Preface

Thank you for purchasing **the Transformer Integrated Characteristic Tester produced by our Company.** This Manual will help you to use the equipment you have already purchased proficiently, please read it carefully when you use the equipment for the first time. **Meanwhile, please keep the Manual well for future use.**

- Our aim is to meet the demands of users as far as possible by continuously improving and perfecting our products. Even if some of the products you need this time are somewhat different from the conventional ones provided by us in technical requirements or other aspects, our Company will strive to describe the application method and relevant precautions more clearly, so as to facilitate your smooth use of the equipment you have purchased this time.

- Please contact us timely in case of any questions or equipment maintenance matters encountered during the use of the equipment, and we will give you a satisfactory answer within the shortest possible time.

- **Product Warranty:** The replacement will be implemented once the product produced by our Company fails within three months since the date of delivery. The free maintenance will be implemented if the product fails within one year (including one year). The paid lifelong maintenance will be implemented if the product fails after one year and more.
- **Safety Advice:** This product can only be used within the specified scope in order to avoid possible hazards, such as personal injury or damage to other related products.

- By adhering to the enterprise spirit of "Quality + Innovation + Service" and Strive for Excellence, our Company is committed to providing integrated solutions and excellent services for every customer. Our Company hereby promises that we will answer any problems you encounter during the test and provide corresponding services at any time, regardless of the time, place or way you purchase our products. Our Company will respond to your suggestions and requirements promptly and timely. We are sure to obtain your support and recognition.

Precautions

In order to avoid electric shock or personal injury, please observe the following guidelines when operating:

- Please read the Manual carefully before test and operate strictly according to its requirements, so as to protect the equipment and personal safety.
- Do not place the instrument on an unstable platform or table to prevent it from falling and being damaged.
- The power supply of the device should not exceed AC220V (± 10%) 50Hz, and the power cord above 15A should be used.
- Please turn on the power switch first when the equipment is powered on, and then push the leakage protector after the picture appears.

- Make ensure that the CT/PT wiring is disconnected from the original wiring and is not grounded during the test.
- When performing the PT volt-ampere characteristic test, **please ensure to reserve sufficient electrical safety distance for primary winding**.
- When performing the CT transformation ratio test, please ensure that the grounding wire of the secondary winding is disconnected, while **other secondary windings are short connected.**
- Note: During the CT\PT volt-ampere, PT transformation ratio, load and voltage withstand tests, no grounding point is allowed in the output circuit, or otherwise the test cannot be performed.
- If the test is performed continuously and lasts too long, please stop and cool the device properly to prevent it from overheating and burning out.
- Please do not block the circular holes on the left/right wall of the instrument which are provided for ventilation and heat dissipation, so as to ensure normal operation of the instrument.

- **This instrument, as a kind of precision electronic instrument, is unable to withstand the high temperature environment such as scorching sun, so please pay attention to sun blocking and ventilation when using outdoors, to prevent it from overheating or resulting in a decrease of measurement accuracy.**
- **As a safety measure, the protective grounding terminal is installed on the instrument, and that on the panel should be reliably grounded before test.**
- Do not drop any foreign matters into the case to avoid short circuit.
- Please do not operate in a humid or explosive environment due to high voltage inside.
- When transporting, please lay sponges and other buffer substances outside the instrument to prevent from damaging the instrument or reducing its accuracy due to vibration or bump.
- The data, when almost full, should be printed in time or uploaded to the USB flash disk or computer for storage.
- When dumping the test data with USB flash disk, you cannot unplug the USB flash disk until the data is stored completely, or it will lead to the unsuccessful data dump, or may lead to the loss of data and the damage of the USB flash disk.
- Please do not plug and unplug the test wire during the test. In case of any abnormal phenomena encountered, please turn off the power and reboot the instrument in time.

Our Company reserves the right to amend this Manual.

In case of any inconsistency between the product and the Manual, the practical product shall prevail.

Main Features of Automatic Transformer Integrated Characteristic Tester

Only some simple digital settings are required: to set the rated parameters of the transformer. The instrument will automatically record the data in the whole process, and automatically calculate and display the transformation ratio polarity and volt-ampere characteristic curves, omitting the cumbersome labor like wire changing, manual voltage regulation, manual recording, sorting, and curve tracing.

The extremely simple operation and wiring method is used to realize the measurement of the transformer, which greatly reduces the work intensity and improves the work efficiency, facilitating the on-site measurement of the transformer; Fast, Simple, Accurate and Convenient.....

---------- 一= High Output Voltage, Large Capacity =一----------

★ Volt-Ampere Characteristic Test: the maximum output voltage of a single machine is up to **2500V/3000V** (Optional), which can be used to perform the volt-ampere characteristic test for 500KV 1A current transformer. Transformation Ratio Test: the maximum current output is up to **600A/1000A** (Optional). The power supply of the equipment outputs the real voltage and current values, and forms the standard sine wave with a frequency of 50Hz, which can effectively simulate the real state of the transformer, conforming to the relevant national maintenance regulations.

The minimum voltage regulation resolution can reach 0.13V

---------- —= *Comprehensive Function* =—----------

★ Items that can be tested include CT/PT: “volt-ampere characteristics”, “5%, 10% and 15% error curves”, “transformation ratio, polarity”, “angle difference, ratio error”, “secondary DC resistance” and “secondary load”, “secondary circuit”, “secondary voltage withstand” and demagnetization function.

★ The tests satisfy various transformer standards such as GB1208 and GB1207, and are automatically selected according to the type and level of transformers.

★ Chinese input method provided in the 7-inch color touch screen allows you to enter the Chinese serial number.

★ Full-Chinese graphical interface, friendly and beautiful. The panel’s built-in printer allows you to print graphs and test data at any time.

★ A large-capacity memory provided can store 4000 groups of test data, and the data will never be lost in case of power failure;

★ After the test, the data can be stored in the USB flash disk and analyzed with software on the computer to generate the WORD report.

★ Online function is equipped to carry out the test via computer control instrument.

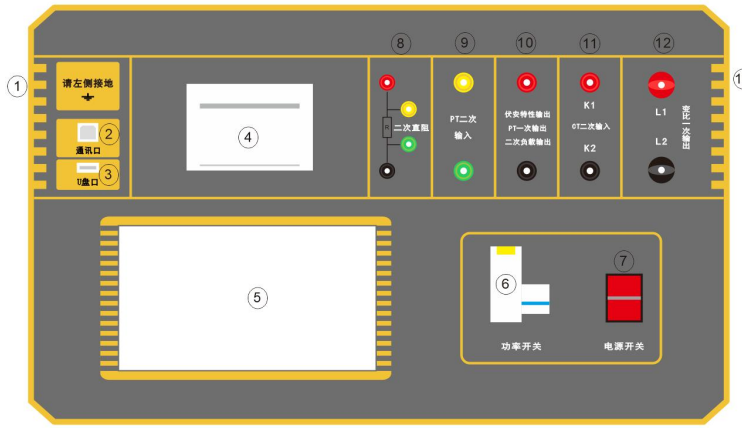
★ Automatic inflection point calculation; perfect data query, browsing, printing and deleting; built-in date/time.

★ Integrated single machine, with the weight as light as only 26Kg, easy to carry and perform the flow test.

