

ZCHG-12
CT Testing System
User Manual V2.0



Dear Customers,

Thank you for purchasing our ZCHG-12 CT Testing System. Before you use the product for the first time, please carefully read this Manual which can help you skillfully use the Tester.



Our aim is to improve our products continuously, so that the product you use may be a little bit different from the Manual. In case of any changes, we will inform you in the attached sheets! Thanks for your understanding. If anything is unclear, please contact the After-Sale Service Department in our company, and we will certainly meet your requirements.



Since the I/O terminal, testing column and etc. may carry voltage, electric spark may be produced when you insert and unplug the test lead, power socket and etc.. Please do be careful of electric shock and avoid hazards. Pay attention to your personal safety!

Prudent Warranty

For the products manufactured by our Company, if the defects appear within 3 months from the date of delivery, we can provide the replacement; if the defects appear within one year from the data of delivery, we can provide free services and repairs; if the defects appear more than one year after delivery, we can provide life-long paid maintenance services.

◆ Safety Requirements

Please carefully read the following safety precautions so as to avoid personal injury and prevent the product or any other products connected thereto from being damaged. In order to avoid the possible dangers, the product can only operate within a specified range.

Only the qualified technicians can implement the maintenance.

— Prevent Fire or Personal Injury

Use appropriate power cables. Only the dedicated power cables which conform to the specifications of the product can be used.

Correct connection and disconnection. When the test lead is connected to the charged terminal, please don't connect or disconnect the test lead at will.

Earth the product. In addition to be earthed using the power line, the earthing rod on the shell of this product must also be earthed. In order to prevent electric shock, the earthing conductor must be connected to the ground. Before the connection to the input or output terminal of the product, please make sure that the product has been properly earthed.

Pay attention to the rated values of all terminals. In order to prevent fire or electric shock, please pay attention to all the rated values and marks of the product. Before the connection, please read this Manual so as to gain more insight into the information on rated values.

Never operate the product without an instrument cover. If the cover or panel has been removed, never operate the product.

Use appropriate fuses. Use the fuses of the type and rated value specified for the product.

Avoid touching the exposed circuits or charged metal. When the product is electrified, never touch the exposed contacts or parts.

In case of suspected failure, never operate the product. If you suspect the product is damaged, please contact the maintenance personnel for examination and never operate the product.

Never operate the product in a humid environment.

Never operate the product in an explosive environment.

Keep the surface of the product clean and dry.

— Safety Terminology

Warning: Warning messages indicate the conditions or practices that may cause loss of life or personal injury.

Caution: Caution messages indicate the conditions or practices that may cause the damages to the product or other properties.

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1 Summary

ZCHG-12 automatic CT Testing System is a new generation of transformer automatic accuracy test system developed by our company to adapt to the fast and accurate characteristics of modern current transformer calibration. The device is composed of ZC-103 Transformer Verification meter, ZC-113B Programmable CT Load Box, variable frequency power supply, transformer test bench and so on. The operator can set the type, range, accuracy level, secondary load, power factor, transformer station position and other main parameters of the transformer to be tested through the computer error verification management software. Through RS485 transmission and control, the measurement work of 12 current transformers with the same ratio can be completed at one time, which greatly improves the work efficiency.

2 System composition

Name	Function
Transformer Verification meter ZC-103A	Current transformer technical performance verification
Programmable CT Load Box ZC-113B	Various payloads are available when testing current transformers
Variable frequency power supply ZC-506S	Voltage is provided during testing
Standard CT ZC-113	Provide the high current required for the test and test the transformer for data comparison
12 CT testing bench	Place the transformer and connect the transformer secondary.
Transformer verification management software	Data management, CT test control

3 Functional Features

- 1) The device has three test modes: on-line automatic, single-machine automatic and single-machine manual.
- 2) The device adopts RS485 communication port, stable communication signal and strong anti-interference ability.
- 3) The primary and secondary wiring of the current standard transformer is automatically switched according to the parameters set by the computer.
- 4) You can choose any station for verification, and display the station in the test process synchronously.
- 5) The system has a variety of perfect protection functions such as over current and over voltage protection, polarity error, signal failure, etc
- 6) The error management software can record, print and back up the testing data according to the requirements of the verification regulations, and modify the certificate format as required
- 7) The device appearance design is beautiful, humanized function design, automatic function display, greatly optimize the working environment.

4 Main Technical Parameters

4.1 Environmental conditions for the use of CT testing system

- 1) Temperature: $-10^{\circ}\text{C}\sim 50^{\circ}\text{C}$
- 2) Relative humidity: $<80\%$ (25°C)
- 3) Elevation: $<2500\text{m}$
- 4) Power frequency: $50\text{Hz}/60\text{Hz} \pm 10\%$
- 5) Power supply voltage (control loop and instrument power supply) : $220\text{V} \pm 10\%$
- 6) Power supply voltage (voltage regulator or variable frequency power supply input) : $400\text{V} \pm 10\%$

4.2 CT Testing system parameters

Working range

Current: Primary current: 5~2000A
 Secondary current: 5A
 Accuracy Class : 0.02 (S)

Measuring range

In-phase component (%): 0.0001 ~ 200.0
Resolution :0.0001
Orthogonal component (min):0.001 ~ 700.0
Resolution :0.001
Impedance (Ω): 0.0001 ~ 20.0
Resolution :0.0001
Admittance (ms) : 0.0001 ~ 20.0
Resolution :0.0001

Verification basis

《JJG313-2010 Verification regulation of current transformer for measuring purposes》

Polarity error indication

When the rated working current is more than 5% and the error is more than 180%, the polarity should be indicated.

Note: If more than 10% of the rated working current, there is still no polarity indication, indicating that there is a fault, please do not increase the current, so as not to burn the instrument.

Ratio Error indication

When the rated working current is more than 2%, the error is more than 30% but less than 180%, there is a ratio error indication.

Fundamental Error

In-phase component: $\Delta X = \pm (X \times 2\% + Y \times 2\%) \pm D_x$

Quadrature component: $\Delta Y = \pm (X \times 2\% + Y \times 2\% \times 34.48)$

“X”、“Y”—— displayed value of the instrument

“D_x,D_y”—— Quantization error of the instrument

D_x=2,D_y=5

Current %: 1 class

Workload

Current: TO to TX < 0.12Ω cosΦ=1

Voltage: a to x < 0.25VA (100V)

4.3 Programmable CT Load box Technical Parameters

Rated Load

Current : 2.5VA~40VA COSΦ=0.8 (selectable)

2.5VA~10VA COSΦ=1.0 (selectable)

Measuring range and accuracy

Current: 1%~120% (optional 200%)

Secondary current: 5A

Accuracy: ±3% ± 0.05 VA

5 Transformer verification meter

5.1 Overview

The main purpose of the intelligent transformer calibrator is to verify the technical performance of the voltage transformer and current transformer used in the field or in the laboratory. In order to achieve this goal, the intelligent transformer calibrator must be a complete transformer calibration device with related equipment. Because there is a close technical relationship between the performance index of intelligent transformer calibrator and related equipment, it is necessary to have a basic understanding of the transformer calibrator in order to correctly study and understand the overall concept of intelligent transformer calibrator.

China's intelligent transformer calibrator can be roughly divided into three generations: the first generation of electrical calibrators, the use of complex operation, complex wiring; The second generation of calibrator adopts more advanced electronic circuit, which is more convenient to use than the previous generation of calibrator, but it needs to manually switch the range gear during the measurement process, and displays less information during the test. The third generation of the calibrator mostly uses the single chip computer, so that the intelligent degree of the instrument has been improved, some of the instruments have computer communication interface, improve the level of office automation.

