KINGSINE

KT220 Current Transformer Analyzer

Instruction Manual

Version: V2.0

KINGSINE Electric Automation Co., Ltd.

Preface

Dear User,

Hello! Thank you for choosing the instrument products of Shenzhen KINGSINE Electric Automation Co., Ltd. To use this instrument correctly, please read this manual carefully before use, especially the "Safety Procedures" section.

The purpose of this manual is to familiarize users with the operation and application scope of the KT220 Comprehensive CT Analyzer. It contains guidance on how to use the instrument safely, correctly, and efficiently.

This guidance helps you prevent hazardous operations, reduce repair costs, and minimize instrument downtime caused by improper operation. In addition, it ensures reliable operation and extends the service life of the instrument.

The use of this instrument must comply with all safety requirements stipulated in existing standards for accident prevention and environmental protection, and observe national safety regulations related to instrument transformers. In addition, attention must be paid to various technical procedures for safety and operation.

All users operating this instrument must read this manual.

Our company reserves the right to revise this manual without prior notice. If you have any other technical questions during use, please call: 0755-88352590, and we will respond promptly!

content

Safety Regulations

Before operating this instrument, please read this manual carefully and follow the safety regulations for the instrument and the site environment.

If any content of this manual is unclear, please contact our technical support.

Precautions

- If not in a laboratory environment, the grounding jack must be reliably grounded before testing; ensure that the equipotential ground of this instrument is connected to protective earth (PE), otherwise the instrument may be damaged;
- In case of emergency during testing, please turn off the main unit power immediately;
- The power socket of this instrument must be equipped with protective grounding;
- The supply voltage of this instrument must not exceed the input power range;
- Please use the original accessories of this instrument;
- Do not allow foreign objects to fall inside the instrument to avoid short circuits;
- This instrument is a precision instrument; please protect it from water and moisture.

Safe Operation

- Before using this instrument, please check whether the analyzer has any visible damage;
- Before testing, please wire strictly according to the wiring diagram shown in the manual or on the instrument;
- It is forbidden to connect external voltage or current to the output terminals of the instrument, otherwise the instrument will be damaged;
- The output terminals must not be short-circuited during testing;
- During testing, high voltage and high current may be present at the output interfaces of the instrument and on the device under test; do not touch them;
- During testing, never connect or disconnect the test object;
- When the red LED on the panel flashes, it indicates that the instrument is outputting, and voltage will be present at the input or output terminals;
- Before replacing the fuse, please turn off the instrument and unplug the power cord; replace with a

fuse of the same specification (10A, 250V);

If this instrument does not work properly, please contact our technical support.

Chapter 1 Intended Use and Main Technical Features

The KT220 Comprehensive CT Analyzer complies with national and international standards such as IEC 61869-2, IEC 60044-1, IEC 60044-6, and IEEE C57.13. It performs excitation characteristic, ratio, polarity, and winding resistance tests, as well as burden impedance tests, on various types of low-leakage magnetic instrument transformers. It can also test and evaluate transient protection-type current transformers.

The instrument adopts advanced variable-frequency technology. With a maximum test voltage of 120V, it can test current transformers with a knee-point voltage exceeding 30kV. The entire test process is fully automated and completed in one run, with fast test speed and high accuracy. Test results are automatically evaluated, and all test results can be previewed after testing is complete.

