

HZCT-100A CT PT Analyzer



Safety Precautions

1. In order to protect both the instrument and the instructor, please read the reference manual details before testing, and operate strictly with the requirements of the manual.
2. Do not place the instrument on unsteady platform or desk, to prevent it from falling and being damaged.
3. The fan and ventilation holes of instrument side is for ventilating and cooling, so do not plug to ensure the instrument work normally.
4. This instrument is a precision electronic instrument. Please pay attention to prevent hot sun and other high temperature when used outdoors. Pay attention to the sun and ventilation to prevent the overheating of the instrument or decrease the accuracy of measurement.
5. As a safety measure, the instrument is equipped with protective earthling terminal. the pilot should be installed prior to the grounding terminal side of a reliable ground.
6. The power supply of the instrument is 220V (50/60Hz) AC power, and you should choose 10A or more power line.
7. Do not let any foreign body into the case, in order to avoid short circuit.
8. When the instrument is transported, cushion the sponge and other cushioning products outside the instrument, so as to avoid vibration and bump, damage the instrument or reduce the accuracy of the instrument..
9. Do not arbitrarily delete the preservation of the history test records in the host, to avoid test data loss.

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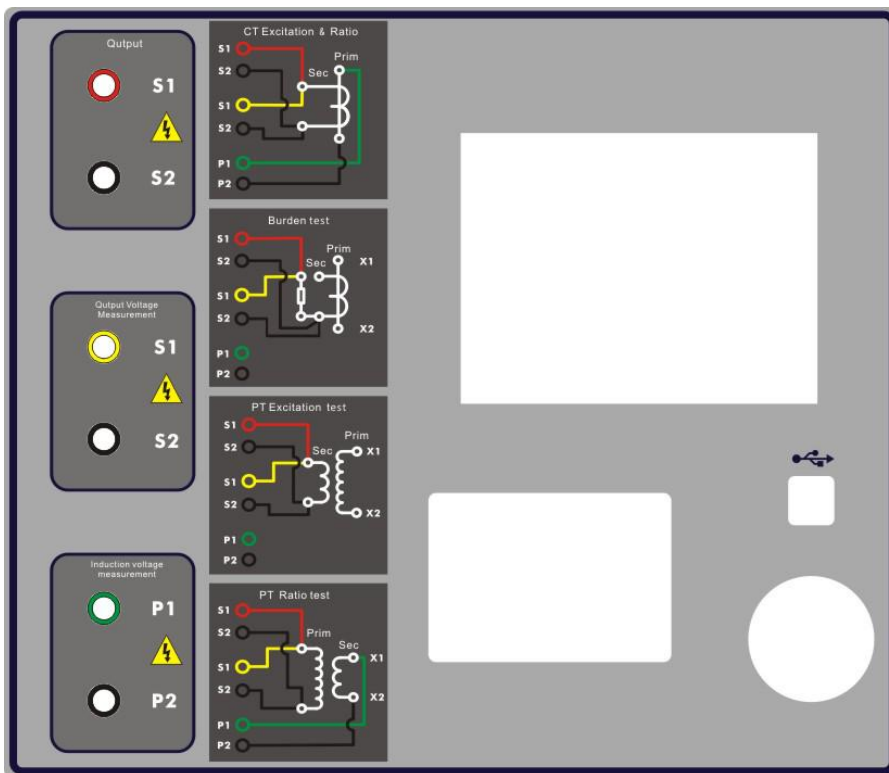
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I. Instrument Characteristics and Parameters

1.1 Main technical features

- ◆ Full-featured to meet the excitation characteristics (ie, volt-ampere characteristics), ratio, polarity, secondary winding resistance, secondary load, ratio difference, and angle difference of various types of CT (eg, protection, metrology, TP) Such test requirements, but also for various types of PT electromagnetic unit excitation characteristics, transformation ratio, polarity, secondary winding resistance test.
- ◆ Automatically give corner voltage/current, 10% (5%) error curve, accurate limit factor (ALF), instrument security factor (FS), secondary time constant (Ts), remanence factor (Kr), saturation inductance, etc.
- ◆ The test meets various types of transformer standards such as GB1208 (IEC60044-1), GB16847 (IEC60044-6), and GB1207, and tests are automatically selected according to the type and level of the transformer.
- ◆ Based on the advanced low-frequency test principle, it can deal with CT tests with inflection points up to 40KV.
- ◆ The device uses the international popular square wave method to make the excitation curve more perfect.
- ◆ Device storage capacity up to a few G, can store hundreds of thousands of test data, power loss is not lost.
- ◆ The test is simple and convenient, one-button CT direct resistance, excitation, ratio and polarity tests are performed, and in addition to the load test, all other CT tests use the same wiring method.
- ◆ It is easy to carry and the device contains about 8Kg of total weight of wiring.