Main Technical Parameters

Test purpose		Protective and metrological CT, protective PT
Input power	Voltage	AC220V/± 10%
	Frequency	50Hz/±10%
	Maximum power	5KVA
CT volt-ampere	Maximum voltage	0 - 2500V/3000V (optional)
	Maximum current	20A
	Accuracy	±0.5%
CT transformation ratio	Maximum current	0-600A/1000A (optional)
	Maximum voltage	0-7V
	Accuracy	±0.5%
PT volt-ampere	Maximum voltage	Safety Limit: 0 - 500V
	Maximum current	20A
	Accuracy	±0.5%
PT transformation ratio	Maximum voltage	0 - 2500V/3000V (optional)
	Accuracy	±0.5%
Ratio error	Accuracy	±0.5%
Phase	Accuracy	±3min
DC resistance measurement	Scope	0 - 20Ω
	Accuracy	0.5%
Primary current flow	Scope	0 - 200A/5 min
Secondary voltage withstands	Scope	0 - 2500V/5 min
Environmental conditions	Operating temperature	-10℃ - +50℃
	Storage temperature	
	Humidity	Relative humidity: 45% - 60%, non-condensing
Instrument dimension		420 mm x 300 mm x 270mm
Instrument weight		26kg

Instrument Panel Structure Description

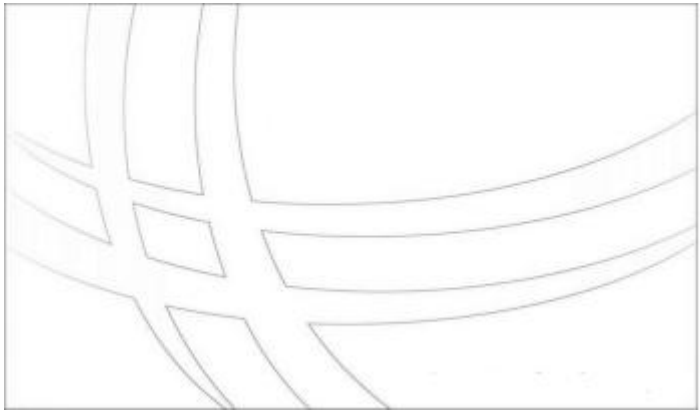


1	Grounding Terminal	**9**	PT Transformation Ratio Secondary Input Port
2	Communication Port	**10**	CT/PT Volt-Ampere Output Port
3	USB Flash Disk Interface		PT Primary Output Port
4	Printer		Secondary Load Output Port
5	7-inch LCD Display Screen	**11**	CT Transformation Ratio Secondary Input Port
6	Power Switch	**12**	CT Transformation Ratio Primary Output Port
7	Power Supply Switch	**13**	Power Supply Input Port (AC220V)
8	DC Resistance Test Port		

Chapter I: Main Menu

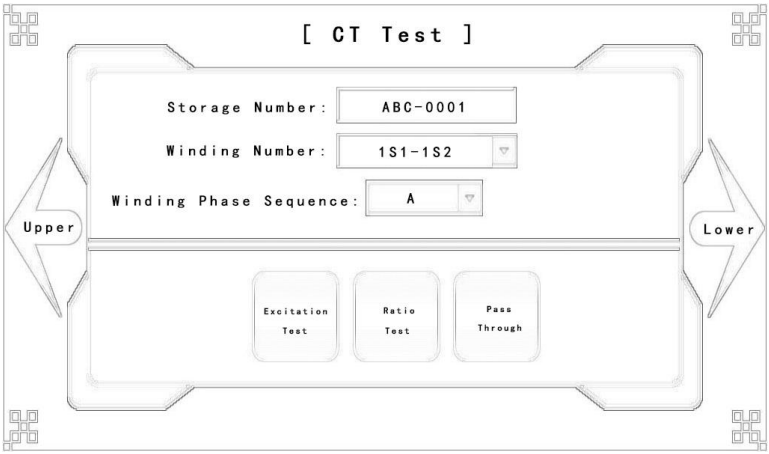
1. Initialization

Connect the AC220V power supply and turn on the power switch on the panel to enter the initialization of the instrument; after that, the buzzer rings twice, and then, you can wait for 15 seconds or **click anywhere on the screen to enter the main menu**.



After entering the interface, click left and right [**Page Up]** or [**Turn Down]** to perform the selection ***on the menu page***.
There are five circular function menus listed on the interface, including **CT Test**, **PT Test, Additional Functions, Data Management and System Management**. Find the item that needs to be tested and click to enter.

Chapter II: CT Test



1. Basic Information:

A. **Save Number**: **at most 10 Chinese characters or 20 characters, letters and numbers can be entered**.

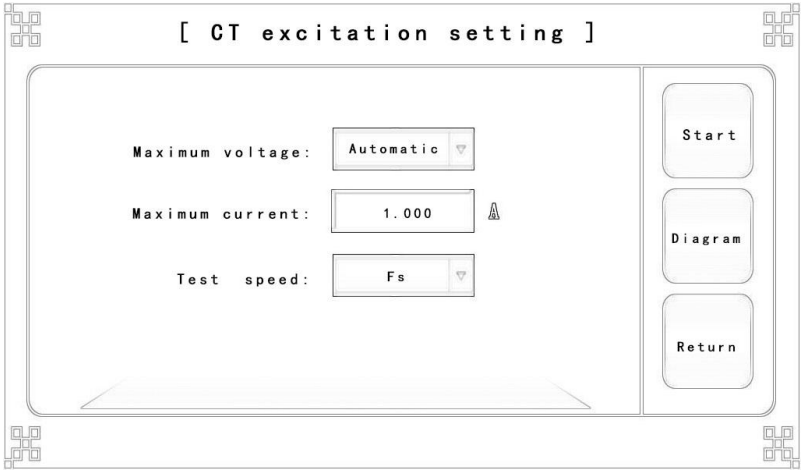
B. **Serial Number of Winding**: **at most 4 Chinese characters or 8 characters, letters and numbers can be entered. The preset value is recommended.**

C. **Phase Sequence of Winding:** means the phase sequence of the winding under test currently. Optional values are**: A, B,**

C.

2. Volt-Ampere Test:

Click [Volt-Ampere Test], and the interface will be as follows:



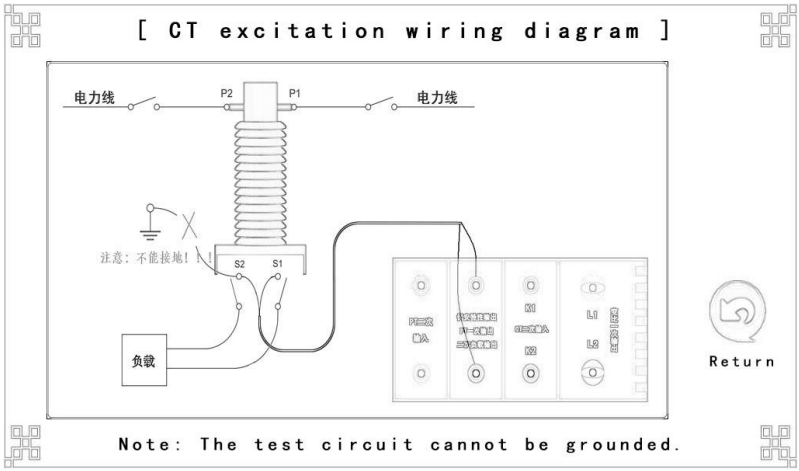
A. Parameter Description:

- Maximum Voltage: voltage to be output.
- You can choose: automatic mode, 30V, 220V, 600V, 1500V, 2500V.
- Maximum Current: current to be output, 20A at most.
- Boost Speed: the speed of the voltage regulator, and you can choose: full speed, high speed, medium speed, low speed.

Note: Please check whether the wiring is correctly connected before test.

B. Test Wiring:

Click [Wiring Diagram], and you can see the Test Wiring Diagram:



Notes:

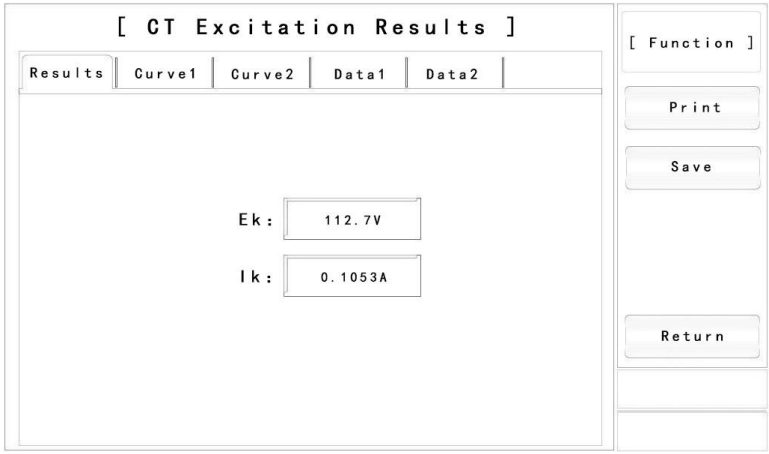
- **During the test, the winding under test cannot be grounded.**
- **During the test, the transformer should be disconnected from the original circuit.**
- **By considering the high pressure in the circuit, please do not**

touch, plug or unplug the test wire during the test.

❖ **Please turn on the power switch at the beginning of the test.**

C. Test Results:

Test Result Page, the interface is as follows.