Here we mainly introduce the main characteristics of the third-generation intelligent transformer calibrator:

- (1) MCU is used to achieve measurement, control, display and other functions;
- (2) Computer interface, improve the level of office automation, reduce labor intensity;
- (3) With large screen display, provide friendly operation interface, and rich measurement information;
- (4) can automatically realize transformer calibration;
- (5) With good protection measures, can inform users of error information in time;
- (6) The instrument can reach level 2. At present, most of the calibrators on the market use the resistance-capacitance phase shift 90° method to achieve data measurement, this method is vulnerable to the impact of ambient temperature and power frequency, once the above environment

changes, its measurement data will be greatly affected.

Intelligent transformer calibrator adopts unique circuit principle and DSP technology to avoid the above problems.

From the measurement principle, the intelligent transformer calibrator can be divided into two categories: direct comparison type and difference measurement type.

The early intelligent transformer calibrator was mainly designed as a direct comparison principle, that is, the secondary voltage or current of the standard transformer and the inspected transformer were respectively sent to the intelligent transformer calibrator, and the difference voltage or current between the two was measured through the measurement circuit such as the resistance voltage divider, the resistance capacitance voltage divider and the magnetic potential comparator. After processing is the ratio difference and phase difference between the tested voltage transformer or current transformer and the standard transformer.

The advantage of this intelligent transformer calibrator is that the ratio between the standard transformer and the transformer to be tested need not be equal, as long as the rated primary voltage or rated primary current of the standard transformer is greater than or equal to the rated value of the transformer to be tested, it can be directly verified, and it is more convenient to use.

The disadvantage of this intelligent transformer calibrator is that it cannot verify the transformer with secondary load less than 1VA; Secondly, the error of the intelligent transformer calibrator is directly added to the error of the standard transformer, because the component error of the intelligent transformer calibrator limits the accuracy level of the transformer being tested. For example, an intelligent transformer calibrator is limited by its own components, and its measurement error limit is $\pm 0.05\%$, even if the standard transformer with higher accuracy is used, it can only be used to verify transformers below 0.5 level. Therefore, this shortcoming limits the application range of direct comparison intelligent transformer calibrator.

The intelligent transformer calibrator based on the principle of difference measurement is to send the secondary voltage or current of the standard transformer and the tested transformer to the difference circuit of the intelligent transformer calibrator, and then send it to the measurement link through the difference taking link and compare it with the secondary working voltage or current of the transformer to give the ratio difference and phase difference between the tested transformer and

the standard transformer.

Because this intelligent transformer calibrator is only used to measure the difference between the standard transformer and the transformer being tested, the error of the intelligent transformer calibrator is only the error of the difference between the two transformers, so the impact on the measurement results is naturally much smaller. In general, no matter what level of transformer is tested, as long as the standard transformer meets the requirements, and the error limit of the intelligent transformer calibrator is not greater than $\pm 2\%$. In this way, not only makes the intelligent transformer calibrator easy to produce, but also reduces the cost, and its application scope is greatly expanded. The intelligent transformer calibrator belongs to the difference measurement calibrator.

The intelligent instrument transformer calibrator is a novel automatic testing instrument, which uses advanced electronic technology to directly collect and decompress the error signal of the instrument transformer, and after proper calculation, the percentage point, in-phase error and orthogonal error of the instrument transformer are displayed digitally at the same time. The instrument is easy to operate, intuitive reading, rapid measurement, can reduce power consumption, reduce labor intensity; Small size, light weight, easy to carry and field test; The instrument can be tested under 5% rated working current (voltage); In addition, it is required that the company can also produce a voltage intelligent transformer calibrator for detecting S-class current transformers and secondary voltage of 100/3V, so that the instrument can measure the error of the current transformer at 1% rated working current; In the process of testing, the instrument can be easily self-calibrated at any time to ensure the accuracy of the instrument; The key components use imported components, stable and reliable quality, widely used in metering, power supply and other departments and transformer manufacturers, is the ideal instrument to carry out transformer testing

Intelligent transformer calibrator, and voltage transformers with rated secondary current of 5A and 1A and rated secondary voltage of 100V, $100/\sqrt{3}$ V, 150V (100/3V, 220V) with accuracy level from 0.01 to 10. The measurement results are directly displayed digitally, and can be equipped with RSC232 interface for users to easily connect with the computer.

When calibrating the transformer, the instrument can measure the active and reactive components of the impedance or admittance of the transformer secondary circuit at any time.

When calibrating the transformer, the instrument can indicate the polarity automatically. When

the polarity is wrong, the instrument can automatically cut off the differential current (differential pressure) circuit to ensure the safety of the instrument input circuit. And issued an alarm, prompting the verification personnel to pay attention.

The device can be used as a rectangular coordinate system AC potentiometer to measure small AC current or small AC voltage.

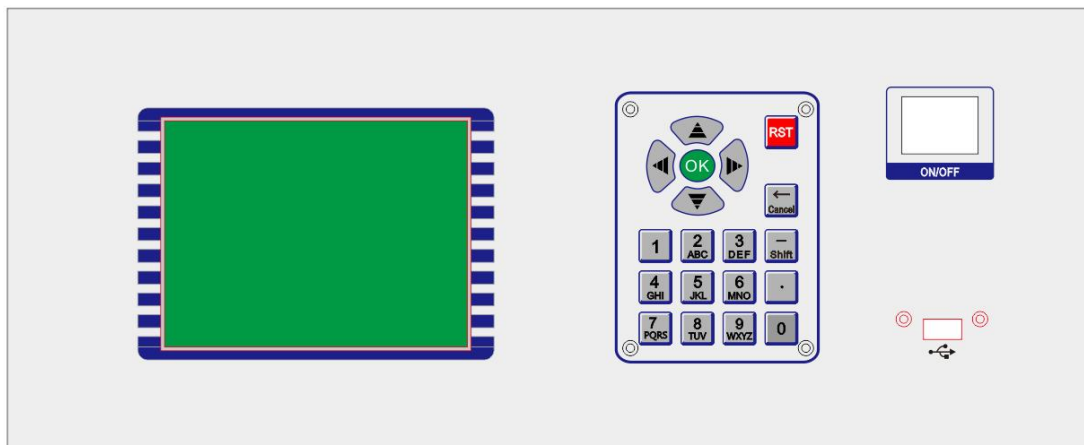
The device can measure the secondary voltage drop of the voltage transformer in conjunction with the isolation PT and the operating box.

In the verification of transformer, the instrument can use standard current transformer or standard voltage transformer as the standard, but also can use two-stage current transformer, two-stage voltage transformer or inductive voltage divider as the proportion standard.

The equipment can be periodically verified by either integral method or component method.

You are welcome to choose our instrument. Although the instrument is very easy to operate, please read this manual carefully when using the instrument.

The figure below is the panel of ZC-103A , which has the characteristics of easy operation and clear display.