1.2 device panel description



Device panel structure as shown above:

·The above S1, S2 terminals: output

- Intermediate S1, S2 terminals: output voltage measurement
- The following P1, P2 terminals: Inductive voltage measurement

1.3 The main technical parameters

		HZCT-100A
Test use		CT, electromagnetic PT
Output		0~180Vrms, 12Arms, 36A(peak)
Voltage measurement accuracy		±0.1%
CT transformation ratio measuring	range	1~40000
	Accuracy	±0.1%
PT transformation ratio measuring	range	1~40000
	Accuracy	±0.1%
Phase measurement	Accuracy	±2min
	Resolution	0.5min
Secondary winding resistance measurement	range	0~300Ω
	Accuracy	0.2%±2mΩ
AC load measurement	range	0~1000VA
	Accuracy	0.2%±0.02VA
Input supply voltage		AC110V-250V, 50Hz/60Hz
working environment		temperature: -10°C~50°C, humidity: ≤90%
size and weight		Size: 340 mm×300 mm×140mm weight: <7kg

II. User Interface and Operation Method

2.1 Current Transformer (CT) Test

In the parameter interface, select the current transformer option in the Instrument Type column.

2.1.1 Test wiring

The first step: According to the description of the CT test item described in Table 2.1, the wiring is performed in accordance with Figure 2.1 (For the CT of various structures, the actual wiring described

in Appendix D can be referred to).

Table 2.1 Description of CT test items

resistance	excitation	Change ratio	load	Instructions	Wiring diagram
√				Measuring CT's secondary winding resistance	Figure 2.1, but the primary side can not be connected
√	√			Measuring CT's Secondary Winding Resistance and Excitation Characteristics	Figure 2.1, but the primary side can not be connected
√		√		Measure the secondary winding resistance of the CT and check the CT ratio and polarity	Figure 2.1
√	√	√		Measure CT secondary winding resistance, excitation characteristics, check CT ratio and polarity	Figure 2.1
			√	Measuring the secondary load of CT	Figure 2.1

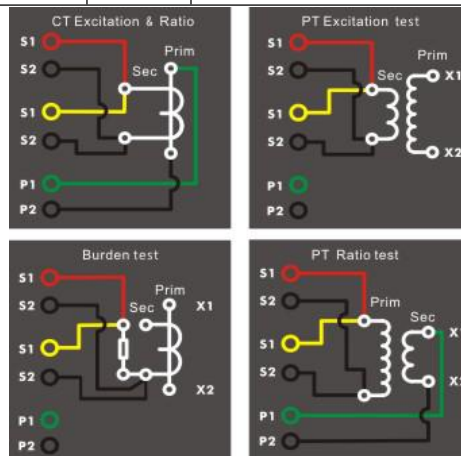


Figure 2.1 Test wiring

The second step: The same CT other windings open, one end of the CT should be grounded, equipment must also be grounded.

The third step: Turn on the power and prepare the parameter settings.

2.1.2 Parameter Settings

The test parameter setting interfaces for P-class, TPY-class, and metrology CT are shown in Figure 2.2, 2.3, and 2.4, respectively.

