when using a manual switch for calibration.

Operation method: press "←, →" and the cursor jumps to the photoelectric and manual settings; press [Confirm] key to lock the option.

For example: choose the photoelectric mode to measure the energy meter.

Press "←, →" keys to move the cursor to the photoelectric setting, and select the "photoelectric" parameter value by pressing [Confirm] key.

Active and reactive power

Active (reactive): refers to the measurement of the energy meter's active or reactive power error.

Operation method: press "←, →" and the cursor jumps to the active and reactive power setting, and press [Confirm] key to lock the option.

Such as: the active power error of the measured energy meter

Press"←, →" and move the cursor to the active power setting, and choose "active" parameter value by pressing [Confirm] key.

Electric meter series

Electric meter series: refers to the level of the measured energy meter, which will be indicated on the electric meter.

Operation method: press "←, →" and the cursor jumps to the electric meter series setting; press [Confirm] key and jump out of a variety of options; press "↑, ↓" to choose the required

level and press [Confirm] key to lock the option.

For example: the measured energy meter is "level 2"

Press "←, →" and move the cursor to the electric meter series setting; press [Confirm] key and find the "level 2" in the options jumped out; press "↑, ↓" and move the cursor to the "level 2" option, and press [Confirm] key to choose to "level 2"

Input:

Current input has six kinds: 5A terminal, 20A clamp meter, 50A clamp meter, 100A clamp meter, 500A clamp meter and 1000A clamp meter inputs.

Operation method: press "←, →" and move the cursor to the input setting; press [Confirm] and jump out of a variety of input options; press "↑, ↓" to choose the required input, and press [Confirm] key to lock the option.

For example, 50A clamp meter is used at the time of field calibration.

Press"←, →" and move the cursor to the input setting, press [Confirm] and find " 50A clamp meter" in the options jumped out; press "↑, ↓" and move the cursor to “50A clamp meter" option, and press [Confirm] key to choose to "50A clamp meter"

Constant:

This is an electric energy constant used to set the measured energy meter, and the constant range is 1-99999; it supports for ordinary mechanical single-phase energy meter to the latest electronic energy meter, and the constant unit is the Plus/kW. h.

For instance: when the constant of energy meter is 600 plus/kW.h

Press [Set] key, and the cursor jumps to the moving constant setting, where 00600 is input through the keyboard.

N (sampling laps):

Laps: when the photoelectric sampler receives each pulse or black mark from the energy meter, the photoelectric sampler will generate a pulse, and the number of laps is the error calculation at a time after how many times pulse signals are received by the instrument.

For example: if the energy meter’s black mark turns 2 laps, the instrument calculates the error at a time. Through the "↑, ↓" keys, move the cursor for N (laps) setting, input 02 here through the keyboard, and the instrument calculates the error at a time after receiving two pulses.

Ratio: generally select the default value.

Notes to the calibration parameter settings:

The difference between "photoelectric" mode and manual mode is large.

For example: check the three-phase mechanical active energy meter, and the electric energy constant is 450 r/kW. h and the set number of laps is 2.

When calibrating by use of the photoelectric mode, every time when the energy meter's black mark moves a lap, the photoelectric sampler generates a pulse; the error calculation is made at a time when the instrument receives three times of pulse signals in total.

When using the "manual" mode to calibrate, press the manual switch at a time when the energy meter's black mark moves a lap. The error can be calculated at a time when the instrument receives a pulse signal.

3.2 Harmonic analysis

Function description

1. Perform the 2nd ~ 51st harmonic analysis on the measured signal, and test the total harmonic distortion rate, odd and even times and each harmonic content.(note: test the 2nd ~ 21st harmonics according to the national standard)

2. Test and analyze three-phase voltage and current, respectively, show the harmonic content of each harmonic in the form of corresponding light bar chart, and display the percentage of corresponding harmonic content accordingly.

Press "3 harmonic" key to enter the "harmonic" state, and after entering the interface, the interface below displays voltage, current and sorting three options; select voltage and press "F2" key, choose current and press "F3", select sorting and press "F5", show the each harmonic content of current or voltage according to the operation, and the biggest harmonic on the scale line is full scale. If the harmonic is very small, only parts per ten thousand, such as maximum 0.06%, the percentage value of the highest scale is 0.06%, and the subtle harmonic is amplified, clear at a glance.