1.1 Main Technical Features

1. Equipped with a 10.1-inch ultra-clear full-screen touchscreen, delivering an entirely upgraded operating experience.
2. Weighs only 3.5kg with a built-in battery, making it highly portable.
3. Features a built-in battery design, unlike 220V mains-powered units, designed for power-free testing scenarios such as field sites, construction sites, and tunnels, enabling testing anytime, anywhere.
4. Equipped with the latest higher-speed processing chip, improving test efficiency by over 50% and cutting excitation and ratio test time in half.
5. Upgraded hardware structure reduces overall volume by 50% and weight by 4–5kg.
6. Software resolves the KT220 measurement accuracy limitation, raising ratio test accuracy by one class to 0.05%.
7. Features a new report management module allowing one-click export of test reports, facilitating generation of complete test reports for printing and comparison.
8. Adopts low-voltage variable-frequency test principle, ensuring test safety and immunity to on-site power-frequency electromagnetic field interference.
9. Eliminates the need for traditional test instruments such as step-up transformers, current boosters, and external standard CTs. It automatically and quickly completes CT error tests, with test points meeting the requirements of relevant regulations.
10. Performs current transformer ratio, polarity, ratio error list, and phase displacement list measurements.

11. Performs DC resistance measurement of current transformer secondary windings.
12. Performs burden measurement of current transformer secondary circuits.
13. Performs current transformer excitation measurement, including excitation characteristic curves, 10% and 5% error curves, CT hysteresis loops, remanence factor, secondary time constant, and saturated and unsaturated inductance.
14. Supports current transformer parameter search. Without setting CT nameplate parameters, it can automatically guess CT type, rated primary and secondary currents, and IEC 60044-1 parameters.
15. Performs secondary winding excitation tests.
16. Automatically detects wiring and provides alarm prompts for wiring errors.
17. Provides Ethernet port and Wi-Fi for host/slave networking. It can operate both online with a PC and as a standalone unit, with simple one-click testing.
18. Supports external mouse and keyboard for more convenient operation.
19. Multi-point DC method for excitation characteristic testing, compliant with GB 16847-1997, with faster speed.
20. Reports are in A4-size Excel format for easy viewing.
21. Stores tens of thousands of reports without data loss after power-off.
22. Exports reports via USB port.
23. Features a nameplate guessing function. For CTs with lost nameplates, it automatically provides CT type (M, P), ratio, CT class, ALF, FS, and rated burden.
24. Comprehensive functionality for steady-state or transient characteristic tests of various CT models (including TP class, transformer bushing CTs, GIS CTs, etc.), including excitation, ratio, polarity, secondary winding resistance, burden, ratio error, and phase displacement.
25. Background analysis software allows overlapping comparison and evaluation of excitation characteristic curves of same-type windings in a table.
26. Automatically provides ratio error and phase displacement lists at 1%–200% rated current, and automatically rounds test data.

Chapter 2 Hardware Structure

2.1 Panel Structure

The panel structure of the KT220 Comprehensive CT Analyzer is shown in Figure 2-1:

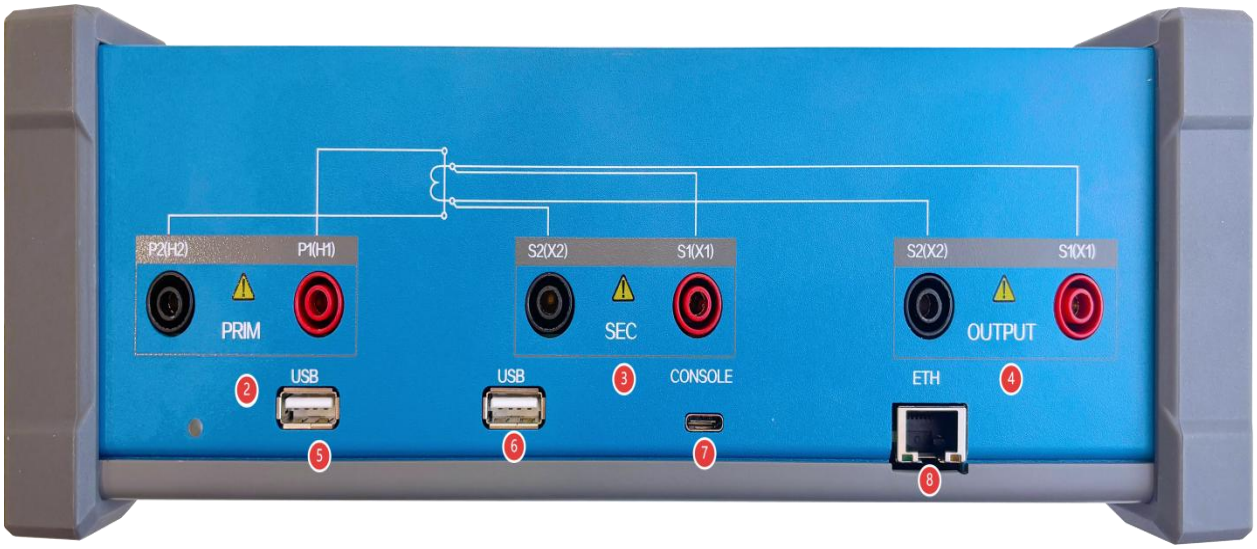


Figure 2-1 Panel Structure of the KT220 Comprehensive CT Analyzer

1	10.1-inch Display	7	Serial Port (for debugging)
2	PRIM (Primary Input) CT primary side measurement, connect to CT primary side	8	RJ45 Ethernet Port
3	SEC (Secondary Input) CT secondary side measurement, connect to CT secondary side	9	Auxiliary DC Interface (Tentative)
4	OUTPUT Test power output, connect to CT secondary side	10	Power Interface
5	USB Interface	11	Power Switch
6	USB Interface	12	Grounding Terminal

Note: Each terminal has clear text labels beside it. Do not make wiring errors during testing to avoid damage to the instrument and equipment!

The KT220 Comprehensive CT Analyzer requires no special maintenance or upkeep; when powered off, it can be cleaned with a soft cloth dampened with a small amount of alcohol or water.

2.2 Hardware Block Diagram

The hardware block diagram of the KT220 Comprehensive CT Analyzer is shown in Figure 2-2.

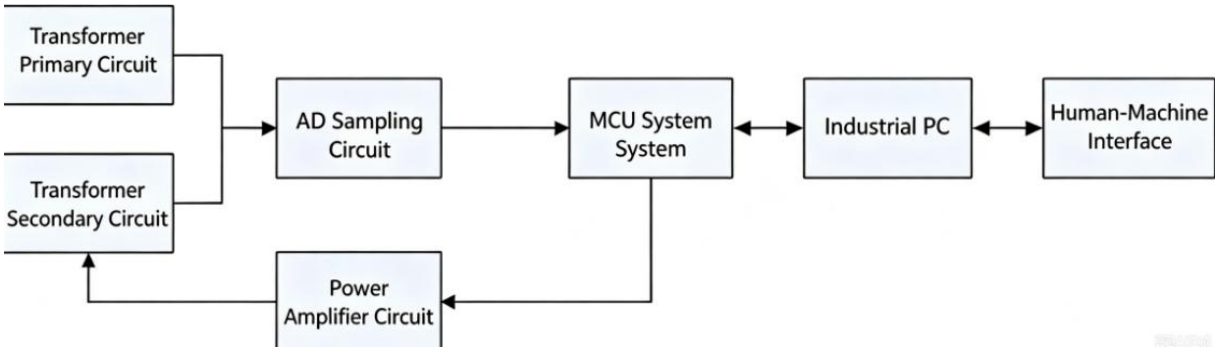


Figure 2-2 Hardware Block Diagram of the KT220 Comprehensive CT Analyzer

The hardware block diagram consists of a human-machine interface, industrial computer, MCU control system, AD sampling circuit, and power amplifier circuit. The MCU control system controls the power amplifier circuit to output the required voltage to the transformer. The sampling circuit collects voltage and current data from the CT primary and secondary sides, exchanges data with the industrial computer after analysis and calculation, and implements functions such as key processing and LCD display.

Chapter 3 Technical Specifications

Guaranteed parameters correspond to an ambient temperature of 23°C ± 5°C and a warm-up time greater than 5 minutes.

Guaranteed values are valid for one year after factory calibration.