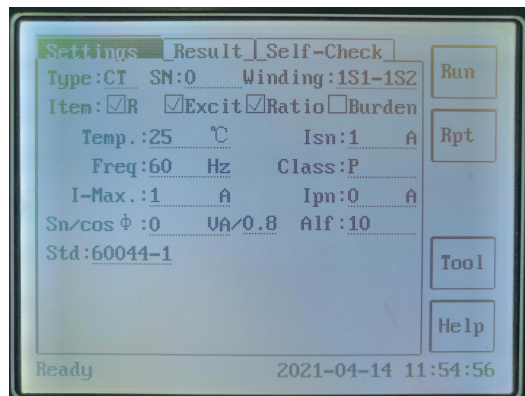


Figure 2.2 P-level CT parameter setting interface

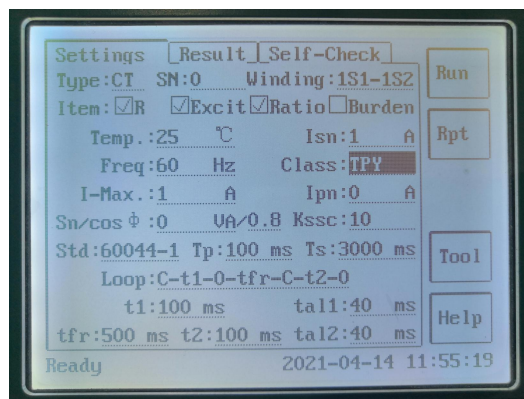


Figure 2.3 TPY-level CT parameter setting interface

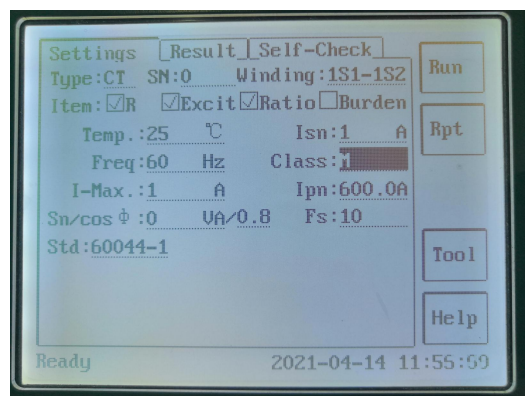


Figure 2.4 Measurement CT Test Parameters Interface

The parameter setting procedure is as follows:

The first step: Select the current transformer as the current transformer type.

The second step: Select the experimental project according to Table 2.1.

The third step: set the following parameters.

(1) Line No., Phase No., CT No., and Winding No.: Chinese characters, letters, and numbers can be input.

The default saved report file is named "CT_Line No._Phase No._CT No._Wind No._Experiment Item_Date_ Hours minutes seconds.xls".

(2) Rated secondary current: The rated current of the secondary side of the current transformer, generally 1A and 5A. The secondary current setting is usually the same as the secondary current setting of the transformer under test.

(3) Level: The level of the measured winding. For CT, there are three options, P, TPY, and metering.

(4) Current temperature: The temperature of the winding at the time of testing. Generally, the temperature at the time of testing can be input.

(5) Rated frequency: The selectable value is: 50Hz or 60Hz.

(6) Maximum test current: Generally, it can be set as the rated secondary current value. For a CT with a rated secondary current of 5A, it is set to 5A. For a CT with a rated secondary current of 1A, it can be set to 2A.

(7) Rated primary current: CT rated primary current used to calculate the actual current ratio.

(8) Rated load, power factor: rated load on the nameplate, power factor 0.8 or 1.

(9) For different CTs, set the special parameters in Table 2.2.

Table 2.2 CT Extended Parameter Description

parameter	description	P	TPY	Measure ment
Rated accuracy limit factor K_{alf}	Nameplate regulations, the default: 10.Used to calculate the limit electromotive force and its corresponding compound error	√		
Rated symmetrical short-circuit current	Nameplate regulations, the default: 10.Used to calculate the limit electromotive force and its		√	

coefficient K_{ssc}	corresponding peak instantaneous error			
Rated transient area factor K_{td}	Nameplate regulations, the default: 20		√	
One time constant	The default: 100ms		√	
Second time constant	The default: 3000ms		√	
Work cycle	C-t1-O or C-t1-O-tfr-C-t2-O, the default: C-t1-O cycle		√	
t1	The first current through time, the default : 100ms		√	
tal1	The time at which a flow maintains accurate limits, by default: 40ms			
tfr	The delay of the first opening and reclosing, default: 500ms.Choosing the C-t1-O-tfr-C-t2-O Cycle to Appear		√	
t2	The second current through time, default: 100ms. Choosing the C-t1-O-tfr-C-t2-O Cycle to Appear		√	
tal2	The time for the secondary flow to maintain accurate limits, default: 40ms Choosing the C-t1-O-tfr-C-t2-O Cycle to Appear		√	
Rated instrument security factor	Nameplate, default: 10. Used to calculate the limit electromotive force and its corresponding compound error			√
Expanded current calibration ext	Range: 100% to 400%, Default: 120%			√

Step 5: Select the right "Start Test" button to test.