The instrument can test a total of 2nd ~ 51st harmonics, and show harmonic spectrum and give out the percentage content of each harmonic. The 21^{st} harmonic is used as an example in the following to calculate (the 51^{st} harmonic is calculated the same as the 21^{st} harmonic)

Wherein:

Percentage content of each harmonic - refers to the percentage of the effective value of the

2nd ~ 21st harmonic relative to the effective value of fundamental wave, defined as follows: $(U_i/U_1)*100\%$ (of which i = 2, 3, 4 · · · · · · 21; Ui is the effective value of each harmonic, and U1 is the effective value of fundamental wave.);

Harmonic order - refers to the multiples of fundamental wave frequency, relative to fundamental wave. If the frequency of mains supply is 50Hz, the 2nd harmonic is 100Hz AC component, the 3rd harmonic is 150Hz AC component and so on.

Channel indicator -- the harmonic state of the channel currently tested.(six channels are Ua, Ub, Uc, Ia, Ib, Ic respectively:);

Odd order harmonic distortion rate - refers to the percentage of the total effective value of odd harmonics relative to the effective value of fundamental wave, defined as follows:

In case of $U_{odd}=(U_3^2+U_5^2+U_7^2+U_9^2+U_{11}^2+U_{13}^2+U_{15}^2+U_{17}^2+U_{19}^2+U_{21}^2)^{1/2}$;

Then, odd aberration rate $=((U_{odd}/U_1)*100\%$;

Even order distortion rate - refers to the percentage of the total effective value of even harmonics relative to the effective value of fundamental wave, defined as follows:

In case of $U_{even}=(U_2^2+U_4^2+U_6^2+U_8^2+U_{10}^2+U_{12}^2+U_{14}^2+U_{16}^2+U_{18}^2+U_{20}^2)^{1/2}$;

Then, the even order distortion rate $=(U_{even}/U_1)*100\%$;

Then, the total harmonic distortion $=(U_{all}/U_1)*100\%$;

Total harmonic distortion——refers to the percentage of the total effective value of harmonics relative to the effective value of fundamental wave, defined as follows:

In case of $U_{all}=(U_2^2+U_3^2+U_4^2+U_5^2+\cdots\cdots+U_{19}^2+U_{20}^2+U_{21}^2)^{1/2}$;

Then, the total harmonic distortion $=(U_{all}/U_1)*100\%$;

The scale line - the biggest harmonic is full.

Harmonic pollution to power grid is becoming more and more serious, so the harm caused by harmonics can not be ignored, mainly reflected in:

1. Greatly increasing the chance of resonance in power grid, thus causing the risk of accidents arisen from very high overcurrent or overvoltage;

2. Increasing additional loss, and reducing the efficiency of power generation, transmission and power equipment and the equipment utilization;

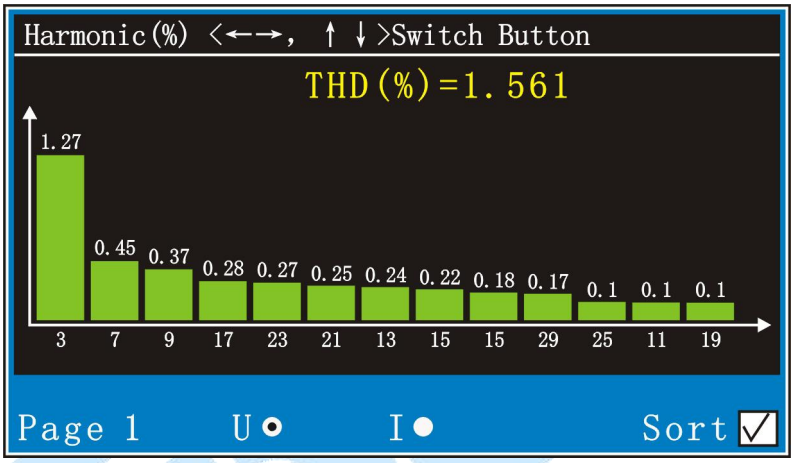
3. Increasing the losses to electrical equipment (rotary motors, capacitors, transformers,

etc.), accelerating the insulation aging, and thus shortening the service life;