ZC-103A transformer verification meter

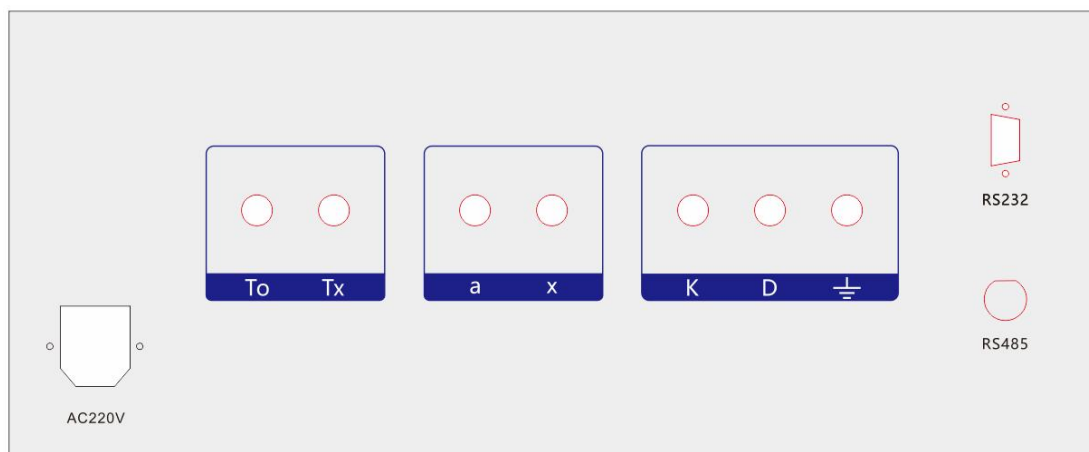
- (1). LCD display, with a resolution of 320×240, showing all the testing statistics and operating indicators.
- (2). Press key pad, press the OK key to select the current input, press "Cancel" to eliminate the incorrect input, and "↑", "↓", "←", "→" to move the cursor conveniently. The “Shift” key is a standby key. At the bottom of the keyboard are data keys from 0 to 9. During data input, these

numeric keys can facilitate data input.

(3). Power Switch

(4). All terminals and lines are on the back panel of the calibrator, making the calibrator more beautiful and safe, convenient for users to use.

(5). USB port used to upgrade software and export data



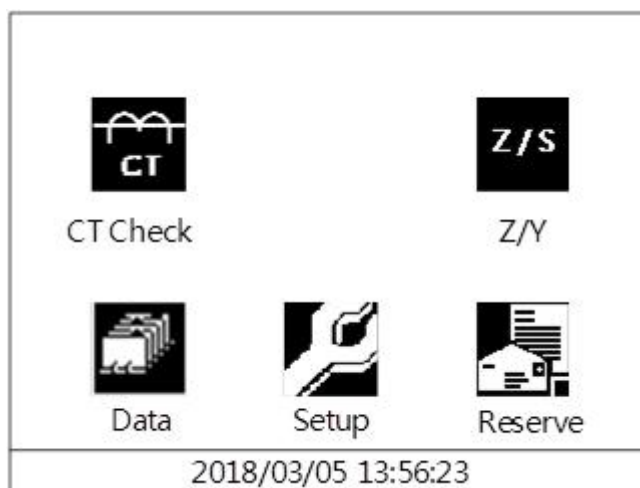
(1) Power socket (connected with 220V power supply)

(2) RS-232 communication interface, can be customized RS485 support.

(3) Input terminal

5.2 Interface introduction

Connect the test cable to the host power supply and turn on the power supply. The main menu interface is as follows:



CT check: Check the current transformer

Z/Y: test CT secondary impedance or admittance;

Data : view the history saved to the machine;

Setup: Set the function;

Reserve: Factory calibration test function

5.3 Check interface introduction

Press "CT check" to enter the calibration test setting interface, the setting test interface of the intelligent transformer calibrator, as shown in the following figure:



Measurement object:

- 1) Measurement object: current transformer, impedance, admittance
- 2) Secondary current: 5A
- 3) Transformer accuracy level: 1, 0.5, 0.2, 0.5S, 0.2S

5.4 Set parameters when testing the current transformer

When measuring the current transformer, you can use the digital shortcut key on the side to quickly switch the transformer parameters or move the cursor to the corresponding parameter and press "OK" to confirm. If it is a touch screen, you can directly touch the corresponding parameter to complete the switch.

Note: The parameters are correctly set on the nameplate of the transformer to be tested, and

then the booster is slowly raised, so that the measurement object, level, accuracy and related information can be clearly displayed. The dial indicator, ratio and Angle difference are displayed in large font for easy observation. To this interface, it can be seen whether its error is within the accuracy range.

After the test is completed, slowly return the booster to the zero position, and then press the "RST" reset key to return the intelligent transformer calibrator to the main interface, turn off the host power supply, and disconnect the voltage regulator input power. Remove the test wire and put it back in the instrument for next use.

Before testing, please read the relevant wiring diagram and connect the cables by qualified professionals.

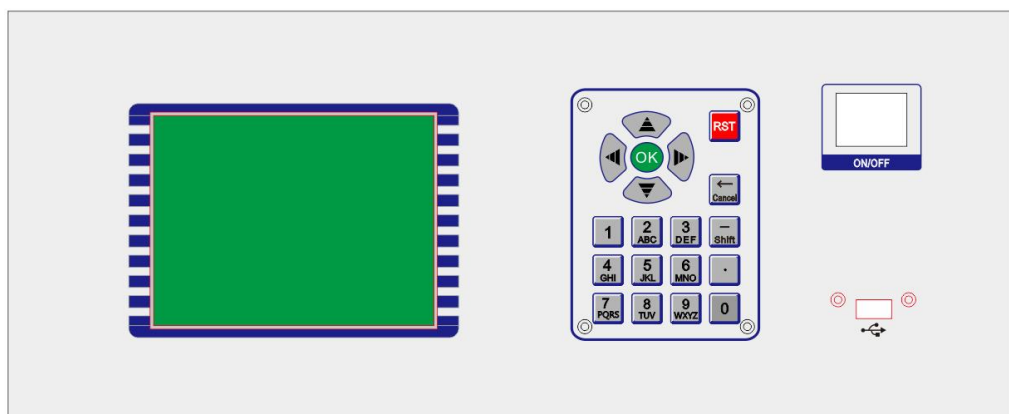
If you are not clear, please call the manufacturer first, and then operate.

6 Transformer load box

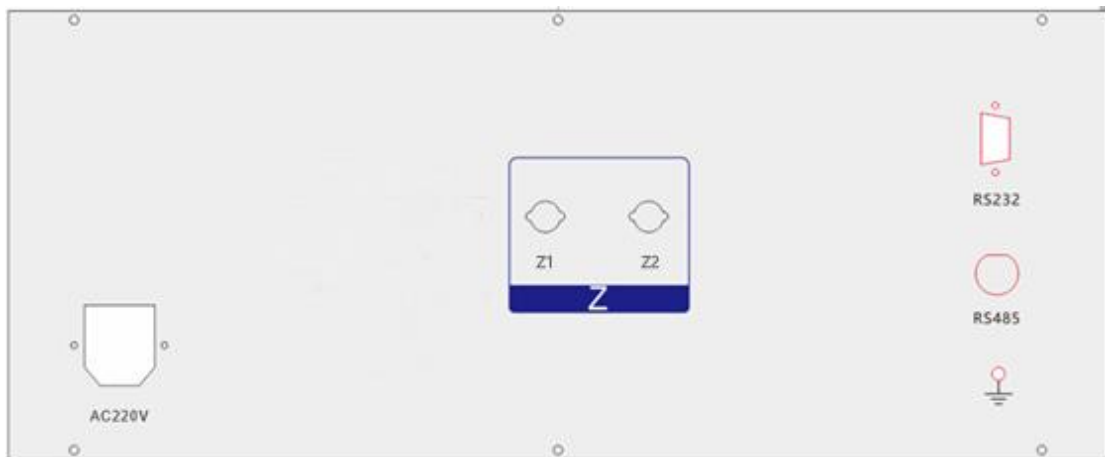
6.1 General description

The current load box is a kind of equipment specially provided for various loads when testing the current transformer. It is an ideal instrument for automatic transformer calibration station and field transformer error test.

The following figure is the panel of the calibrator, which has the advantages of easy operation and clear display.



load box front panel



load box rear panel

- 1) Screen LCD display, resolution is 320×240 points, all measurement data and operation tips are displayed in it, can be customized according to user needs to use the touch screen.
- 2) Press the key pad, "OK" key to select the current input, "Cancel" can eliminate the wrong input, "↑", "↓", "←", "→" can easily realize the cursor movement. The "Shift" key is a standby key. At the bottom of the keyboard are data keys from 0 to 9. During data input, these numeric keys can facilitate data input.
- 3) Power switch.
- 4) All terminals and connection lines are on the back panel of the calibrator.
- 5) USB interface for software upgrade and data export. Computer interface, the default support RS232 interface, can be customized RS485 support.