2.1.3 Test results

Select the results page, CT test results interface as shown in Figure 2.5. Select the results page, CT test results interface as shown in Figure 2.5.

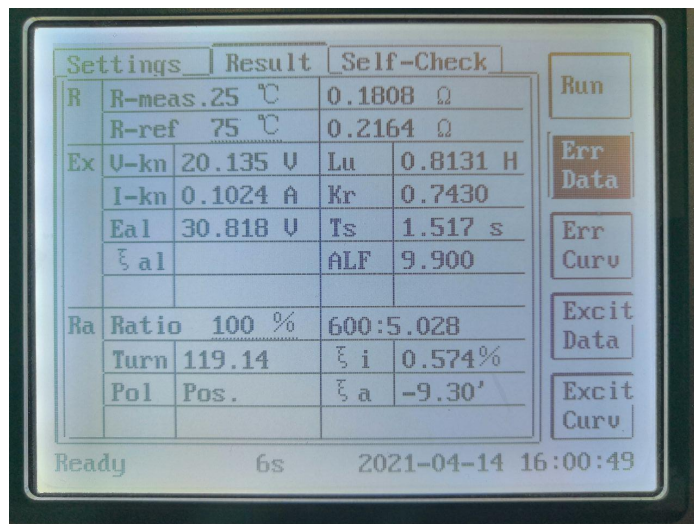


Figure 2.5 CT test results interface

For different levels of CT and selected test items, the test results are also different, see Table 2.3.

Table 2.3 Description of CT Test Results

test results		description	P	TPY	Measurement
load	Measured load	Unit: VA, CT secondary measurement load	√	√	√
	Power factor	Measured load power factor	√	√	√
	impedance	Unit: Ω, CT secondary measured impedance	√	√	√
resistance	resistance (25°C)	Unit: Ω, CT secondary winding resistance at current temperature	√	√	√
	resistance (75°C)	R_{ref} , Unit: Ω, converted to 75°C resistance	√	√	√
excitation	Inflection point and knee current	Units: V and A, respectively, according to the standard definition, when the knee voltage increases by 10%, the knee current increases by	√	√	√

		50%.			
	Unsaturated inductance L_u	Unit: H, average inductance of linear segment of excitation curve	√	√	√
	Remanence coefficient K_r	The ratio of residual flux to saturation flux	√	√	√
	Second time constant T_s	Unit: s, time constant for CT secondary load rating	√	√	√
	Extreme electromotive force E_{al}	Unit: V, limit electromotive force calculated from CT nameplate and 75°C resistance	√	√	√
	Compound error ε_{al}	Extreme electromotive force E_{al} Or compound error at rated knee power E_k	√		√
	Peak instantaneous error ε	Peak instantaneous error of E_{al} under extreme electromotive force		√	
	Accurate limit factor	Measured accurate limit factor	√		
	Instrument security factor	Measured meter security factor			√
	Symmetrical short circuit current multiples K_{ssc}	Measured symmetrical short-circuit current multiples		√	
	Transient area factor	Actual transient area factor		√	
Change ratio	Change ratio	Actual current ratio under rated load	√	√	√
	Number of turns	The actual twist ratio of the tested secondary winding to the primary winding	√	√	√
	Difference in ratio	Current error at rated load	√	√	√

Phase difference	Phase difference under rated load	√	√	√
polarity	CT primary and secondary polarity relations, with the same polarity / - (minus polarity) and reverse polarity / + (plus polarity)	√	√	√
Ratio error	The relative error of the measured turns ratio and the rated turns ratio			

2.2 Voltage Transformer (PT) Test

On the Parameters screen, select Transformer Type for Voltage Transformer.

2.2.1 Test wiring

The test wiring procedure is as follows:

The first step: According to the description of the PT test item described in Table 2.4, perform the wiring in accordance with Figure 2.1.