3.1 Technical Specifications

Main technical specifications:

No.	Technical Parameter Name	Technical Parameter Specification
1	Output Voltage Range	0–120V (maximum not exceeding 120V)
2	Output Current Range	0–5Arms (15A peak)
3	Output Power Range	0–250 VA (750 VA peak)
4	Input Power (Charger)	85V–265V (AC); 127V–350V (DC) 47–63Hz
5	Maximum Knee-Point Voltage	30000V (DC method)
6	Maximum Test Ratio for Voltage Method Ratio Measurement	35000:1, 45000:5
7	Maximum Permissible Error for Ratio Measurement	±0.05%
8	Maximum Permissible Error for Phase Measurement	±3′
9	Phase Measurement Resolution	0.01′
10	Secondary Burden Impedance Measurement Range	0.05–100Ω
11	Maximum Permissible Error for Secondary Burden Impedance Measurement	±(0.1% × reading + 1mΩ)
12	Secondary Winding Resistance Measurement Range	0.1–300Ω
13	Maximum Permissible Error for Secondary Winding Resistance Measurement	±(0.1% × reading + 1mΩ)
14	Operating Environment Conditions	Specified operating temperature range: -10°C to +55°C Storage and transport limit range: -40°C to +70°C Relative humidity: <95% (25°C), non-condensing
15	Case Dimensions and Weight	288×185×95 mm (W × H × D); 3.5kg
16	Lithium Battery Parameters	10.8V, 2×47.52Wh (4500mAh) Type-C, PD3.0, 20V/3.25A, 20V/5A

No.	Technical Parameter Name	Technical Parameter Specification
17	Lithium Battery Operating Temperature	Charging state: 0 to 45°C (ambient temperature) Non-charging state: -20 to 60°C (ambient temperature)
18	Charging Time	2h (0–80%) / 4h (0–100%)

Table 3-1 Main Technical Specifications

Chapter 4 CT Test Wiring Methods

For standard current transformers defined in IEC 60044-1, the KT220 Comprehensive CT Analyzer can perform testing even without any CT data under test.

Note: Although the KT220 Comprehensive CT Analyzer can determine CT parameters (primary current, secondary current, class, ratio, etc.) and evaluate whether the CT meets standards, the nameplate guessing function is only intended as an auxiliary tool for users to discover parameters of unknown CTs. Parameters obtained from the nameplate guessing function are not guaranteed to be correct and require further verification by the user.

4.1 Basic CT Test Wiring

The basic CT wiring applies to secondary circuit resistance tests, excitation tests, ratio tests, quick ratio tests, and manual demagnetization tests. The CT must be disconnected from the power line before testing. For secondary circuit resistance tests, excitation tests, and manual demagnetization tests, the CT primary side does not need to be connected to the analyzer, but the CT must be disconnected from the power line.