6.2 Current transformer load box usage

Note: If the load box is integrated in the calibration station, it is generally not necessary to operate the load box during automatic testing.

- 1) Connect the device in series between K2 of the tested current transformer and TX of the calibrator.
- 2) Adjust the load to the actual secondary load of the tested current transformer. The load box is compatible with Test bench, and can also be used for field test.
- 3) The current load box should deduct the resistance of the external wire 0.06Ω, which means that when the load box is actually used, the load of the tested transformer in addition to the load box has

the resistance of the connecting wire. If $\cos=1$, 0.4Ω , the actual resistance of the load box is 0.34Ω ; $\cos=0.8$, 0.4Ω , resistance of the actual load box $R=0.4*0.8-0.06=0.26\Omega$, reactance $X=0.40.6=0.24\Omega$.

4) Turn on the power switch, the power indicator lights up, and the LCD display enters the main interface:



In the current interface, there are two ways to set the load, one is to enter the required load value directly by pressing the keyboard in the upper left corner, and the other is to select the current required load value by selecting the button.

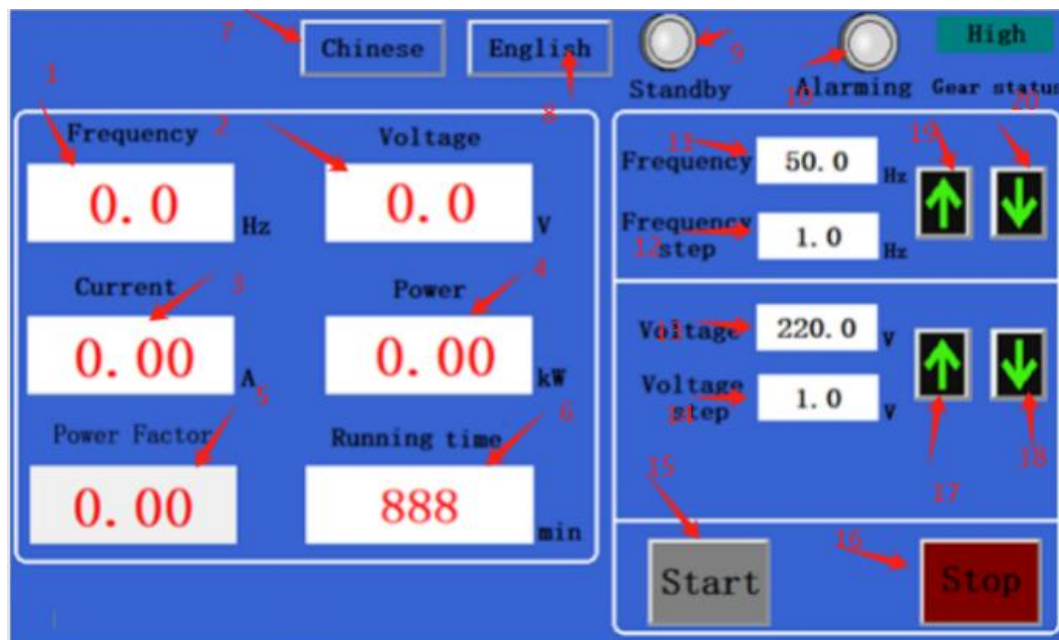
7 Variable frequency power source

7.1 General description

High frequency SPWM hardware adjustment technology, fast response speed, stable output; High power MOS/IGBT driver, reliable operation, large overload capacity; Suitable for various loads, such as resistance, induction, rectification and other loads; With overheating, overcurrent, short circuit abnormal protection function, parameter memory function and shortcut key operation mode, easy to operate power supply voltage can be adjusted online, output frequency can be selected; With a very bright LCD display, it is clearly visible and has a large viewing Angle, suitable

for production lines.

The following is an introduction to the operation panel



- 1 -- Frequency display window, display output frequency;
- 2 -- Voltage display window, display output voltage;
- 3 -- Current display window, display output current
- 4 -- power display window, display output power;
- 5 -- Power factor display window, display output power factor;
- 6 -- Time display window, showing the total running time of the power supply;
- 7 -- Chinese switch;
- 8 -- English switch;
- 9 -- Status display window, display the current status of the power supply
- 10 -- status display window, display the power supply alarm status;
- 11 -- Frequency setting window, showing the frequency currently set;
- 12 -- Status display window, display frequency rise step;
- 13 -- Voltage setting window, showing the current set voltage;
- 14 -- Status display window, display voltage rise steps;

- 15 -- Start button, touch the start power supply;
- 16 -- Stop button, touch to stop power or eliminate alarm;
- 17 -- voltage rise button, touch to rise voltage according to the step
- 18 -- voltage drop button, touch to drop voltage according to the step;
- 19 -- Frequency rise button, touch to rise frequency according to the step;
- 20 -- Frequency drop button, touch to drop frequency according to the step

Note: All ground marker terminals must be firmly grounded

8 12CT Test bench

8.1 General description

12CT test bench is designed to realize multiple current transformers with the same ratio and class, and complete transformer calibration quickly in one upflow process. It forms a multi-functional transformer calibration device with intelligent transformer calibrator, voltage transformer load box, current transformer load box and transformer verification device to complete the calibration work. (Includes standard current transformer with current riser). The equipment can be operated directly by PC, fast and convenient, rapid testing, stable and reliable performance, and has powerful software support, can be connected to the 12 current transformers with the same ratio for continuous testing, automatic switch rated and lower limit load, the whole test process can be automatically demagnetized.

8.2 Functional characteristics

- 1) According to the parameters set by the computer, it can automatically switch the standard primary and secondary wiring;

- 2) A maximum of 12 current transformers of the same ratio and class can be connected at one time. Under the control of PC or panel button, switch the transformer to the test loop one by one and complete the automatic test according to the test points;
- 3) The digital tube display panel is used to display the ratio and position of the current transformer being measured;
- 4) The instrument transformer test bench can be used to test one of the multiple current transformers under test at a fixed point;
- 5) On the PC software, you can choose whether to demagnetize the transformer under test.

8.3 Operating instructions

- 1) Before powering on, connect each component of the device according to the wiring diagram in the appendix;
- 2) Connect the primary lines of CT to be tested in series with each other, and connect the two ends to the terminal posts. If it is through the core transformer, use a large current wire through the center hole, the two ends are fixed in the terminal, and the connection should ensure good contact with each other.
- 3) The secondary lines of the CT to be measured are introduced into the test bench with clips successively, and the positions of S1 and S2 should not be misaligned. (S1 connects to the red end, S2 connects to the black end.)
- 4) Connect the PC with the communication port of the test bench with a cable.
- 5) After all kinds of connection cables are correctly connected, turn on the power.
- 6) If the default value is appropriate, the test bench can enter the test program; If you want to change the primary current value or the position of the transformer to be measured, you can issue a command through the PC, or change through the panel button.