Table 2.4 Description of PT test items

Resistance	Excitation	Ratio	Instructions	Wiring diagram
√			Measure PT secondary winding resistance	Figure 2.1, the primary side must be disconnected
√	√		Measuring secondary winding resistance and excitation characteristics of PT	Figure 2.1, the primary side must be disconnected
		√	Check PT ratio and polarity	Figure 2.1

The second step: Open the same winding with other PT.

The third step: To turn on the power and prepare the parameter settings.

2.2.2 Parameter Settings

The test parameter setting interface of PT is shown in Figure 2.6, 2.7.

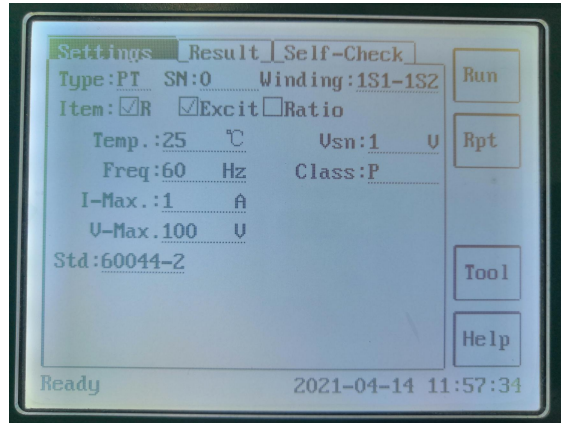


Figure 2.6 Parameter setting interface for PT resistance and excitation test

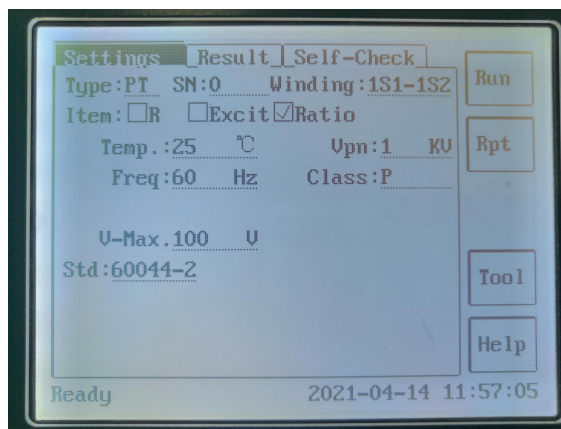


Figure 2.7 Parameter Setting Interface for PT Ratio Test

The parameter setting procedure is as follows:

The first step: choose the transformer type as voltage transformer.

Step 2: Select the test item according to Table 2.4.

Step 3: Set the following basic parameters.

Enter the letters and numbers for the line number, phase number, PT number, and winding number.

Rated secondary voltage: The rated voltage of the secondary side of the voltage transformer.

Current temperature: The temperature of the winding at the time of the test. Normally the temperature at that time can be entered.

Rated frequency: The selectable value is: 50Hz or 60Hz.

Maximum test voltage: The maximum power frequency equivalent voltage output by the equipment during the test, generally input 100V.

Maximum test current: The maximum AC current output by the device during the test, typically input 5A or 2A.

Rated primary voltage: rated voltage of the primary side of the excitation winding of the voltage transformer.

Step 4: Select the right start button to test.

2.2.3 Test results

Switch to the test results page, similar to Figure 2.5. The test results are described in Table 2.5.

Table 2.5 Description of PT test results

test results		description
resistance	resistance (25°C) R	Unit: Ω , resistance at current temperature
	resistance (75°C) R_{ref}	Unit: Ω , resistance at reference temperature, temperature can be modified
excitation	Inflection point and knee current	Units: V and A, respectively, according to the standard definition, when the knee voltage increases by 10%, the knee current increases by 50%.
Change ratio	Change ratio	Actual current ratio under rated load or actual load
	Number of turns	The actual twist ratio of the tested secondary winding to the primary winding
	Difference in ratio	Current error at rated load or actual load
	Phase difference	Phase difference under rated load or actual load
	polarity	PT primary and secondary polarity relations, with the same polarity / - (minus polarity) and reverse polarity / + (plus polarity)

2.3 Self-test interface

Select the self-test button to enter the self-test interface. With the help of the multimeter, the self-test function can be used to check if the device is damaged and the circuit is normal.