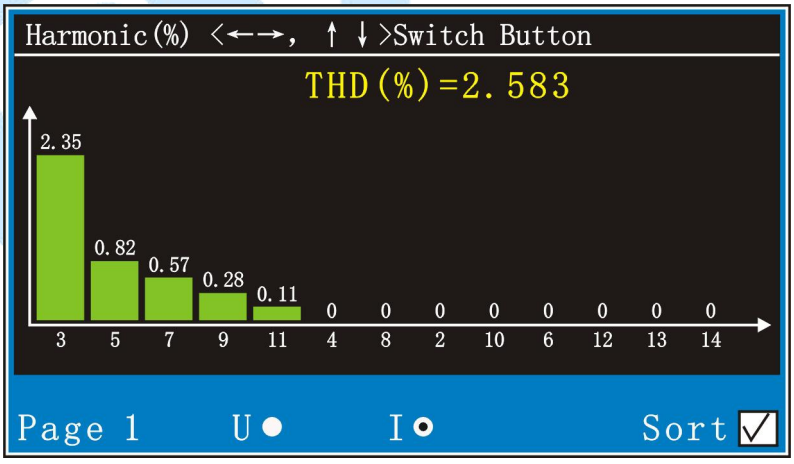
4. Enabling the relay protection and automatic device, computer systems, and a lot of electrical equipment to run abnormally;

5. Leading to the metering and measuring instruments (such as: energy meter) not to give correct instructions or measurement;

6. Interfering with the communication system, lowering down the quality of signal transmission, disturbing the normal transmission signal, and even damaging the communications equipment.



Instrument voltage-current harmonic interface



3.3 Timing

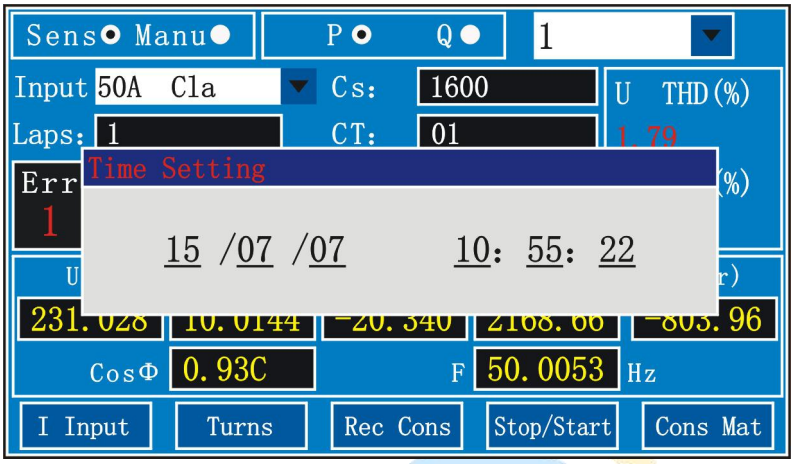
Press [7] key to enter the time settings interface and set the required year, month, day and time through the "↑, ↓", "←, →" and number keys.

Such as: set 10:55:22 on July 7, 2015

Press [7] key to enter the time setting interface

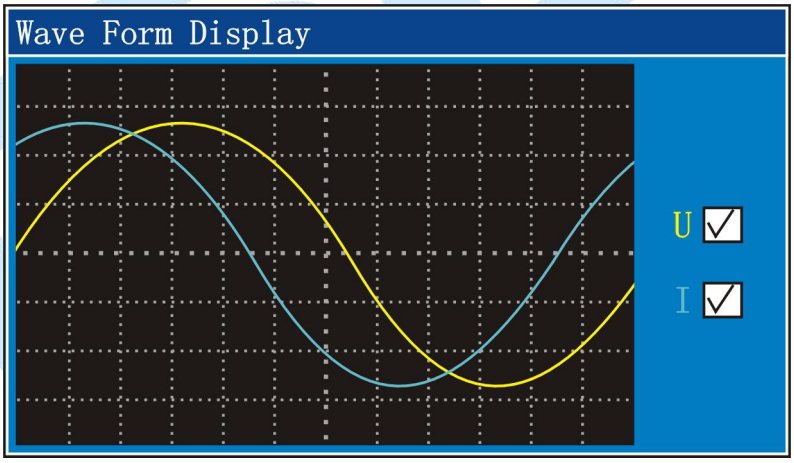
Move the cursor to year, and input "15" by the number key, then press "↓" key and move the cursor to the month, input "7" and then press "↓" and move the cursor to day; input "7" and

press "↓" key, move the cursor to hour, input "10", then press "↓" key, move the cursor to the minute and input "55"; next, press "↓" key, move the cursor to second, and input "22"; press [Confirm] to complete time setting, and return to the main interface system.



3.4 Waveform

Press [8] key to enter into the waveform display interface, and there are two options voltage and current on the right of the interface; voltage or current item can be selected by "↑, ↓" key, and press [Confirm] to select the item and display voltage and current waveform.



3.5 User

User function is used to inquire the user information on the calibration data of the current calibration main interface, including work order number, user number, user name, meter number, inspector and other data; the user information can be modified.