- **Basic Data:** to display all basic results tested, as shown in the figure above.
- **Excitation Curve**: to display the excitation curve for the current data.
- **Error Curve:** to display 5% or 10% error curve for the current data.
- **Excitation Data:** to display the excitation data according to the set mode, which includes: complete data, standard data and specified data.
- **Error Data**: to display the error data according to the set mode, which includes: complete data and standard data.

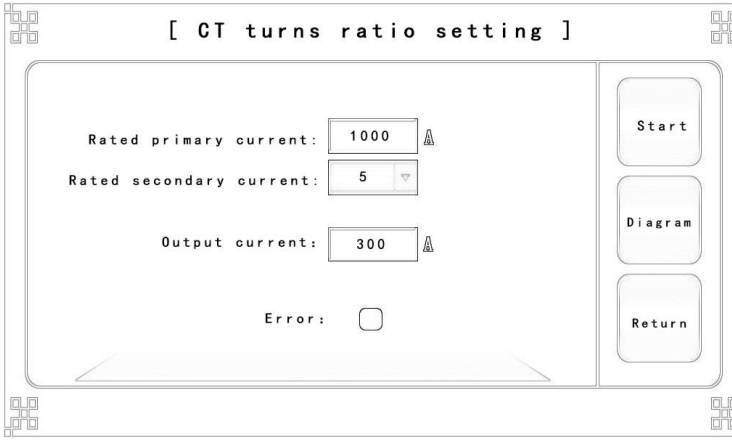
- **Result Printing:** to print the results according to the set mode.
- **Data Save:** to click and save the current data.

Note:

The results need to be saved manually, i.e., press the [Data Save] button on the right side once the save is necessary.

3. Transformation Ratio Test:

Click [Transformation Ratio Test], and the interface will be as follows:



A. Parameter Description:

- Rated Primary Current: the rated primary current of the transformer under test.
- Rated Secondary Current: the rated secondary current of the transformer under test.
- Output Current: the primary current to be output, which is recommended to be set at 300A when the rated primary current is greater than 300A, while half of the rated primary current when it is less than 300A.
- Transformation ratio error: the values are taken according to 1%, 5%, 20%, 100%, 120% of the rated primary current, with the

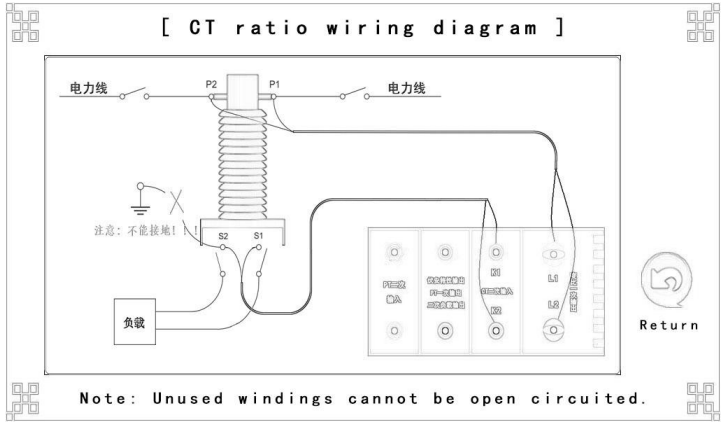
angle difference and ratio difference displayed at the same time.

Note:

When the parameter is selected, the output current already set will become invalid, and the current of the equipment will be raised according to 120% of the rated primary current or the maximum current of the equipment.

B. Test Wiring:

Click [Wiring Diagram], and you can see the Test Wiring Diagram:



Notes:

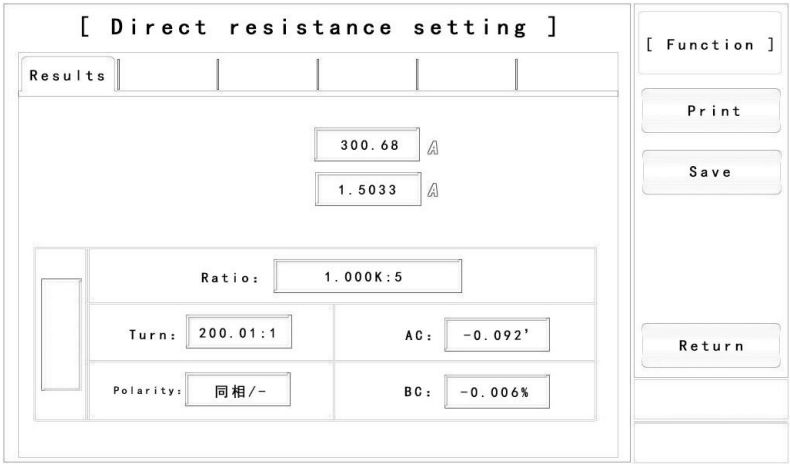
- **The secondary winding cannot be open, and the unused ones must be short connected.**
- **During the test, the transformer should be disconnected from the original circuit.**
- **By considering the high pressure in the circuit, please do not touch, plug or unplug the test wire during the test.**
- **Please turn on the power switch at the beginning of the test.**
- **When the output current exceeds 400A, the diameter of the**

power supply line shall not be less than 2.5 m2,
for the instrument may be damaged if the diameter is too small.

- **Instruments and wires will overheat during the continuous current raising. Please cool them down before test. Overheating**
may have the risk of damaging the instrument.

C. Test Results:

Test Result Page, the interface is as follows.



- **Basic Data:** display all basic results tested, as shown in the figure above.
- **Error Test**: It will appear only when the transformation ratio error is selected, which will display the angle difference and ratio

error of 1%, 5%, 20%, 100%, and 120%.

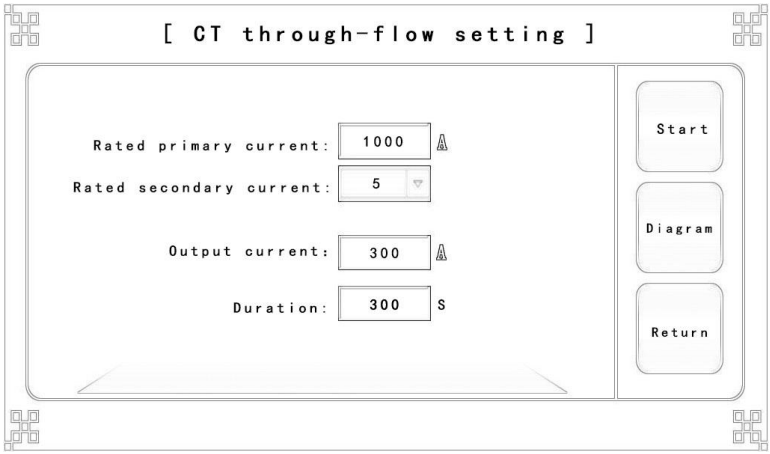
- **Result Printing:** print the results according to the set mode.
- **Data Save:** click and save the current data.

Note:

The results need to be saved manually, i.e., press the [Data Save] button on the right side once the save is necessary.

4. Primary current flow:

Click [Primary Current Flow], and the interface will be as follows:



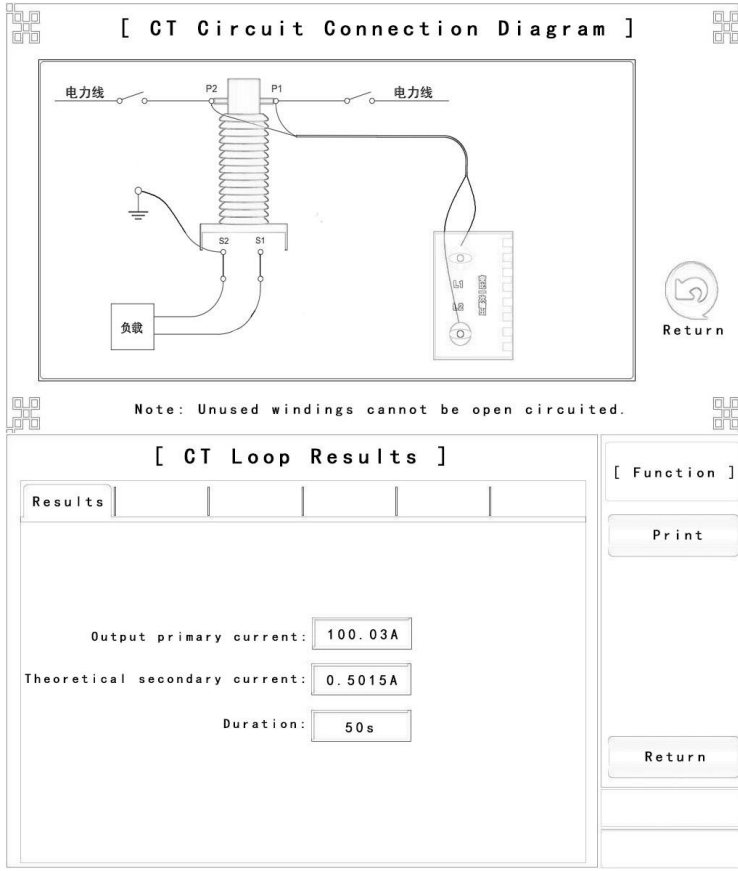
D. Parameter Description:

- Rated Primary Current: the rated primary current of the transformer under test.