2.3.1 Parameter Settings

The parameters required for self-test testing are as follows:

Table 2.6 Self-test test parameters

parameter	description
Test current	The current output from the device is required. Valid range: 1mA~5A
Test voltage	Required output voltage, valid range: 1V~100V
Test frequency	Required device output voltage or current frequency, range: 0~50Hz

After setting the test current or test voltage, set the test frequency. The device will output the voltage or current of the corresponding frequency and display the actual voltage or current detected. After the voltage is selected, if the load is too small and the actual current rms value is greater than 5A, the overload message is displayed. After the current is selected, if the load is too large and the actual test voltage is greater than 100V, the overload message will also be displayed.

2.3.2 Wiring method

- When selecting a voltage test, short S1 to another S1 and S2 to another S2. Measure the voltage between S1 and S2 with the multimeter's voltage range. If it matches the actual voltage, the device can

output the voltage and the voltage measurement is normal.

- During the current test, short the S1 and S2 terminals of the power output. S1 and S2 of voltage backtest are not connected. You can enter the multimeter current range between the output S1 and S2. If the current measured by the multimeter matches the actual current, the device can output the current normally and the current measurement is normal.

2.4 Function Buttons

2.4.1 Parameter Page Function Buttons

(1). Open the report

Open the test report interface, as shown in Figure 2.8.

Select to open a test report. The parameter information and data of the report will be displayed in the corresponding column of each page.

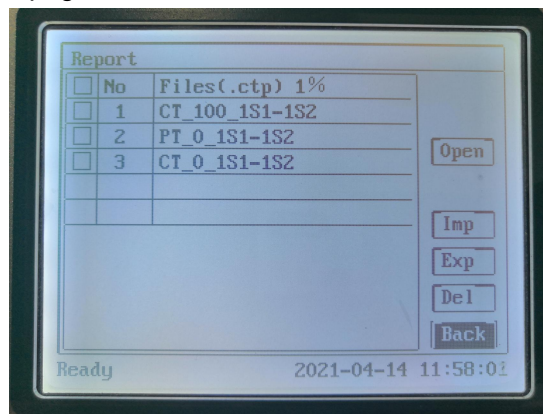


Figure 2.8 Open the test report interface

(2). Save report

After each trial, the tablet or smartphone automatically saves the report. To open the test report directly when you need to see it;

If you need to export the test report, you can send it directly to the network in the presence of a WIF network; the auto-save directory is in the “My Documents” document directory of your tablet or smartphone.

(3). System Tool

System tool interface, as shown in Figure 2.9. WIFI connection, communication test and other operations are performed in this interface.

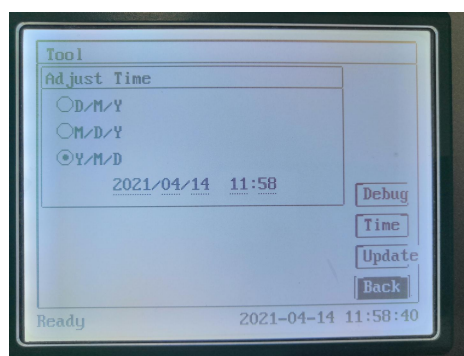


Figure 2.9 System Tools Interface

(4). help

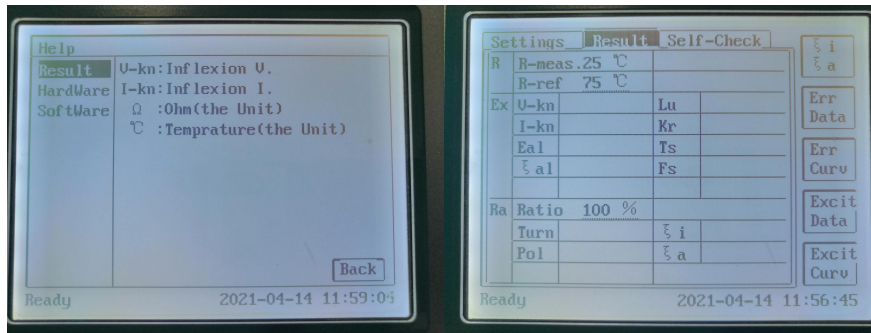


Figure 2.10 Help interface

2.4.2 Result Page Function Buttons

(1) Error data

Selecting the error data will show the relationship between the rated current multiple and the maximum load in the 5% and 10% error cases, as shown in Figure 2.11. The data given in the interface is calculated based on the actual excitation test data. The calculation method is shown in Appendix B.