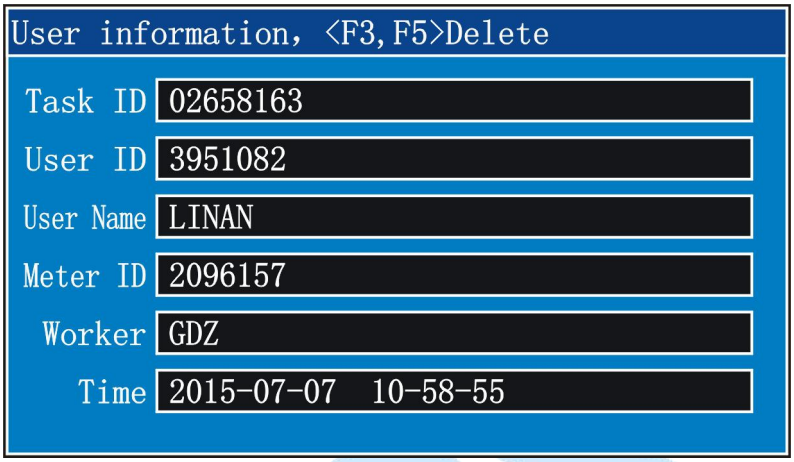
For example, view the user information of the current calibration task, and change the user name to "LINAN"

1. In the current calibration task interface, press [user] to view the user details about the calibration task;

2. Press [↓] and move the cursor to the user name,

3. Press [Switch] key to Switch to the English input method; input "LINAN";

4. Press [Confirm] key to save the user information and return to the main interface, press [Exit] key not to save the edited and modified information and return to the main interface.

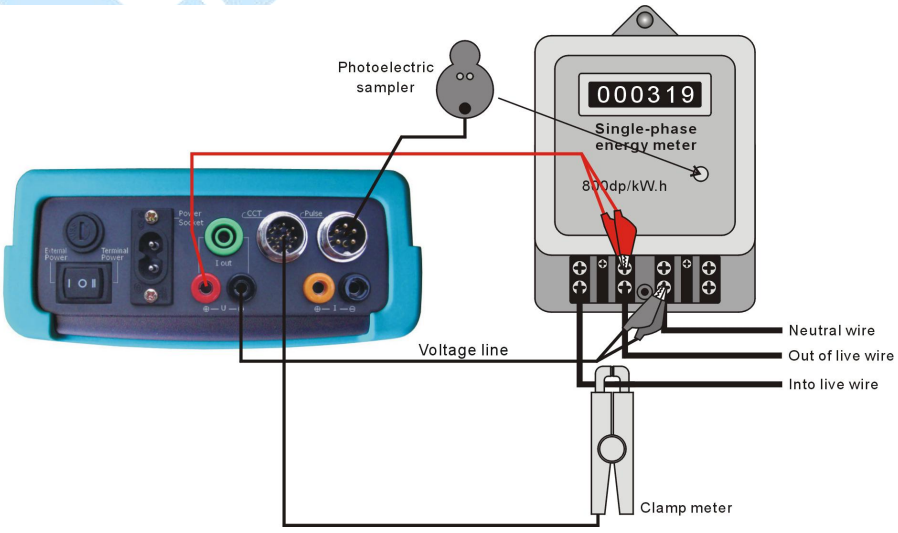


Ⅳ. How to use the instrument

4.1 How to calibrate the single-phase energy meter

Example 1: a single-phase calibrator is used to measure the error of electronic single-phase energy meter (the user number of this energy meter: 3951082, meter number 2096157, user name: LINAN, inspector: GDZ; meter level: level 1, and meter constant: 1600 imp/kW. h)

As shown below:



Operation method:

1. Connect the instrument voltage line, current line, and clamp meter line (connect the energy meter's "live" line on the instrument side to the instrument U+, connect "zero" line to

the instrument U-, and connect the clamp meter line with the clamp meter interface);

2. Connect the energy meter voltage line, current line, and current clamp meter (when the instrument voltage is input from the live wire inlet, the clamp meter should be connected to the live wire outlet; when the instrument voltage is input from the live wire outlet, the clamp meter should be connected to the live wire inlet; attention is paid to the current direction of the clamp meter, and the current flows from the clamp meter "+" into "-")

3. Connect the photoelectric sampler or pulse line to the instrument pulse interface, and connect the electric meter end to the corresponding interface;