8.4 Precautions for use

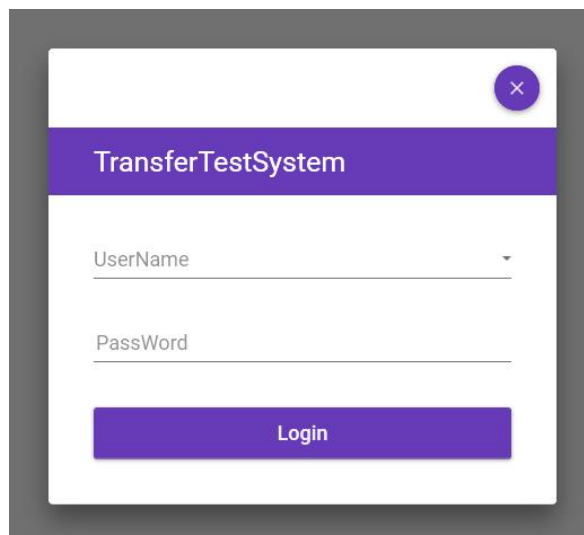
- 1) The current transformer is strictly forbidden to Secondary open circuit

- 2) Before the test, be sure to check the wiring and the connection lines between the devices several times;
- 3) Before the test, be sure to take protective isolation measures;
- 4) When verifying the large current transformer of 600A and above, Due to the large magnetic field interference caused by the transformer primary current is too large, there will be a slight resonance sound inside the test bench, and the computer display and instrument display may appear irregular flashing screen phenomenon;

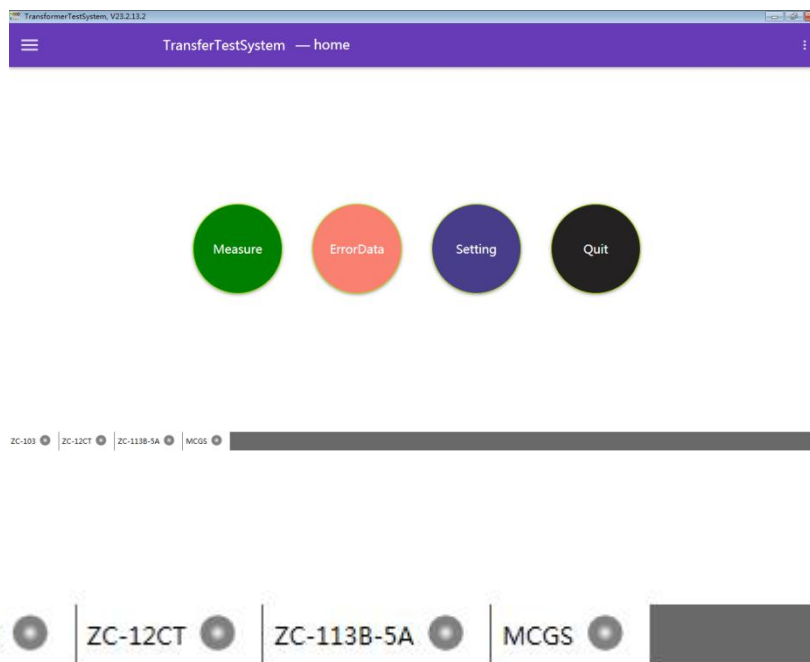
Note: All ground marker terminals must be firmly grounded

9 Instrument transformer verification management software

9.1 System Login



Initial login information: Account 1001, password: None. After the first login, create new user information for easy management. If the login succeeds, the main window of the system is displayed



The four boxes in the lower left corner of the interface are the communication lights of the verification meter, load box, variable frequency power source and test bench. The green light indicates normal communication, and the gray light indicates communication not connected.

9.2 Current transformer measurement

9.2.1 Input basic information of the current transformer

Class	Rated primary current	Testing standard	Rated Burden(VA)	Quarter Burden(VA)
0.1	5A	ANSI	1.25	1.25
0.1S	7.5A	IEC	2.5	2.5
0.2	10A		3.75	3.75
0.2S	12.5A	Rated PF	5	5
0.5	15A	0.8	6.25	6.25
0.5S	20A	1	7.5	7.5
1	25A	Quarter PF	10	10
3	30A	0.8	12.5	12.5
5	40A	1	15	15
	50A	Rated secondary current	20	20
	60A	5A	30	30
	75A	1A	40	40
	80A		60	60
	100A			
	120A			
	125A			
	150A			

cancel next step

When selecting the transformer power factor, click on the corresponding load and power factor according to the IEC standard.

9.2.2 Data browsing

TransferTestSystem — error data manage

begin date

end date

Appliance type

Marking

Utensil number-Utensil number

Manufacturer

Inspection unit

console

certificate

record

All

Group recording

data count 36

Serial number	bar code	Name	Marking	Manufacturer	console	Test man	Date of trial	ErrorData	Edit	Delete
1	36	1	1	1	✓	Admin	2024-04-29 09:23:35			
2	35	1	1	1	✓	Admin	2024-04-29 09:23:35			
3	34	1	1	1	✓	Admin	2024-04-29 09:23:35			
4	33	1	1	1	✓	Admin	2024-04-29 09:23:34			
5	32	1	1	1	✓	Admin	2024-04-29 09:23:34			
6	31	1	1	1	✓	Admin	2024-04-29 09:23:34			
7	30	1	1	1	✓	Admin	2024-04-29 09:23:34			
8	29	1	1	1	✓	Admin	2024-04-29 09:23:34			
9	28	1	1	1	✓	Admin	2024-04-29 09:23:34			
10	27	1	1	1	✓	Admin	2024-04-29 09:23:33			
11	26	1	1	1	✓	Admin	2024-04-29 09:23:33			
12	25	1	1	1	✓	Admin	2024-04-29 09:23:33			

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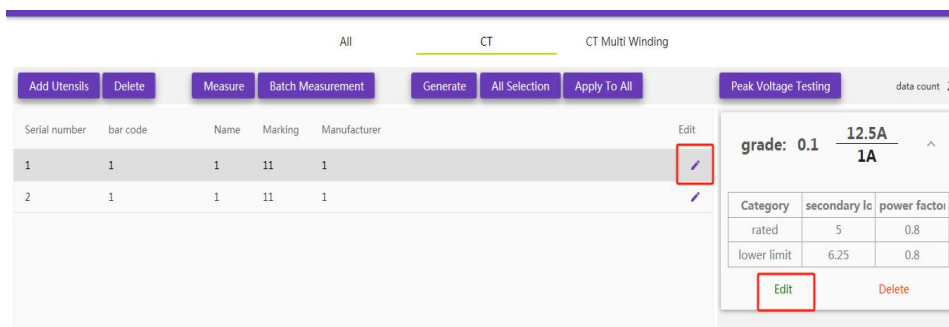
9.2.3 Data Management

a) Add a new record, select the utensil type and click “Add utensils” to enter the new equipment

All CT CT Multi Winding

Add Utensils Delete Measure Batch Measurement Generate All Selection Apply To All Peak Voltage Testing

- b) Delete this record
- c) Select and delete. Edit this record

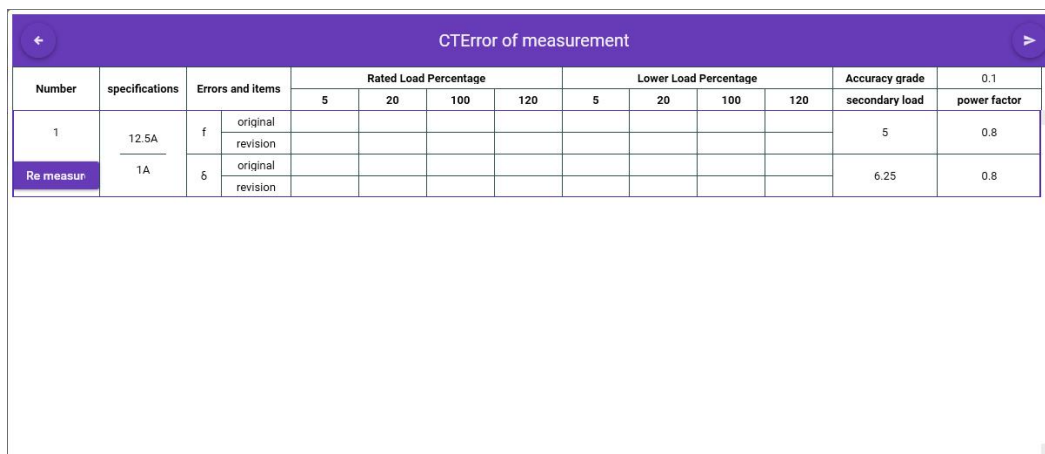


The screenshot shows the software interface with a table of records. The table has columns: Serial number, bar code, Name, Marking, and Manufacturer. Two records are listed. A red box highlights the 'Edit' button (a pencil icon) next to the first record. To the right, a detailed view of the selected record is shown, including 'grade: 0.1', '12.5A', and '1A'. Below this, there is a table with columns: Category, secondary Ic, and power factor. The table contains two rows: 'rated' and 'lower limit'. The 'rated' row has values 5 and 0.8. The 'lower limit' row has values 6.25 and 0.8. At the bottom of this detailed view, there are 'Edit' and 'Delete' buttons, with the 'Edit' button highlighted by a red box.