- Rated Secondary Current: the rated secondary current of the transformer under test.
- Output Current: the current to be output, 200A at most.
- Duration: 300 seconds at most.

E. Wiring and Test:

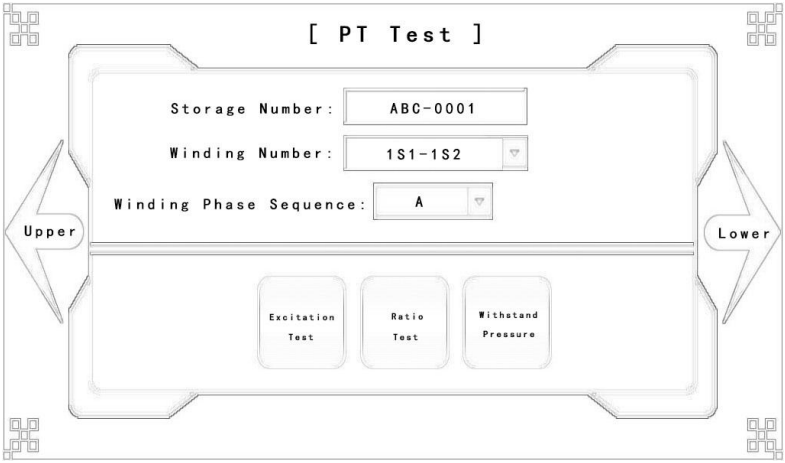
The wiring diagram and test results are as follows:



Notes:

- **The secondary winding cannot be open, and the unused ones must be short connected.**
- **Please turn on the power switch at the beginning of the test.**
- **The SAVE function is not included, so please print it directly once you need to save the results.**

Chapter III: PT Test

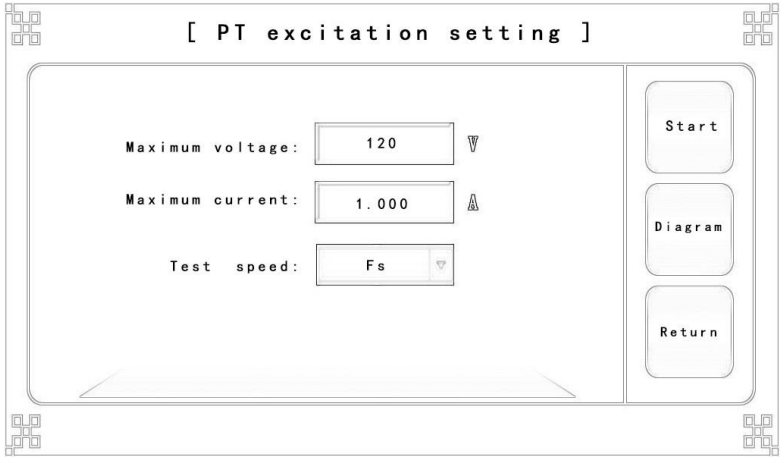


1. Basic Information:

- **Save Number**: **at most 10 Chinese characters or 20 characters, letters and numbers can be entered**.
- **Serial Number of Winding**: **at most 4 Chinese characters or 8 characters, letters and numbers can be entered. The preset value is recommended.**
- **Phase Sequence of Winding:** means the phase sequence of the winding under test currently. Optional values are**: A, B, C.**

2. Volt-Ampere Test:

Click [Volt-Ampere Test], and the interface will be as follows:



A. Notes:

- Maximum Voltage: voltage to be output.

  In terms of safety, the upper limit of the output voltage shall be set to 500V.

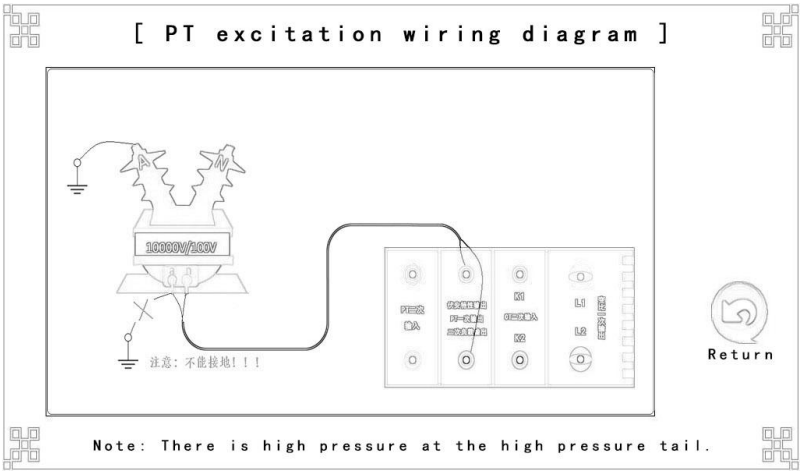
- Maximum Current: current to be output, 20A at most.

- Boost Speed: the speed of the voltage regulator, and you can choose: full speed, high speed, medium speed, low speed.

Note: Please check whether the wiring is correctly connected before test.

B. Test Wiring:

Click [Wiring Diagram], and you can see the Test Wiring Diagram:

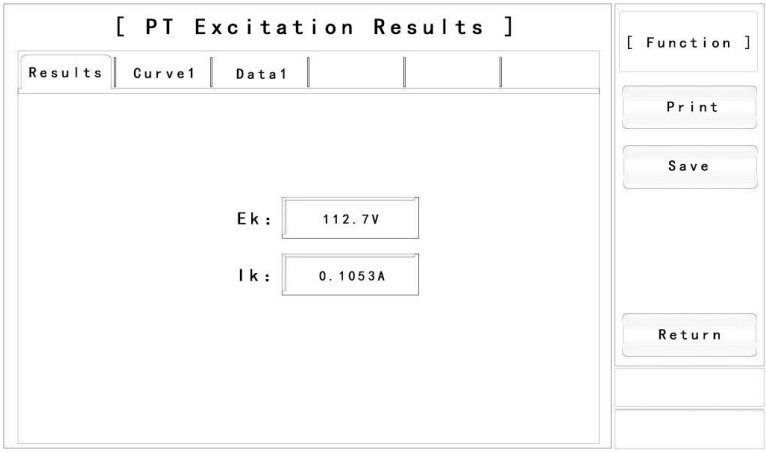


Notes:

- **During the test, the winding under test cannot be grounded.**
- **During the test, the transformer should be disconnected from the original circuit.**
- **The primary winding will produce high voltage when the secondary winding is pressurized, so please stay away from the primary winding and set up a warning line.**
- **By considering the high pressure in the circuit, please do not touch, plug or unplug the test wire during the test.**
- **"Please turn on the power switch" at the beginning of the test.**

C. Test Results:

Test Result Page, the interface is as follows.