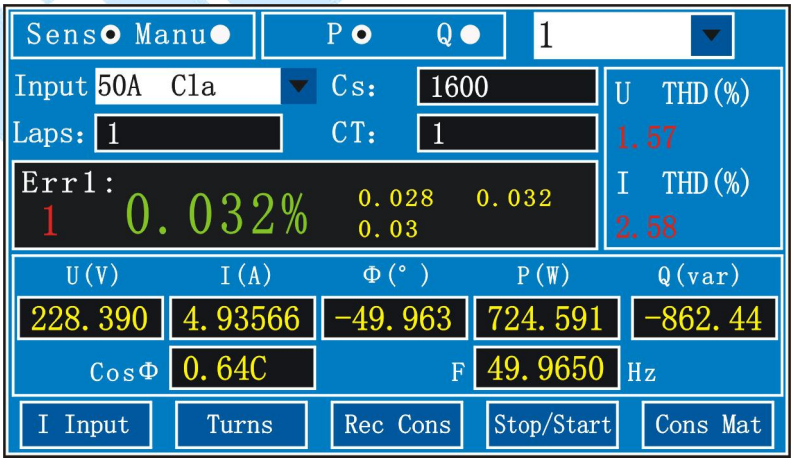
4. Open the "terminal power supply" to start;

5. Move [← →] cursor to the photoelectric or manual mode, active and reactive power, move to the target and determine, continue moving the [← →] key to the electric meter series key and input item, and press [↑↓] to select the corresponding electric meter series and 50A clamp "meter".

6. Press [set] and the cursor is normal, and input "1600"; (**if it is mistyped, press [F5] to single delete, and press [F3] to delete the entire line)**

7. Press [↑↓] and move the cursor to the number of laps, and input "1"; (set a corresponding big one if the current is big)

The setting parameters are shown in the figure below:



8. After the settings, click [Confirm] key to begin with calibrating;

9. If there is a need to save the data, press [Storage] key, and enter the storage interface.

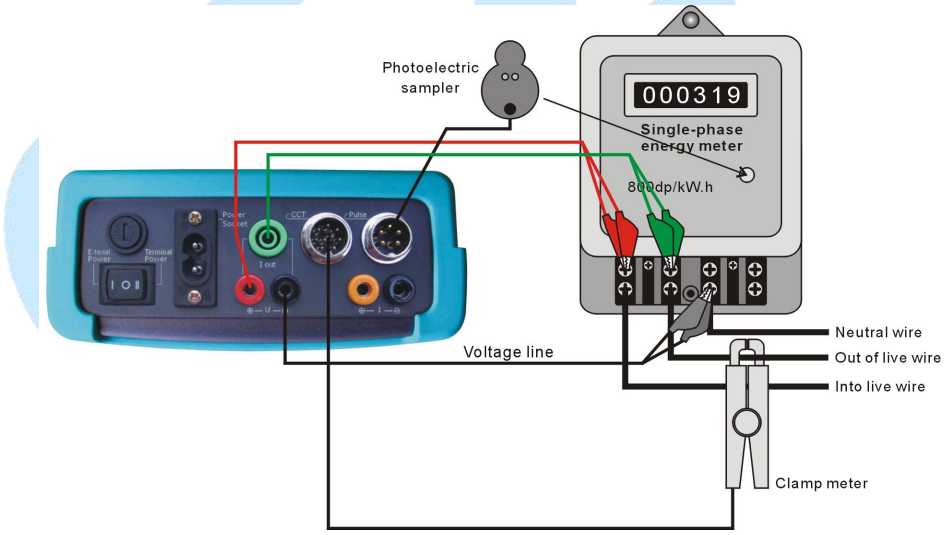
10. Move the cursor to the "user number" column on the store screen by [↑↓], press [Switch] key to switch the input method to 123 and input 3951082 (**if it is mistyped, press [F5] to single delete, and press [F3] to delete the entire line**); then move the cursor to the "user

name" column by [↑↓], press [Switch] key to switch to ABC, use the English input method to input "LINAN", move the cursor by [↑↓] to the "meter number" column, and press [Switch] key to switch the input method 123 and input 2096157 (**if it is mistyped, press [F5] to single delete, and press [F3] to delete the entire line**); move the cursor by [↑↓] to the "inspector" column, press [Switch] key to switch the input method 123 and input GDZ (**if it is mistyped, press [F5] to single delete, and press [F3] to delete the entire line**). After the settings are completed, press [Confirm] key for storage.