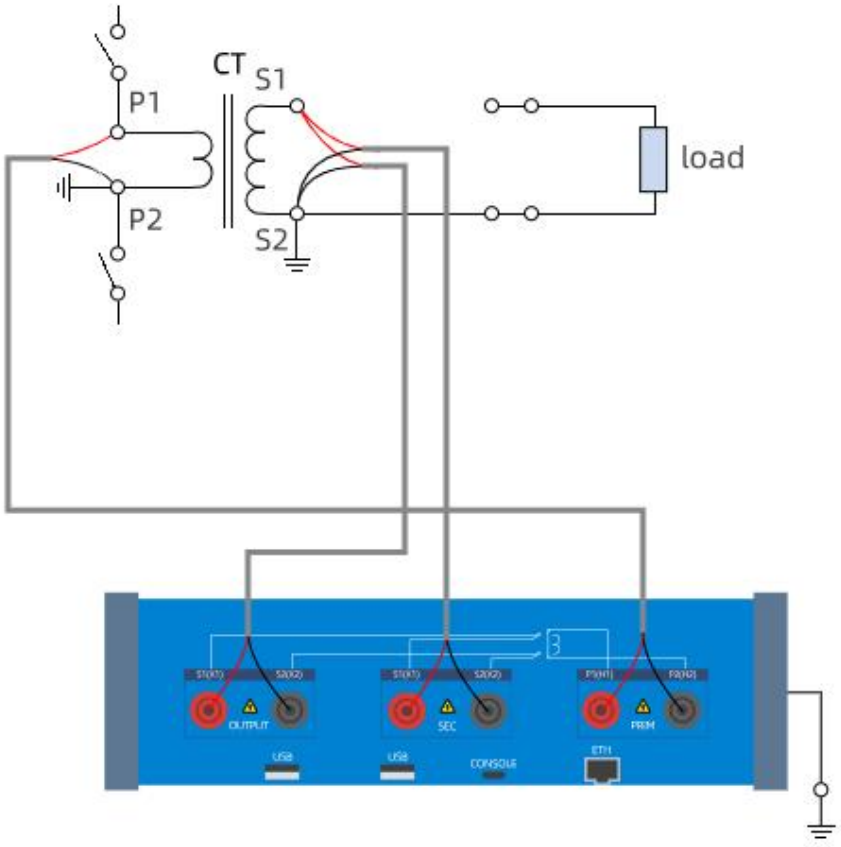


Figure 4-1 Basic CT Test Wiring Method

Wiring steps:

1. Connect the equipotential ground terminal of the KT220 Comprehensive CT Analyzer to protective earth (PE)

2. Connect the CT secondary side to the "SEC" input and "OUTPUT" output of the KT220 Comprehensive CT Analyzer.

Connect CT secondary terminal S1 to the red terminal of the analyzer; connect terminal S2 to the black terminal of the analyzer, as shown in Figure 4-2