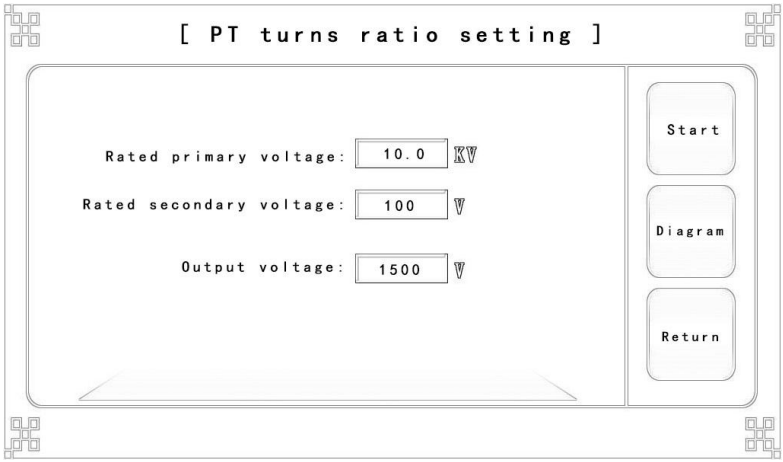
- **Basic Data:** display all basic results tested, as shown in the figure above.
- **Excitation Curve**: display the excitation curve for the current data.
- **Excitation Data:** display the excitation data according to the set mode, which includes: complete data, standard data and specified data.
- **Result Printing:** print the results according to the set mode.
- **Data Save:** click and save the current data.

Note:

The results need to be saved manually, i.e., press the [Data Save] button on the right side once the save is necessary.

3. Transformation Ratio Test:

Click [Transformation Ratio Test], and the interface will be as follows:

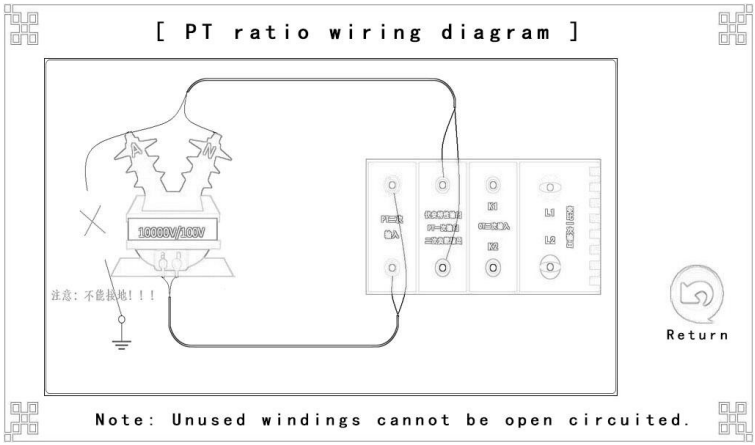


A. Parameter Description:

- Rated Primary Current: the rated primary current of the transformer under test (Unit: KV).
- Rated Secondary Current: the rated secondary current of the transformer under test.
- Output Voltage: the primary voltage to be output, which is recommended to be set as: 1500V.

B. Test Wiring:

Click [Wiring Diagram], and you can see the Test Wiring Diagram:

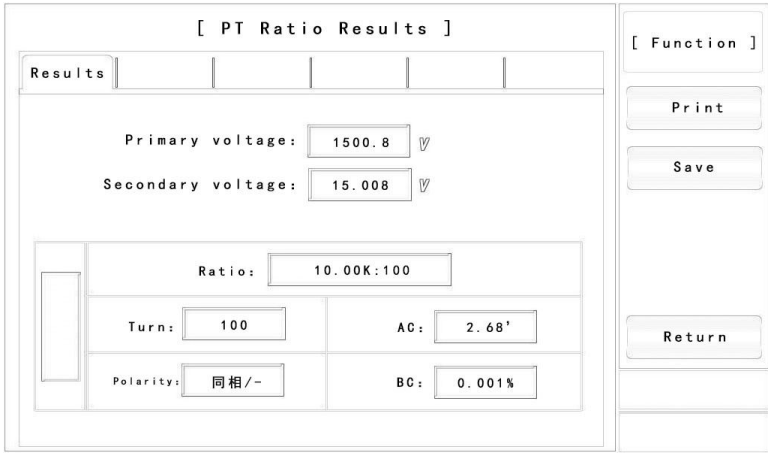


Notes:

- **The primary end and secondary end cannot be reversely connected.**
- **During the test, the transformer should be disconnected from the original circuit.**
- **By considering the high pressure in the circuit, please do not touch, plug or unplug the test wire during the test.**
- **"Please turn on the power switch" at the beginning of the test.**

C. Test Results:

Test Result Page, the interface is as follows.



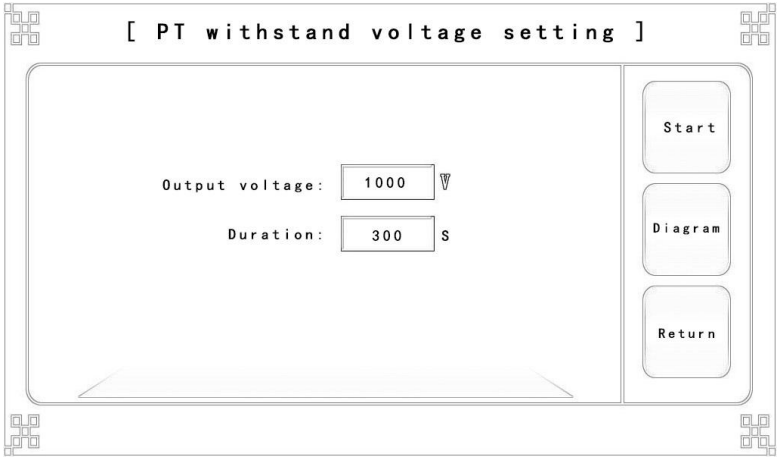
- **Basic Data:** display all basic results tested, as shown in the figure above.
- **Result Printing:** print the results according to the set mode.
- **Data Save:** click and save the current data.

Note:

The results need to be saved manually, i.e., press the [Data Save] button on the right side once the save is necessary.

4. Secondary Voltage Withstand:

Click [Secondary Voltage Withstand], and the interface will be as follows:

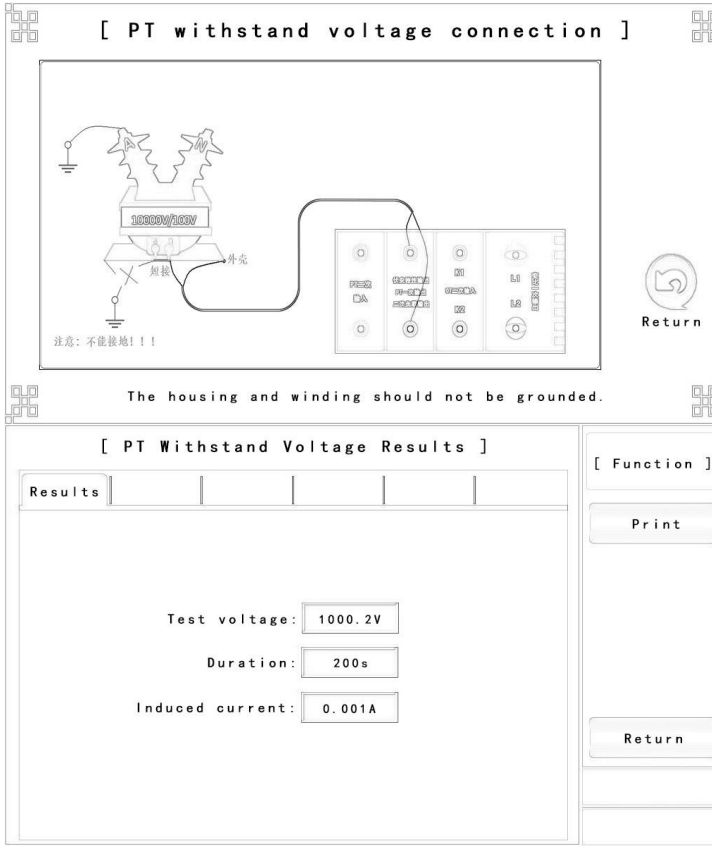


A. Parameter Description:

- Output Voltage: the voltage to be output, 2500V/3000V at most (optional).
- Duration: 300 seconds at most.