4.2 How to calibrate the single-phase energy meter with no load (superposition)

For example: a single-phase calibrator is used to measure the error of electronic single-phase energy meter (the user number of this energy meter: 3951082, meter number 2096157, user name: LINAN, inspector: GDZ; meter level: level 1, and meter constant: 1600 imp/kW. h)

As shown below:



Operation method:

1. Connect the instrument voltage line, current line, and clamp meter line (connect the energy meter's "live" line on the instrument side to the instrument U+, connect "zero" line to the instrument U-, and connect the clamp meter line with the clamp meter interface);

2. Connect the green up-flow line to the instrument "I out" port, and connect the other end of the up-flow line to the voltage outlet of the electric meter;

3. Connect the energy meter voltage line, current line, and current clamp meter (when the instrument voltage is input from the live wire inlet, the clamp meter should be connected to

the live wire outlet; when the instrument voltage is input from the live wire outlet, the clamp meter should be connected to the live wire inlet; attention is paid to the current direction of the clamp meter, and the current flows from the clamp meter "+" into "-")

4. Connect the photoelectric sampler or pulse line to the instrument pulse interface, and connect the electric meter end to the corresponding interface;

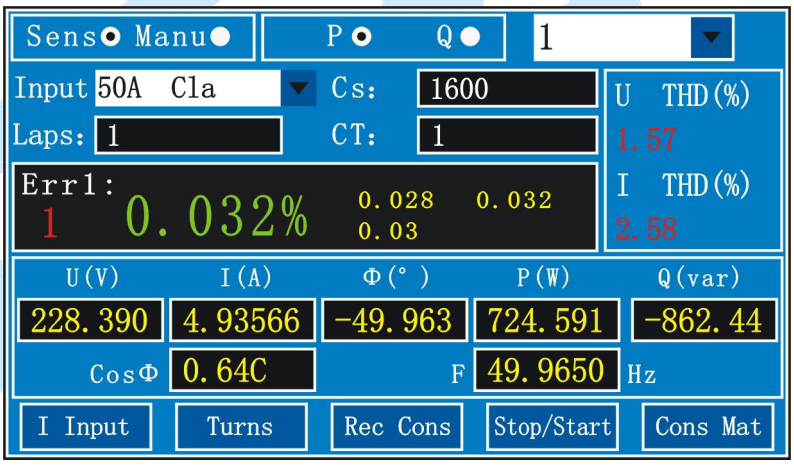
5. Open the "terminal power supply" to start;

6. Move [← →] cursor to the photoelectric or manual mode, active and reactive power, move to the target and determine, continue moving the [← →] key to the electric meter series key and input item, and press [↑↓] to select the corresponding electric meter series and 50A clamp "meter".

7. Press [set] and the cursor is normal, and input "1600";

8. Press [↑↓] and move the cursor to the number of laps, and input "1"; (set a corresponding big one if the current is big)

The setting parameters are shown in the figure below:



9. After the settings, click [Confirm] key to begin with calibrating;

10. If there is a need to save the data, press [Storage] key, and enter the storage interface.

11. Move the cursor to the "user number" column on the store screen by [↑↓], press [Switch] key to switch the input method to 123 and input 3951082 (**if it is mistyped, press [F5] to single delete, and press [F3] to delete the entire line**); then move the cursor to the "user name" column by [↑↓], press [Switch] key to switch to ABC, use the English input method to input "LINAN", move the cursor by [↑↓] to the "meter number" column, and press [Switch] key to switch the input method 123 and input 2096157 (**if it is mistyped, press [F5] to single delete, and press [F3] to delete the entire line**); move the cursor by [↑↓] to the

"inspector" column, press [Switch] key to switch the input method 123 and input GDZ (**if it is mistyped, press [F5] to single delete, and press [F3] to delete the entire line**). After the settings are completed, press [Confirm] key for storage.

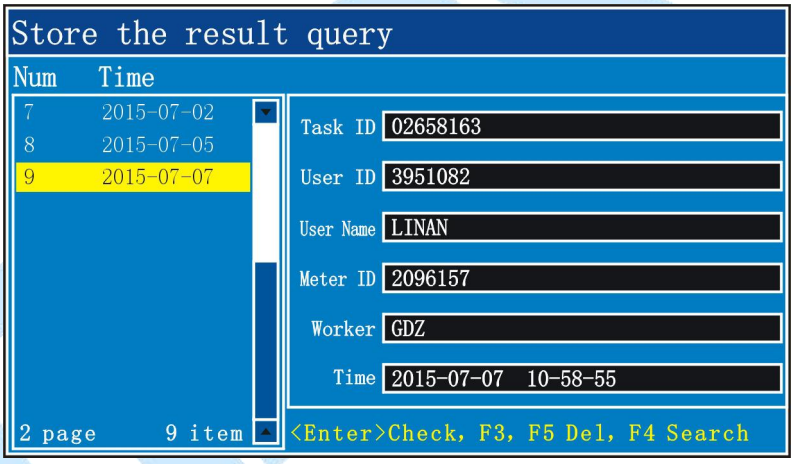
Note: when testing the energy meter with no load (superposition), directly connect the current test line to raise the current automatically.