After selecting the record to be edited, the basic information of the transformer can be modified on the entry. The green edit button on the right can edit the parameter information of the transformer.

9.2.4 Measurement

Click the measurement button to enter the measurement interface. Click the right-most triangle button to start measurement.

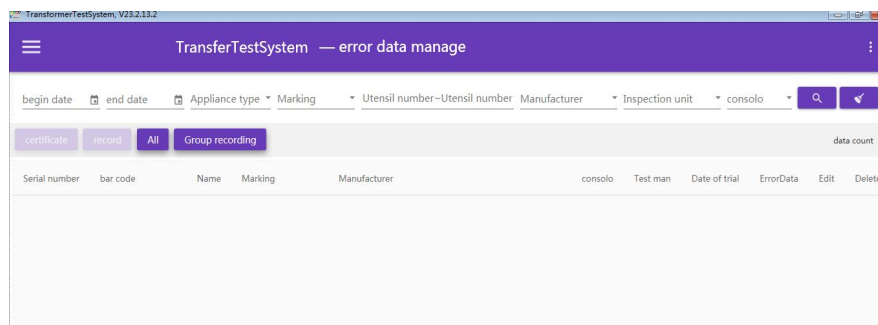


The screenshot shows the 'CTError of measurement' interface. It features a table with the following columns: Number, specifications, Errors and items, Rated Load Percentage (with sub-columns 5, 20, 100, 120), Lower Load Percentage (with sub-columns 5, 20, 100, 120), Accuracy grade, secondary load, and power factor. The table contains two rows of data. The first row has '1' in the Number column, '12.5A' in the specifications column, 'f' in the Errors and items column, and 'original' in the Rated Load Percentage column. The second row has '1A' in the specifications column, 'd' in the Errors and items column, and 'original' in the Rated Load Percentage column. Below the table, there is a 'Re measun' button. The interface also includes a 'Re measun' button and a right-most triangle button to start measurement.

9.2.5 Exit interface

Click this button  to exit the measurement

9.2.6 Error data



Home page Click Error data button to view error data management. By default, you can view information about all devices.

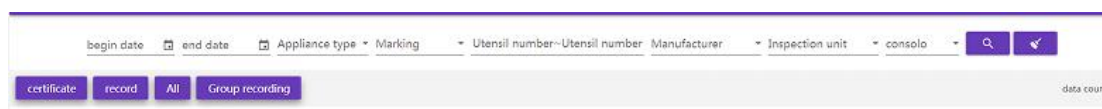
9.2.7 Data management

A. Data browsing

- Click the toolbar button to browse



- Data screening



This column filters the data according to the corresponding parameters

B. Data management

data count 868			
ErrorData	Edit	Delete	
0			
0			

- Error data viewing

- b) Click the icon under data to view the error data
- c) Edit this record
- d) After clicking the icon below Edit, the parameters section is editable. You can modify some recorded parameters as required.
- e) Delete this record
- f) **Delete the error record for the current article. A message indicating whether to confirm the deletion is displayed before the deletion.**

C. Report printing



Select the record you want to print, select the report type, and press the Print button to print

9.3 Menu description



9.3.1 Function realization

A. Measure

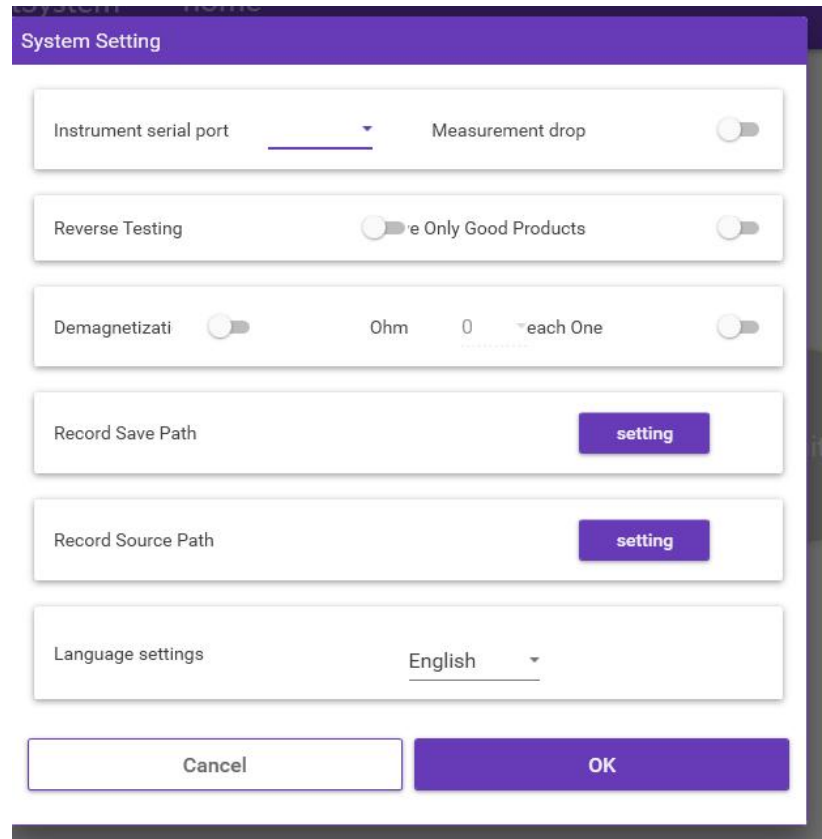
For CT tests, see "II. Transformer measurement"

B. Error data

For specific use, see ". Error data"

C. Setting

Set this parameter based on the device information and device requirements



"Reverse Testing" refers to reverse testing, in which the test points are tested by 120%, 100%, 20% and 5%

"Measurement" is preservation rate of good products, open the switch test data will only save the data that passed, and the data that does not pass is not saved.

Instrument serial port: Serial port number for the software to communicate with the device

Demagnetization : If the subject needs to do demagnetization test, the alternative option will be selected. After this option is selected, [Ohm] and [each One] will be activated.

Ohm : Ohm value set 0, 2, 4, 8, 12 these several gears, if you do not know how to set, you can set to 0, the program automatically calculates the value of ohm according to the test parameters.