B. Wiring and Result:

The wiring diagram and test results are as follows:



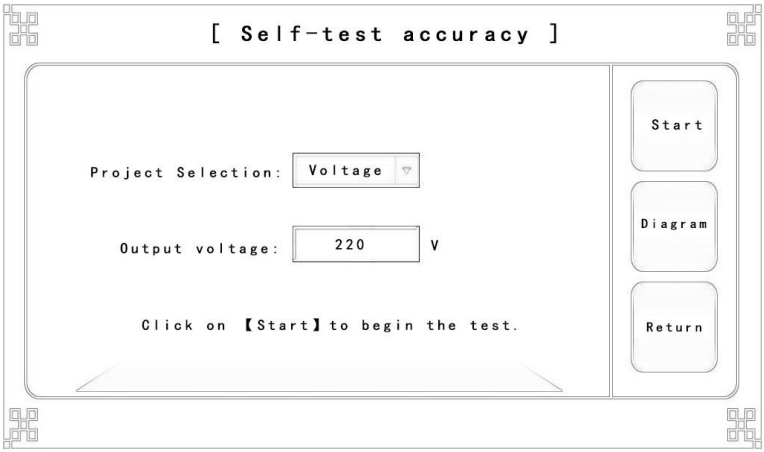
Notes:

- **The enclosure and test circuit cannot be grounded.**
- **Please turn on the power switch at the beginning of the test.**
- **The SAVE function is not included, so please print it directly once you need to save the results.**

Chapter IV: Additional Functions

1. Instrument Self-Test:

Click [Instrument Self-Test], and the interface will be as follows:



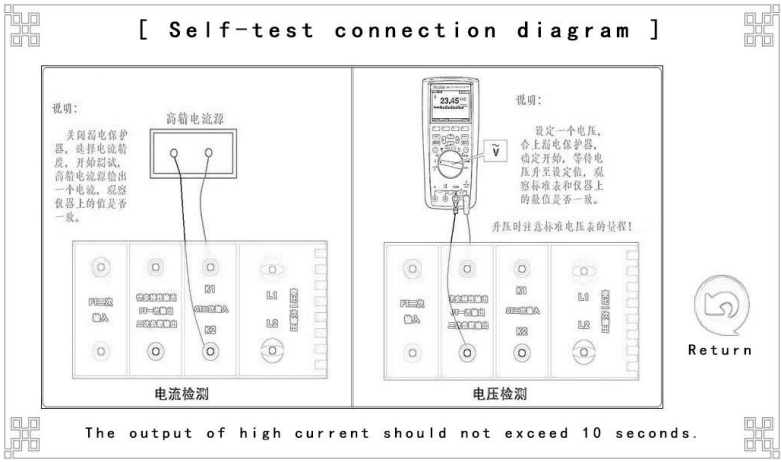
A. Parameter Description:

- Self-Test Items: the items [Voltage Test] and [Current Test] can be selected.
- Output Voltage/Current: the voltage or current to be output, 2500V or 20A at most.

Note: Please check whether the wiring is correctly connected before test.

B. Test Wiring:

Click [Wiring Diagram], and you can see the Test Wiring Diagram:

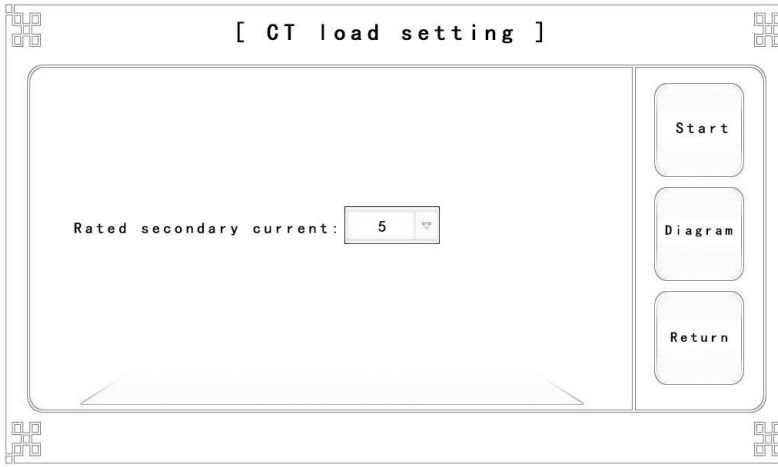


Notes:

- **Please check whether the output voltage matches the range of the voltmeter before the voltage test.**
- **During the current test, higher output current needs shorter retention time.**
- **Please “turn on” the power switch during the voltage test.**
- **Please “turn off” the power switch during the current test.**

2. Load Test:

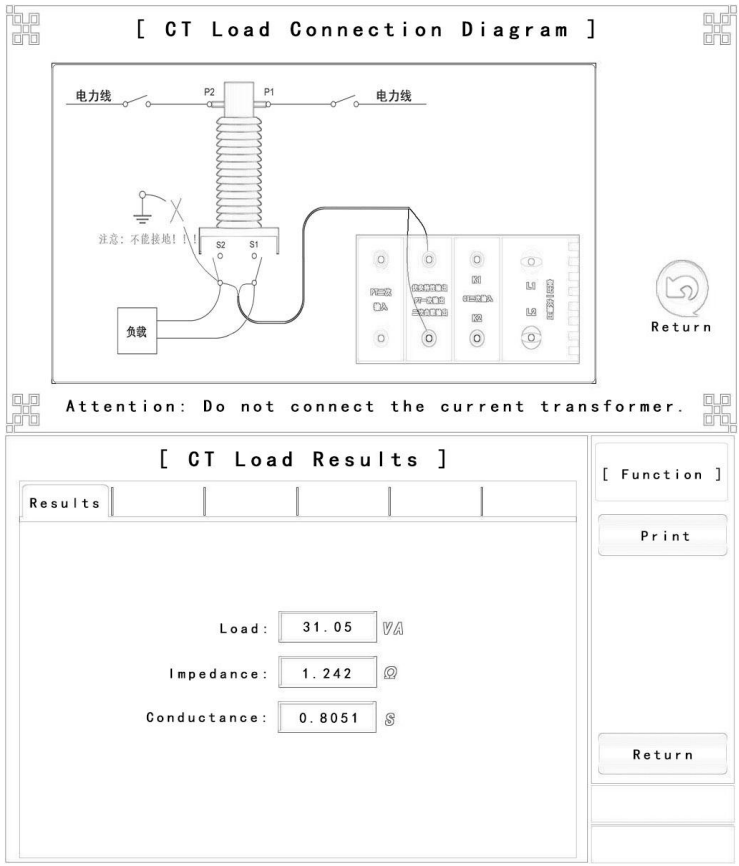
Click [Secondary Load], and the interface will be as follows:



A. Parameter Description:

- Rated Secondary Voltage: the rated secondary voltage of the transformer under test.

D. Wiring and Result:



Notes:

- **Disconnect the load from the transformer during the test.**
- **No grounding point is allowed in the load circuit during the test.**
- **Please “turn on the power switch” at the beginning of the test.**
- **The SAVE function is not included, so please print it directly once you need to save the results.**

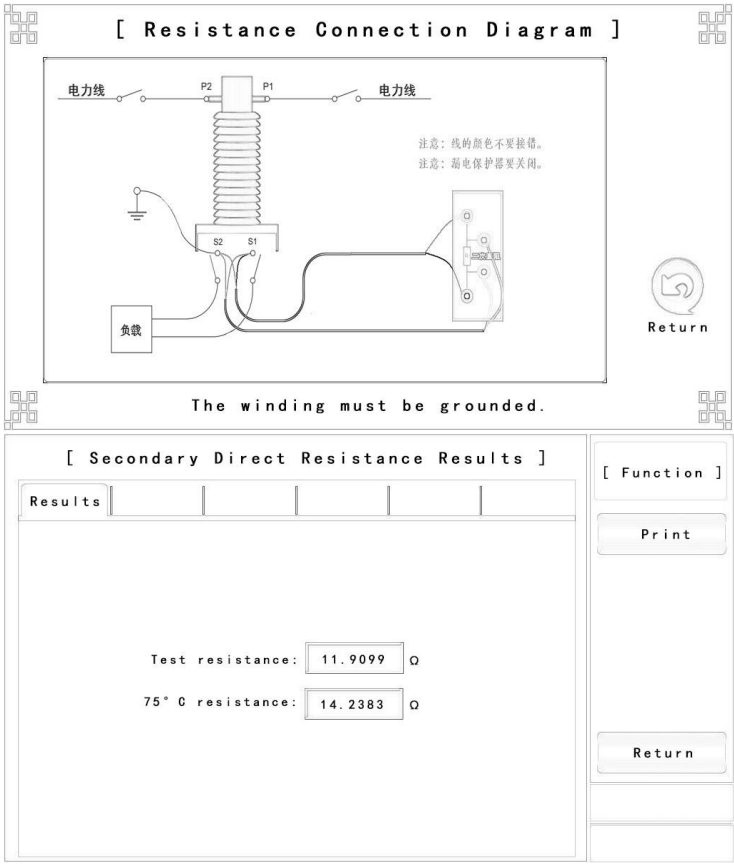
3. Secondary DC Resistance:

Click [Secondary DC Resistance], and the interface will be as follows:

A. Parameter Description:

- Current Temperature: the actual temperature at present.