4.3 How to use query function

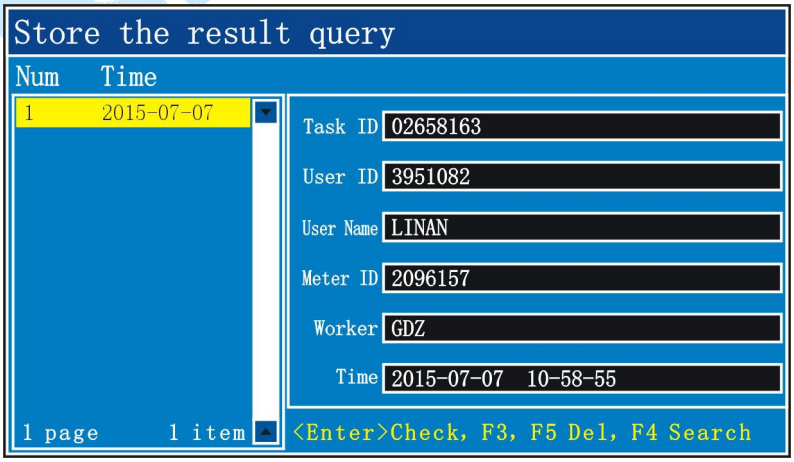
For example: check the calibration data with the calibration date 2015-07-07 and meter number 2096157.

1. Press [Query] to enter into the calibration plan query interface, where you can see the calibration data lists marked with different dates and meter numbers.

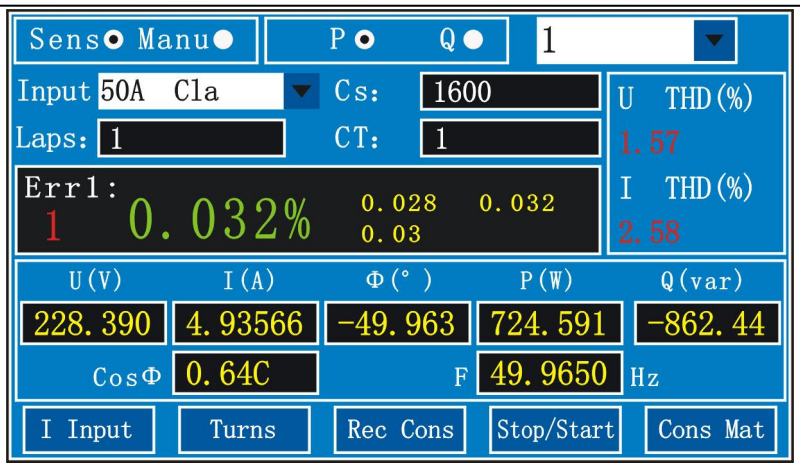
As shown below:



1. Move the cursor through [↑↓] key to 2015-05-27 data for query.



2. Press down [Enter] key to enter the field calibration interface at that time (you can view the energy meter error value each phase voltage, current, power and other data detailed in the calibration records in this interface).



3. Press [Exit] key to return to the data query interface

Note: if the calibration task you want to find can't be found on the current interface, search by turning pages through [← →] key.

Ⅴ. Frequently Asked Questions

1. Question: press down the power on/off key, but the instrument has not been open, why?

Answer: if the voltage terminal has no voltage input or no power adapter is used, the battery may be out of electricity. In case that the terminal voltage has input voltage (57.7V – 265V), the instrument may be fail if it cannot be switched on/off

2. Question: the instrument is suddenly abnormal at work, but the keys operation is also invalid, why?

Answer: there may be large interference, leading to the chip stopping; the power supply can be shut off to restart, and in general, this problem can be solved;

3. Question: when the calibration error found is very large, if it is a relatively stable value, why?

Answer: (1) first of all, check whether the settings are correct, because it is often easy to mistake in the following

a) The present current is greater than 1A, and it is set to 1A current shift;

b) When the input is greater than 100A, the set transformation ratio is not correct;

c) The meter constant setting is abnormal;

d) Active and reactive power settings are abnormal;

e) Manual and photoelectric settings are not correct;

(2) Check whether the clamp meter is in the reverse direction.