Each One: Before the test, each subject performed a demagnetization operation

Record Save Path: directory for saving the exported report

Record Source Path: Path for saving the data template of the exported data

Language setting: Switch between Chinese and English

9.3.2 Exit System

Close this software

10 Appendix

10.1 Error calculation of current transformer

According to the equivalent circuit and phasor diagram of the current transformer, due to the existence of the excitation current I_0 , the actual primary current I_1 and the secondary current I_2 rotated 180° and converted to the primary side are different in value and phase, so there are ratio difference and phase difference, where the ratio difference is calculated using the formula $f = (K_N I_2 - I_1) / I_1$. K_N is the rated current ratio, and I_1 and I_2 are the actual primary and secondary current RMS. In addition, the phase difference between the secondary current phasor I_2 and the primary current phasor I_1 after rotation of 180° is called the phase difference, expressed by δ , and the unit is ' or crad. If I_2 is ahead of the I_1 phase difference is positive; If the lag, the phase difference is negative, the error of the transformer can also be expressed by a complex symbol, denoted as $K = I_1 / I_2$ and $\varepsilon = f + j\delta$, δ in radians. The complex symbol method is a very useful tool in calculating the comprehensive error of measurement results.

According to the definition of the error of the current transformer, The ratio difference of the current transformer is the ratio of the error current I_0 projected on the I_1 phasor to I_1 , and the phase difference is the delta Angle δ . Since the δ Angle is small, it is negligible compared to the ψ and α angles. Therefore, the Angle between I_0 and I_1 can be thought of as $90^\circ - \psi - \alpha$, and the radian value of δ Angle can be replaced by the sine function value of δ Angle, resulting in

$$f = -(100 I_0 / I_1) \sin(\psi + \alpha) \quad (\%)$$

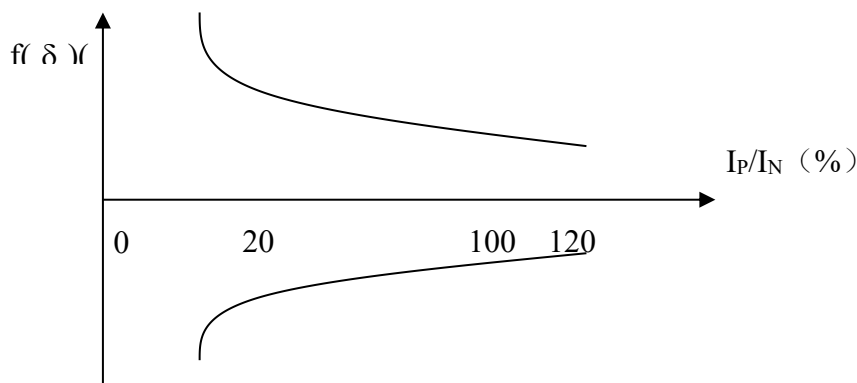
$$\delta = (3438 I_0 / I_1) \cos(\psi + \alpha) \quad (')$$

The above equation indicates that the ratio error and phase difference of the current

transformer are related to the ratio of the excitation currents I_0 and I_1 , as well as the size of the ψ angle, and also to the size of the impedance angle α of the secondary circuit.

10.2 Error characteristics of current transformer

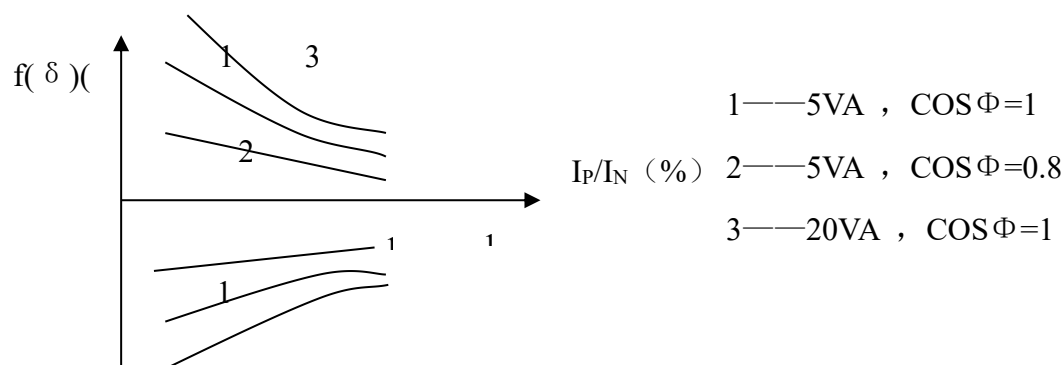
The relationship between the error of the current transformer and the primary current is called the current characteristic, as shown in Figure. In the small current region, due to the low magnetic density of the core (tens of mtex), the value of I_0 / I_1 is relatively large, the ψ Angle is relatively small ($30^\circ - 40^\circ$), the ratio difference is negative, and the phase difference is positive. With the increase of primary current, the magnetic density of the core increases (hundreds of mtex), at this time I_0 / I_1 decreases, the ψ Angle becomes larger ($50^\circ - 60^\circ$), the ratio difference changes in the positive direction, and the Angle difference changes in the negative direction



Current characteristic curve of current transformer

The relation between error of current transformer and secondary load is called load characteristic. The curved load characteristic curve is shown in Figure. As the secondary load increases, the value of I_0 / I_1 also increases. The ratio difference of the current transformer changes in the negative direction, and the Angle difference changes in the positive direction. When the power factor of the secondary load decreases, both the ratio difference and the Angle difference of the current transformer change in a negative direction as the delta Angle δ increases, as shown in Figure.

10.3 Load characteristics of current transformers

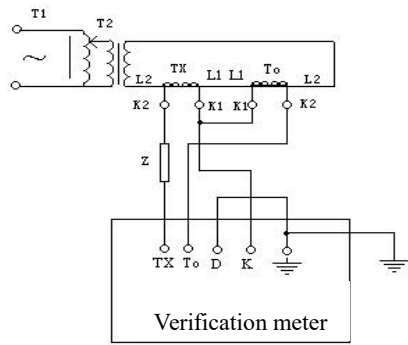


Load characteristic curve of current transformer

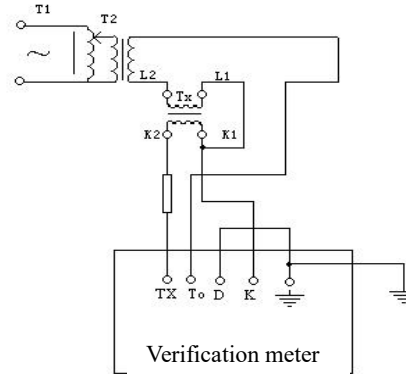
The current transformer can be regarded as the power equipment excited by the current source, and its output voltage depends on the size of the secondary load. Therefore, the current transformer in use does not allow the secondary side of the open circuit, if the secondary coil is open, the primary current I_1 becomes an exciting current, its value is hundreds of times more than the normal I_0 , the magnetic flux in the core from the normal tens of milliteslas to the saturation of 1.4 to 1.8 Tesla, inductive voltage peak up to several thousand volts, endangering equipment and personal safety. In addition, the magnetic density is too high, the core will be seriously heated, the transformer is easy to burn, and the core is also easy to produce residual magnetism, resulting in the current transformer overshoot. If the core of the current transformer has remanent magnetism, its average magnetization curve will no longer pass the origin, then harmonic distortion will be generated, and the ratio difference will change in the negative direction. The change direction of the phase difference is related to the magnetic characteristics of the core. Under normal circumstances, the iron-nickel alloy core changes in the negative direction and the silicon steel sheet core changes in the positive direction.