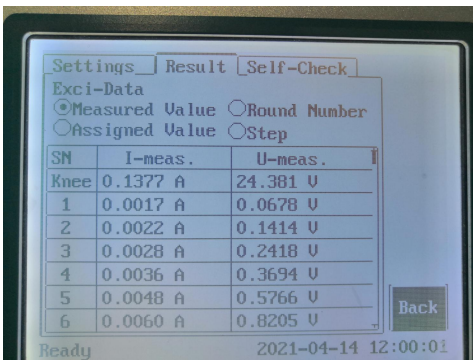
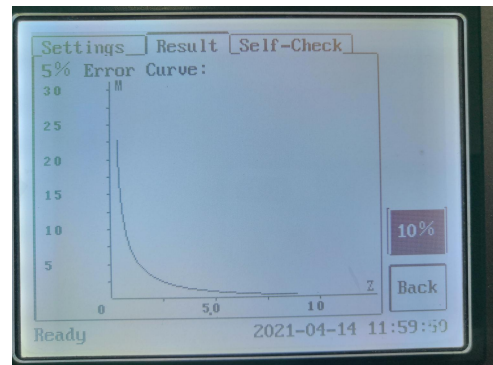


Figure 2.11 5% and 10% error data interface diagram



2.12 5% error curve interface

(2) Error curve

Selecting the error curve will display the relationship between the rated primary current multiple and the maximum load in the case of 10% (or 5%) error, as shown in Figure 2.12. In the interface, the abscissa is the rated primary current multiple, and the ordinate is the maximum allowable load.

(3) Excitation data

Selecting the excitation data will display the excitation data interface, as shown in Figure 2.13. The inflection point voltage and inflection point current are automatically calculated in the interface.

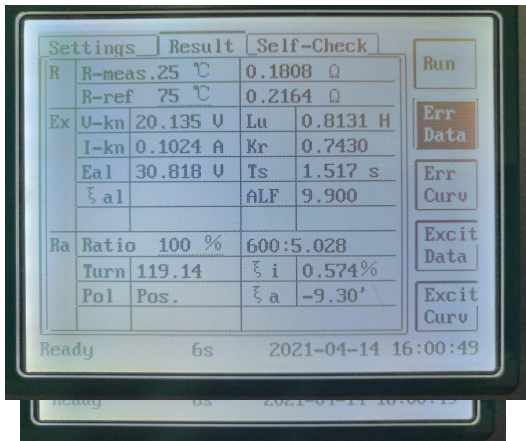


Figure 2.13 excitation data interface

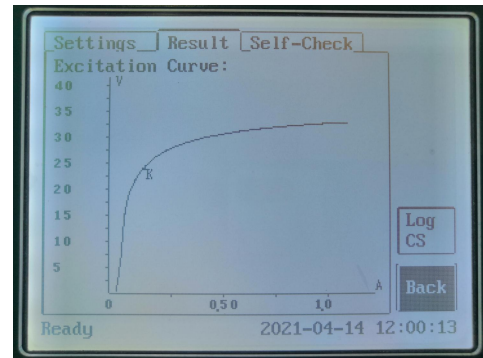


Figure 2.14 Excitation curve interface

(4) Excitation curve

Selecting the excitation curve will display the excitation curve interface as shown in Figure 2.14. The inflection point voltage and knee current are given in the interface.

(5) Ratio difference table

Selecting the ratio difference table will show the difference table of the CT under test under different rated current percentages and different load values, as shown in Figure 2.15:

Figure 2.15 Ratio difference table interface

(6) Phase difference table

Selecting the phase difference table will show the phase difference table of the tested CT under different rated current percentages and different load values as shown in Figure.