B. Wiring and Result:

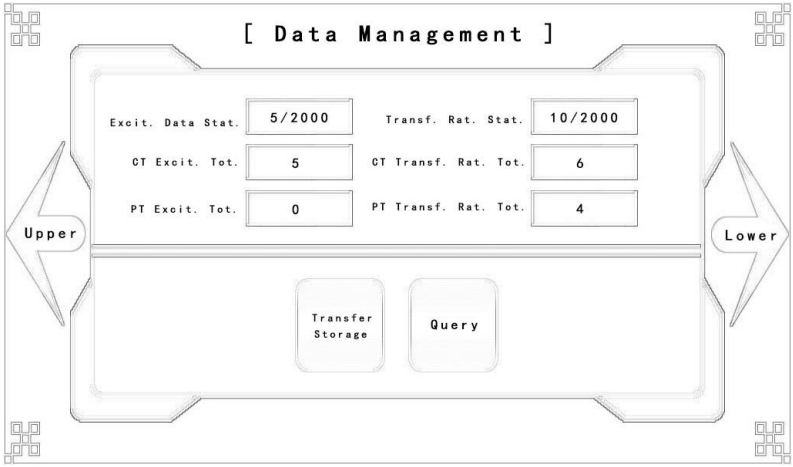


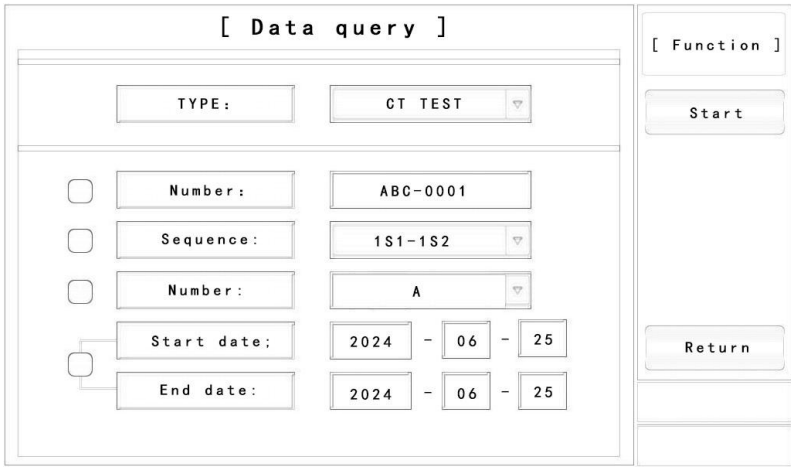
Notes:

- **Please connect the wire by color, or otherwise the test will be inaccurate.**
- **Please "turn off" the power switch during the test.**
- **The SAVE function is not included, so please print it directly once you need to save the results.**

Chapter IV: Data Management

The interface will be as follows:





1. Dump all data:

Click it to dump all data in the instrument to the USB flash disk.

2. Data Query:

Perform the data screening according to the conditions selected.

3. Query Result:

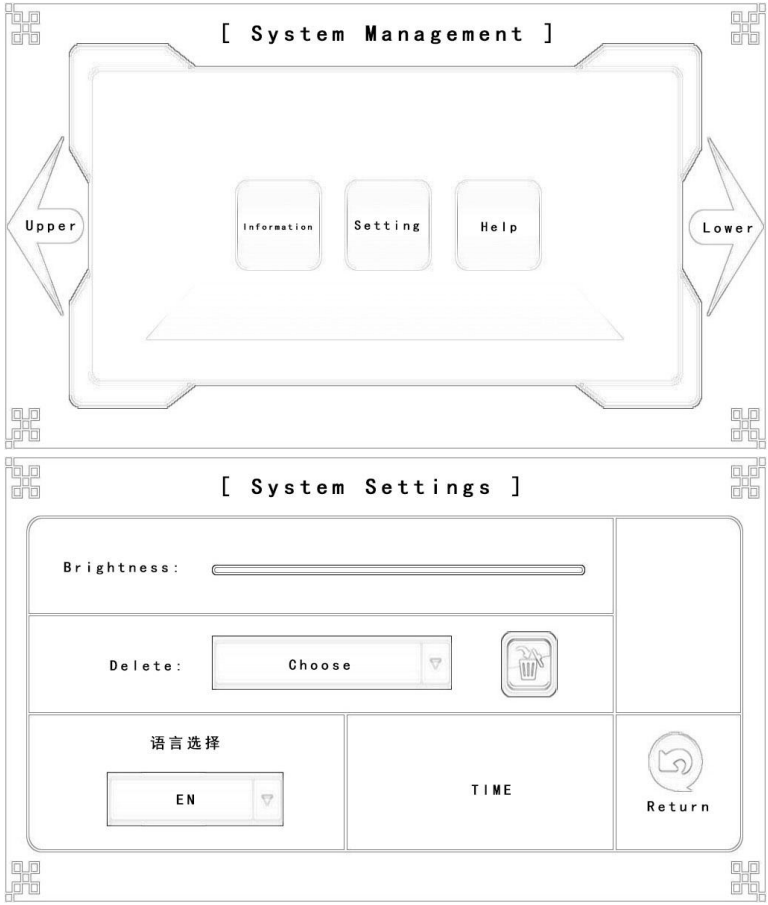
Delete Page: delete all data queried currently.
Dump Page: dump all data queried currently.

4. Data Viewing:

Click the entries required to view the data.

Please note that the data deleted through long pressing of the delete key will not be retrieved.

Chapter V: System Management



● System Information: show the system number and version information.

● System Settings: some general settings (as shown in the figure above).

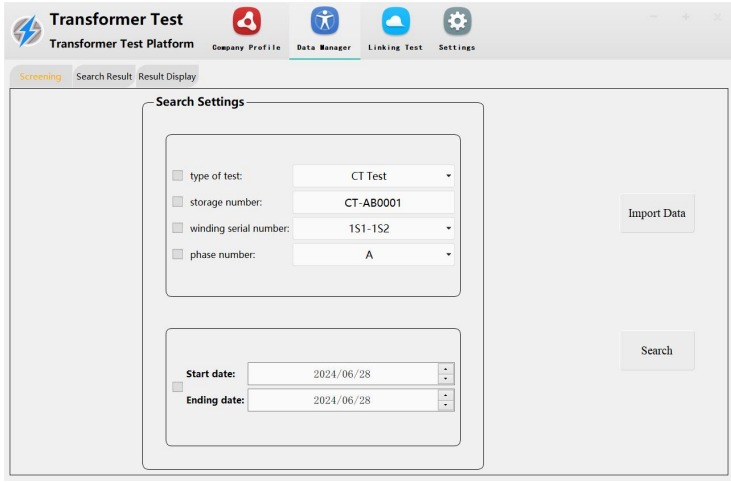
● Help Notes: not available (function reserved).

Chapter VI Instructions for PC Operating Software

The test report of the transformer analyzer in WORD version can be generated after the source data file of the test is analyzed with the PC operating software.

1. Data Management

Click Data Management], and the interface will be as follows:

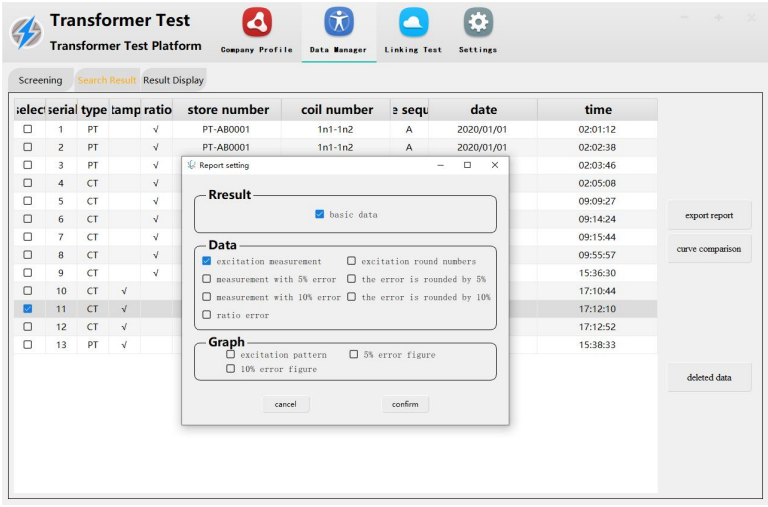


- **Import Data:** import data in the USB flash disk into the software for operation and processing.