10.4 Current transformer verification wiring diagram

10.4.1 The wiring diagram when the verification meter is used in a single machine

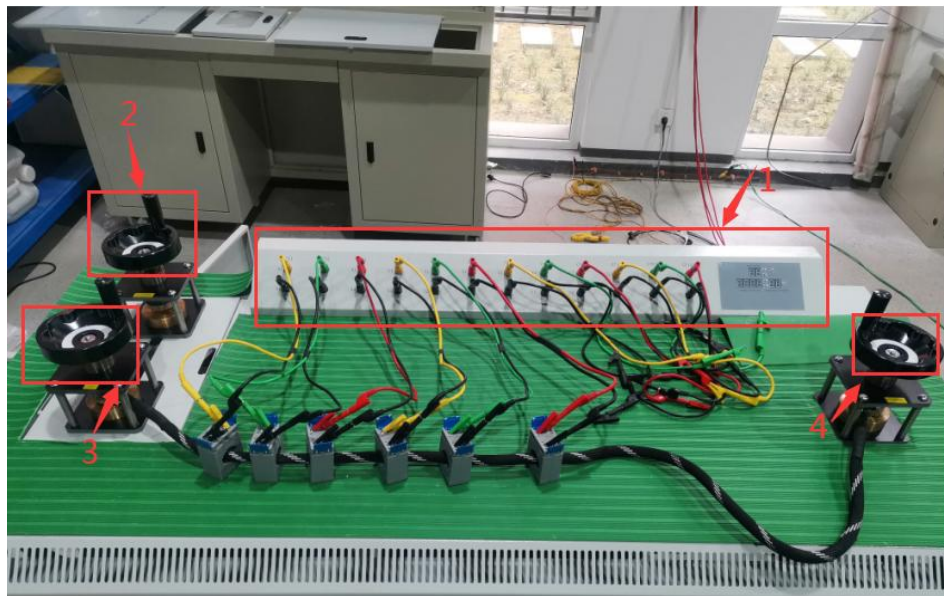


Current transformer error test diagram

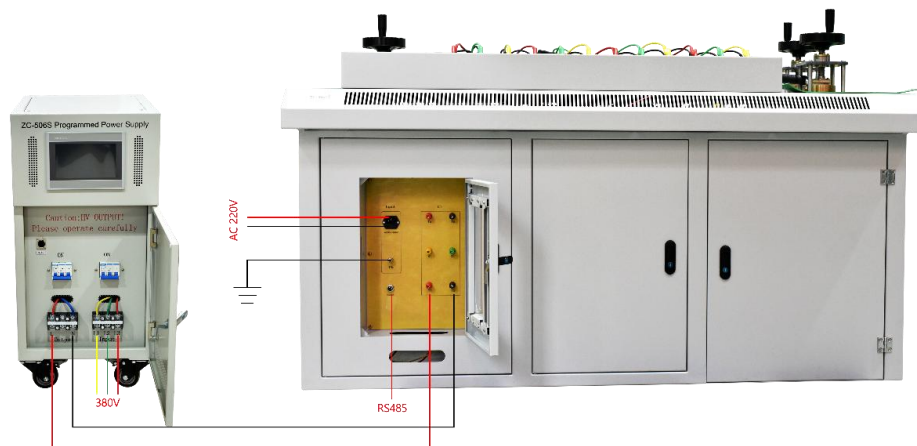


Current transformer self-calibration test diagram

10.4.2 Wiring diagram of the online test bench in use

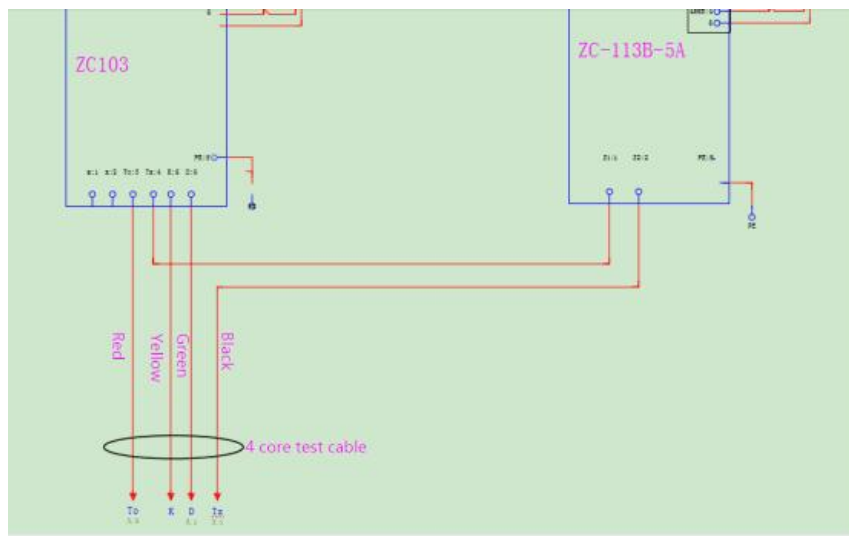


1. Area 1 is connected to the secondary measurement terminal of the transformer, S1 is connected to the transformer S1, S2 is connected to the transformer S2
2. Terminal 2 is terminal P2. For tests higher than 500A, terminal 1 and terminal 3 are used.
All transformer primary side P1 faces terminal 3
3. Terminal No. 3 is the P1 terminal, which is the public terminal
4. Terminal 4 is terminal P2. For tests below 500A, terminal 3 and terminal 4 are used. All transformer primary side P1 faces terminal 3



CT test bench and power supply wiring diagram

1. Variable frequency power supply three-phase input 415V voltage;
2. The navigation plug of the test bench panel is RS485 communication cable, which is used to transmit speed command signals. The RS485 plug of the instrument is connected inside, and the other end is connected to the USB interface of the computer.
3. Test bench panel PE grounding;
4. A and N of the test bench panel are the power line terminals of the test bench, and the two-phase 230V voltage is connected;
5. The T1 and T2 of the test bench panel are connected to the output of the Variable frequency power supply;



ZC 103A and ZC 113B-5A circuit diagram

Mark the To label wire is connected To the To terminal of tester 103A

The Tx of the 103A tester is shorted to the Z1 terminal of the 113B load box

The K label cable is connected to the K terminal of the 103A tester

Connect the D label wire to terminal D of tester 103A

The line labeled Tx is connected to load box 113B Z2

11 Transportation and storage

11.1 Transportation

This product must be packed during transportation. The packing cases must be packed in wooden cases with foam shock-proof layers. The packaged products should be able to be transported by road, railway and air, and should not be placed in the open compartment or inverted during transportation. The warehouse should pay attention to rain, dust and mechanical damage prevention.

In the transportation of instruments in daily use, anti-shock and anti-impact measures must be taken.

11.2 Storage

The ambient temperature of the warehouse where the device is stored is $-10 \sim 60$, the relative humidity is not greater than 95%, and there should be no acid, alkali and corrosive gas in the room, and no strong mechanical shock and vibration.

12 Warranty and after-sales

The warranty period of the products sold by the company is one year. Repair period free maintenance, maintenance period only charge cost.

During the warranty period, if any of the following situations occur, only the cost of maintenance will be charged:

- 1) Failure or damage caused by falling during user use or handling;
- 2) Failure or damage caused by other units entrusted by the user;
- 3) Equipment failure or damage due to abnormal voltage;
- 4) Failure or damage caused by force majeure (such as fire, flood, natural disaster, etc.);
- 5) Failure or damage caused by not connecting other equipment according to the requirements of this instruction manual;

The company has the final interpretation of the above! !

13 Packing List

ITEM	NAME	MODEL	QUANTITY
1	Test bench		1
2	Transformer Verification meter	ZC-103A	1
3	3 Phase 10KVA Variable frequency power supply	ZC-506S	1
4	Transformer current load box	ZC-113B	1
5	Upflow precision current transformer	ZC-113	1
6	Network Cable		1
7	Two-core sheathed Secondary test line	2*6mm ² 50cm	15
8	Test clips		some
9	Variable frequency power supply output line	8mm ² 3m	2
10	USB to RS485 communication cable		1
11	Computer(host, screen, keyboard, mouse)		1
12	Instrument power cord	One for three	1

13	Transformer error management software		1
14	Instrument Cabinet		1
15	Four-core sheathed cable	4*4mm ² 3m	1
16	User manual, test report		1

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