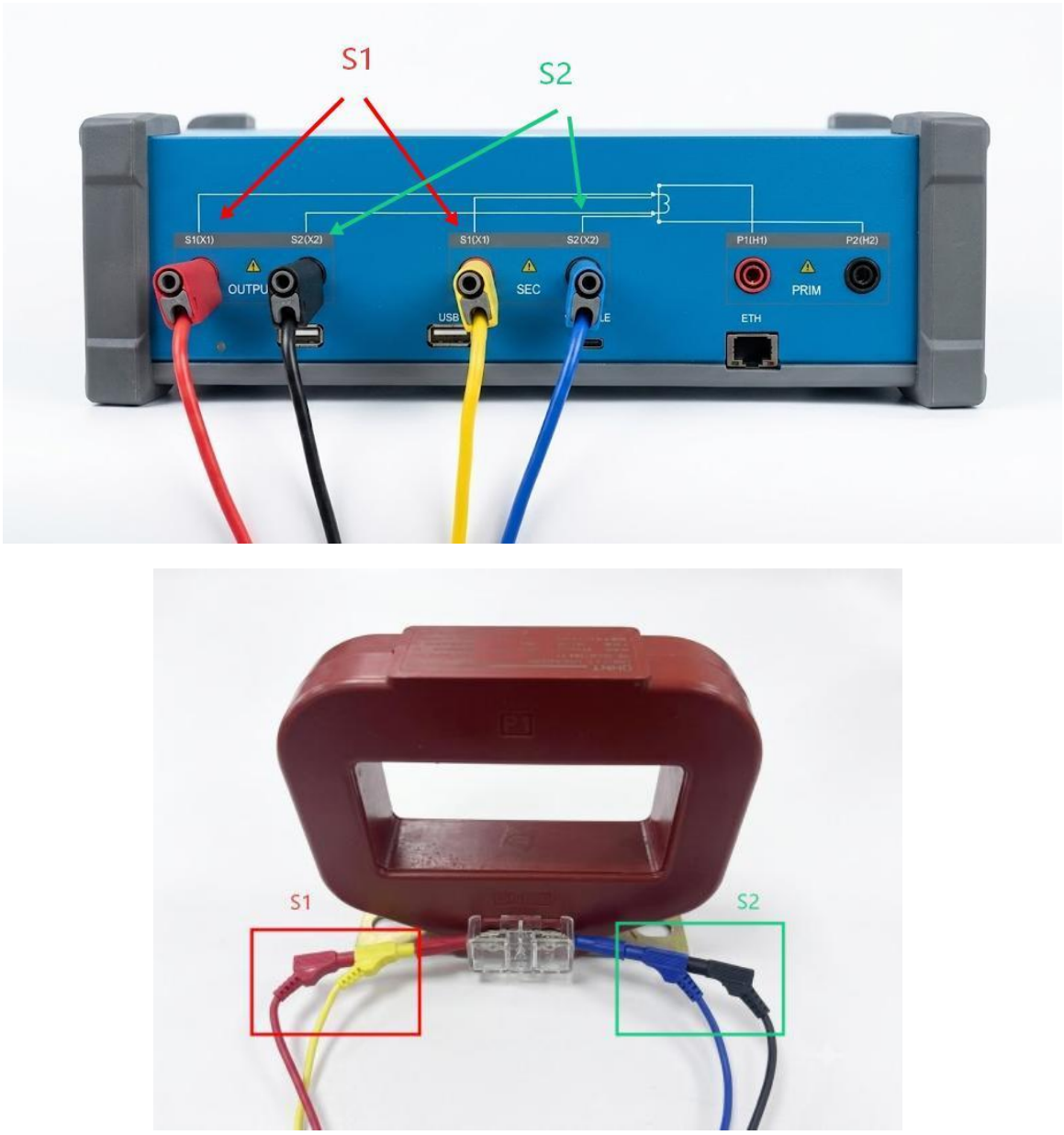


Figure 4-2 Single CT Secondary Side Connection

3. Connect the CT primary side to the 'PRIM' of the KT220 Comprehensive CT Analyzer: connect one end of the wire to terminal P1 of the analyzer, pass it through the transformer, and connect the other end to

terminal P2 (note the passing direction of the primary wire; do not reverse the connection), as shown in Figure 4-3.