Note: If the data to be imported has been inserted into the computer, the software, once opened, will automatically find out the data and display an importing reminder.

- **Search for:** search for the imported data based on settings.

Import the new data or **perform the search command**, and you will enter the search for [result interface]:



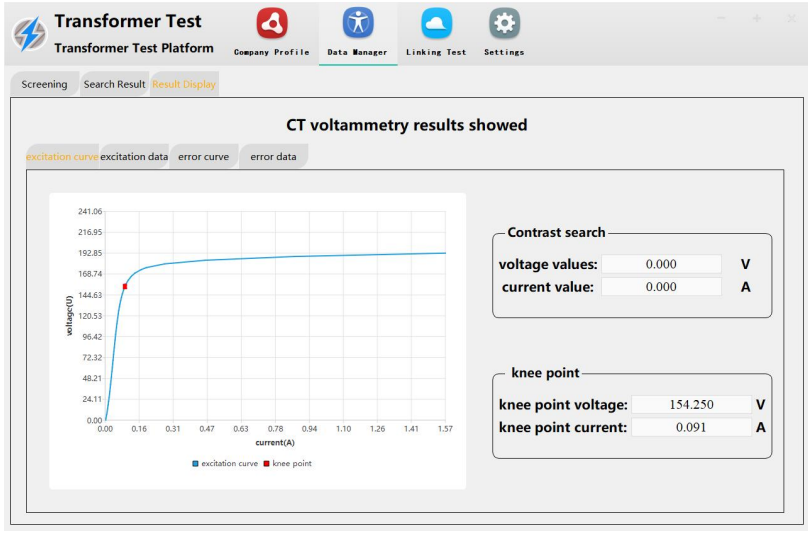
- **Export Report:** select the data you want to export, and click [Export Report] to generate a test report in WORD version.
- **Curve Comparison:** up to 10 groups of data can be selected to display the volt-ampere curve comparison.

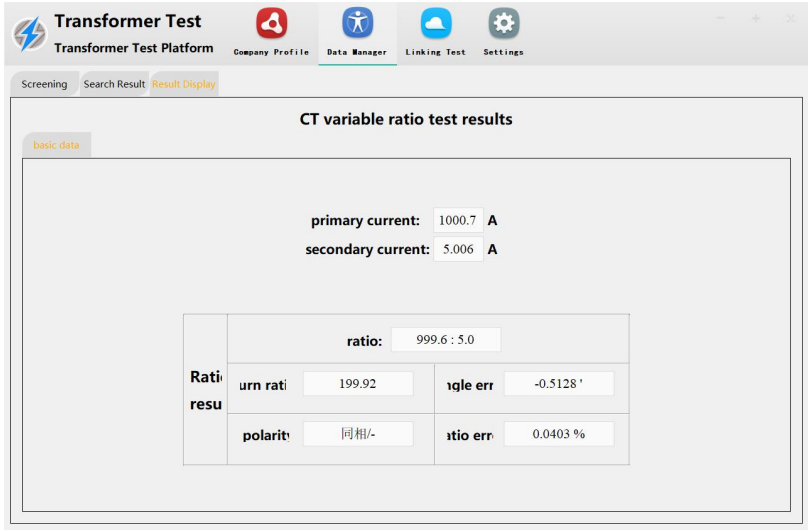
  Note: The curve comparison displays only the volt-ampere curve.

- **Delete Data:** delete the data selected.

  Note: Data will not be restored once deleted.

- **View Data:** click the data you want to view twice to enter the viewing interface **(as shown below).**

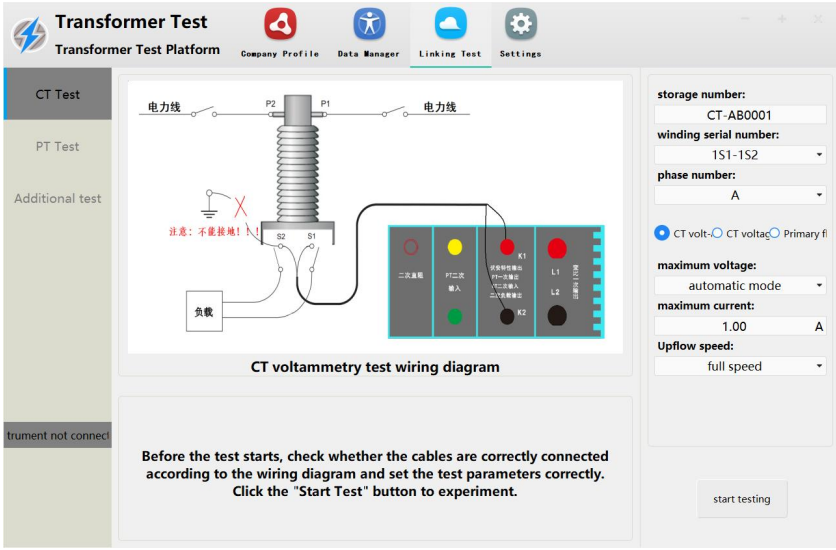




Note: This entry appears only if Transformation Ratio Error is selected for the experiment.

2. Online testing

The interface is as follows after clicking Data Management



Note: Please refer to the stand-alone test for experimental procedures and precautions.

Appendix

B. Calculation and Application Method of 10% Error Curve

The error of current transformer is mainly due to the existence of exciting current I_0 . It makes the secondary current I_2 is different from the primary current $I_1^{'}$ converted to the secondary side not only in value, but also in phase, which results in the error of the current transformer.

The ratio difference of the current transformer is defined as:

$$\varepsilon = \frac{I_1^{'} - I_2}{I_1^{'}} \times 100 = \frac{I_0}{I_1^{'}} \times 100 \qquad (B.1)$$

When the primary current I_1 of the current transformer shall be equal to the maximum short circuit current according to the relay protection requirement, the ratio difference is less than or equal to 10%. When the ratio difference is equal to 10%, the secondary current I_2 , the primary current $I_1^{'}$ converted to the secondary side and the exciting current I_0 shall satisfy the following relationship:

$$I_1^{'} = 10 I_0 \qquad (B.2)$$

$$I_2 = 9 I_0 \qquad (B.3)$$

When M is defined as the maximum multiple of the short-circuit current on the primary side, and K is the transformation ratio of the current transformer, then

$$M = \frac{I_{1M}}{I_{1N}} = \frac{K \times I_1^{'}}{K \times I_{2N}} = \frac{10 I_0}{I_{2N}} \qquad (B.4)$$

Where: I_{1M} refers to the maximum short circuit current on the primary side

I_{1N} refers to the rated current on the primary side

I_{2N} refers to the rated current on the secondary side

When the ratio difference is equal to 10%, the allowable maximum load impedance Z_B can be calculated by the following formula:

$$Z_B = \frac{E_0}{I_2} - Z_2 = \frac{E_0}{9I_0} - Z_2 \qquad \text{(B.5)}$$

Where: Z_2 refers to the impedance for secondary winding of the current transformer

E_0 refer to the induced electromotive force for secondary winding of the current transformer, while the relationship between E_0 and I_0 is described by the exciting characteristic curve.

The above formula can be used to finally obtain the 10% error curve described by the maximum multiple of the short-circuit current M and the allowable maximum load impedance Z_B.

Application Method of 10% Error Curve:

After 10% error curve of a certain CT is obtained, the maximum short-circuits current I_{MAX} flowing through such CT and the impedance of the circuit on the secondary side of such CT must also be checked. The maximum short-circuit current is generally obtained in the setting calculation, which is the short-circuit current and the maximum current multiple $I_{1M} = I_{MAX} / I_E$ once the most serious short circuit occurs under the maximum operation mode of the circuit where the CT is located (rated current). The secondary circuit impedance Z_2 can be measured with a CTP device.

Check the 10% error curve after obtaining I_{1M} and Z_2. The point (I_{1M}, Z_2) below the curve satisfies the requirements, indicating that the current transformation error of CT is smaller than 10% under the most serious short circuit condition. Otherwise, it will be greater than 10%.