III. Packing List

No.	Item	Qty
1	Main engine	1
2	Oil Cup	1
3	Elbow	2
4	Stirrer	2
5	Feeler gauge	1
6	Tweezers	1
7	Power line	1
8	Fuse pipe	2

9	Print paper	2
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Attached

A. Low Frequency Test Principle

The principle circuit of the CT volt-ampere characteristic measurement is as follows: The CT is open on the primary side, voltage is applied from the secondary side, and the curve of the applied voltage V and the input current I is measured. This curve approximates the relation between the excitation potential E of the CT and the excitation current I.

Assuming that the excitation inductance of the CT excitation winding at a certain excitation current I is L and the excitation impedance is Z, then:

$$V = I \cdot Z$$

The relationship between the inductance L and the impedance Z has the following relationship:

$$Z = \omega \cdot L = 2 \pi f L$$

then: $V = I \cdot 2 \pi f L$

It can be seen from the formula that the voltage V applied at a certain magnetizing inductance L is proportional to the frequency f.

Assume that when $f = 50\text{Hz}$, in order to reach the magnetizing current I_x , the required applied voltage V_x is 2000V

$$V_x = I_x \cdot 2 \pi f L = 2000\text{V},$$

If different frequencies are applied:

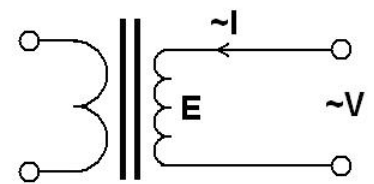
$$f = 50\text{Hz}, \quad V_x = 2000\text{V}$$

$$f = 5\text{Hz}, \quad V_x \cong 200\text{V}$$

$$f = 0.5\text{Hz}, \quad V_x \cong 20\text{V}$$

It can be seen that the need to make the CT into the same degree of saturation, the voltage required to apply a lower frequency signal can be greatly reduced This is the basic principle of the frequency conversion method.

It must be rigorously noted here that the required voltage is not linearly proportional to the frequency, and that instead of decreasing in proportion to the frequency, a complete theoretical calculation must be performed in strict accordance with the precise mathematical model of the transformer.



B. Calculation and Application of 10% Error Curve

The error of the current transformer is mainly due to the presence of the excitation current I_0 ,

which causes the secondary current I_2 and the primary current I_1' after conversion to the secondary side not only to be numerically unequal but also to have different phases, which results in mutual inductance of the current. Error.

The current transformer's ratio difference is defined as:

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

When relay protection requires that the primary current I_1 of the current transformer is equal to the maximum short-circuit current, the ratio difference is less than or equal to 10%. When the ratio difference is equal to 10%, the following relationship is satisfied between the secondary current I_2 , the primary current I_1' after the conversion to the secondary side, and the excitation current I_0 :

$$I_1' = 10I_0 \quad (\text{B.2})$$

$$I_2 = 9I_0 \quad (\text{B.3})$$

Definition M is the primary side short circuit current multiple, K is the current transformer ratio, then there is

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

Where: I_{1M} is the maximum short-circuit current on the primary side

I_{1N} is primary rated current

I_{2N} is the secondary side rated current

When the 10% ratio is poor, the maximum allowable load impedance Z_B is calculated as:

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

In the formula: Z_2 is the current transformer secondary winding impedance

E_0 is the induced voltage of the secondary winding of the current transformer. The

relationship between E_0 and I_0 is described by the excitation characteristic curve.

Based on the above formula, the 10% error curve described by the maximum short-circuit current multiple M and the allowable maximum load impedance Z_B can be obtained finally (see Figure 2.29).

10% error curve application method:

After a 10% error curve of a certain CT is obtained, the maximum short-circuit current I_{MAX} flowing through the CT and the impedance Z_2 of the loop on the secondary side of the CT must also be consulted. The maximum short-circuit current is often obtained during the setting calculation. It is the short-circuit current at the time of the most severe short-circuit under the maximum operating mode of the CT circuit, and the maximum current multiple $I_{1M} = I_{MAX} / I_E$ (rated current). The secondary loop impedance Z_2 can be measured with the XXX device.

After obtaining I_{1M} and Z_2 , look up the 10% error curve. If the point (I_{1M}, Z_2) is below the curve, it meets the requirement, indicating that the current transformation error of the CT is less than 10% under the worst case short circuit condition. Otherwise it will be greater than 10%.