4. At the time of field testing, the error fluctuation is very big, how to do?

Answer: there may be several reasons below:

1) In the case of direct sunlight, it is the best to use an object to cover the photoelectric sampler to prevent hard light interfering with the photoelectric sampler

2) The load fluctuation is too large, and the energy meter and instrument have different reaction speed to increase the number of laps;

3) Harmonic motion is very large, and under the unstable case, a common energy meter can only be used for harmonic measurement, which may lead to big error and instability.

5. At the time of spot measurement, there is no current display

Answer: check whether the current setting parameters meet the equipment input configuration.

Ⅵ. Instrument maintenance

- The instrument should be avoided from being stored in a very humid environment.
- The instrument is a high precision instrument, so it shall be handled with care.
- The clamp meter is a kind of precision instrument, so it should be especially careful in use; it is strictly prohibited to drop, throw, bump or collide, least affect the clamp meter performance.
- When taking down the clamp meter, do not drag and pull out the lines, lest break the clamp meter connection.
- Wiping the instrument surface and panel with a corrosive organic solution is strictly prohibited.
- The clamp meter's jaw should be kept clean, because oil and dirt will affect the accuracy of measurement; it is the best to wipe it with anhydrous alcohol prior to each test.
- After the jaw is wiped and uses, it should be properly kept, but it cannot be placed with other sundry, lest pollute the clamp meter.
- At the time of measurement, it should be as far as possible away from a big current line (especially the jaw is not close to the big current line).

Ⅶ. Appendix

Appendix 1：How to use the photoelectric sampler

The photoelectric sampler shows accurate and fast beam focusing at the time of field calibration, which directly affects the efficiency of field work. Our company has paid close attention to the development of photoelectric sampler and the quality of relevant parts since PEC-1 field calibrator was launched. And in order to meet different needs, we provide three different solutions.

1. Button photoelectric sampler

It is the most commonly used photoelectric sampler so far, and it is fixed on the energy meter relying on two elastic bands. With automatic tracking and intelligent recognition of the energy meter's black belt, it has the advantages, simple structure, small volume and easy to carry, and has the function of intelligent identification. Its weakness is as follows: the front cover of the energy meter needs to be convex, so that it can be fixed up. Also, affected by the energy meter's installation location and space, it can not be used on the electronic energy meter.

The operation method is as follows:

1) At first, arrange the photoelectric sampler beneath the meter being calibrated, about 10 ~ 30 mm apart from the calibrated meter. Adjust the up and down position, and make the center of light beam shoot on the disk of the calibrated meter.

2) press the red button, and enable the red indicator light to go on. After the meter disk's black mark has turned, the red indicator light goes out, and the work of beam focusing is completed.

3) after the black mark turns, if the red indicator light is still on or there is incorrect pulse output or the green indicator light is not on, the front and rear distance or up and down location should be adjusted appropriately; the work of beam focusing is finished after the red indicator light goes out and the green indicator light is on.

2. Power pulse line

It is specially designed for electronic energy meter field calibration. One end is connected to the photoelectric instrument socket, and the other end is connected to three clips. The red large clip is "+5V", the black is "reference ground", and the red small clip refers to "pulse

input". While calibrating the energy meter with the pulse as output voltage, the "reference ground" and "pulse input" are only used. In case of passive optical output, a 1K to 4.7K resistor (pull-up effect) needs to be added between the "+5V" and "pulse input". Any specific applications need to refer to the electronic energy meter manual, or contact with the energy meter manufacturer.

Appendix 2：Technical indicators

	Function	**Accuracy when using a clamp meter**	**Accuracy when using a terminal**
Main functions	Voltage	0.1%	0.1%
	Current	0.3%(0.1A～60A) 0.5%(60A～1000A)	0.1% (0.1A～10A)
	Power	0.3% Guaranteed long-term accuracy (1A～50A)	0.1%
	Active power	0.3% Guaranteed long-term accuracy (1A～50A)	0.1%
	Reactive power	0.5%	0.3%
	Harmonics	2nd～51st Harmonic	0.1%
Others	Source output	Output current: 5A±20%	
	LCD	320x240 （color）	
	Communication	RS232	
	Electric pulse	FH=3.6*10^8P/KW·H FL=36000P/KW·H	
	Data storage	6000 pcs and above	
Environment	Environmental temperature	-20～40℃ （Guaranteed accuracy ）	
	Humidity	0～90%, No condensation （Guaranteed accuracy ）	
Machine	Size	(L)249*(W)156*(H)56mm	
	Weight	1.2kg	