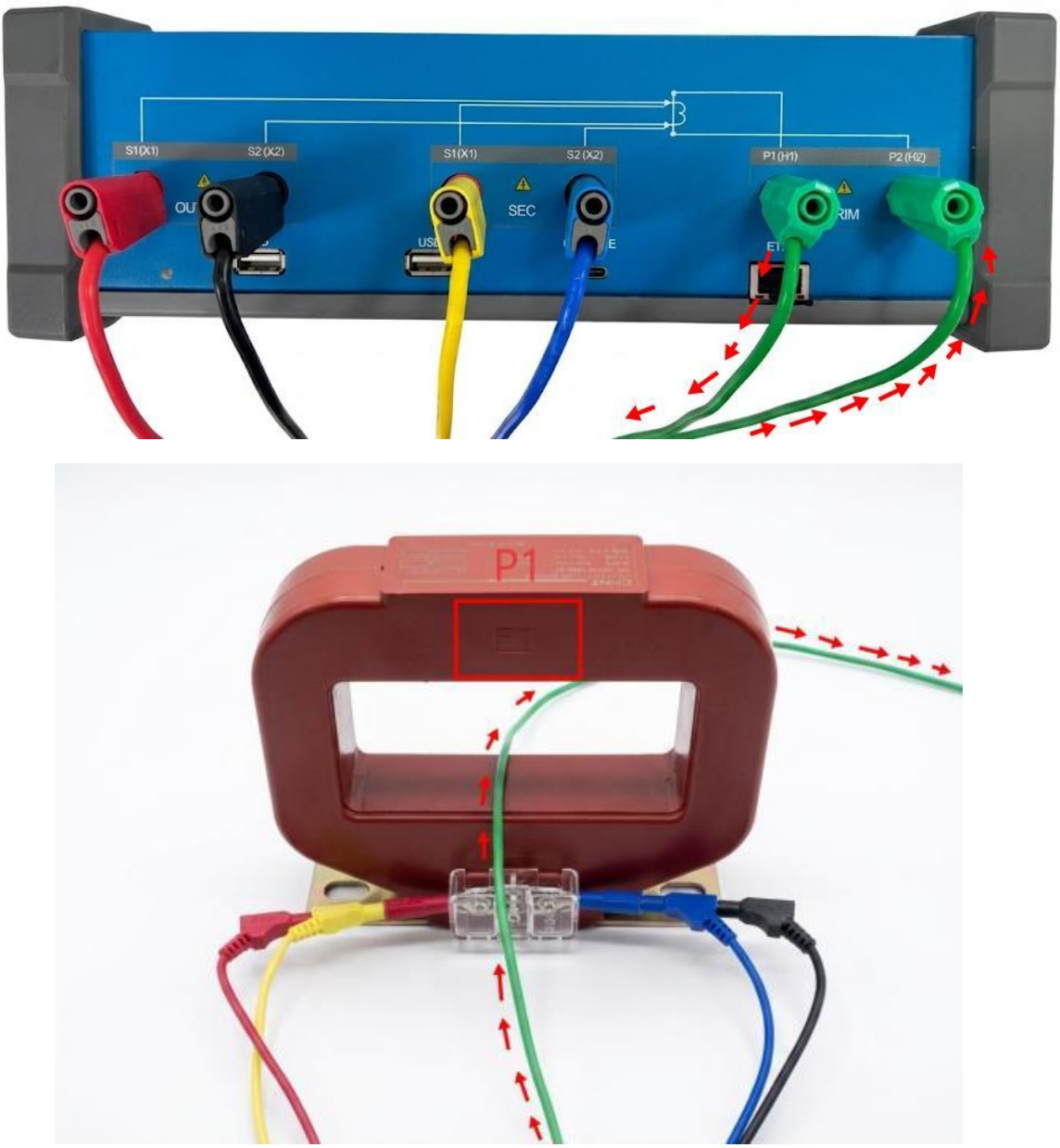
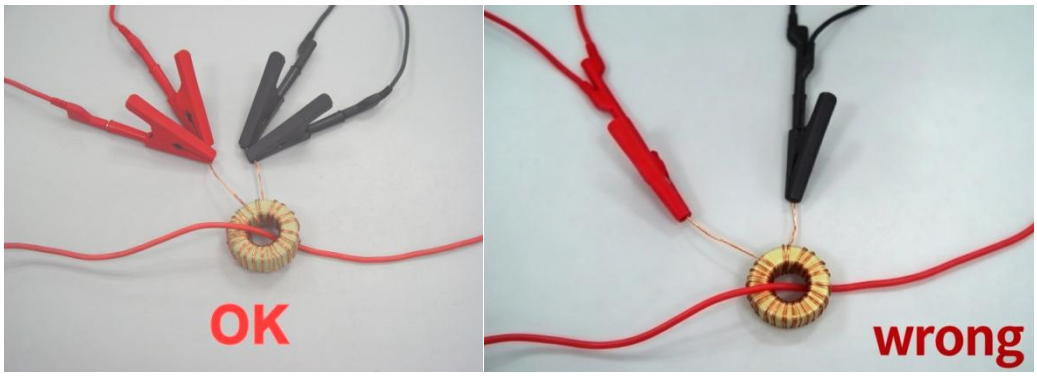


Figure 4-3 Single CT Primary Side Connection

If clamps are required for connecting test leads on the CT secondary side, use a 4-wire connection for measurement; otherwise, clamp resistance will cause deviations in test data.



4-wire connection *2-wire connection*

4.2 Wiring for Multi-Core CTs

4.2.1 Independent Winding CTs

The KT220 Comprehensive CT Analyzer can test multi-core independent winding CTs. An external expansion box is required during testing, and the number of windings (2 or 3) can be selected in the software.

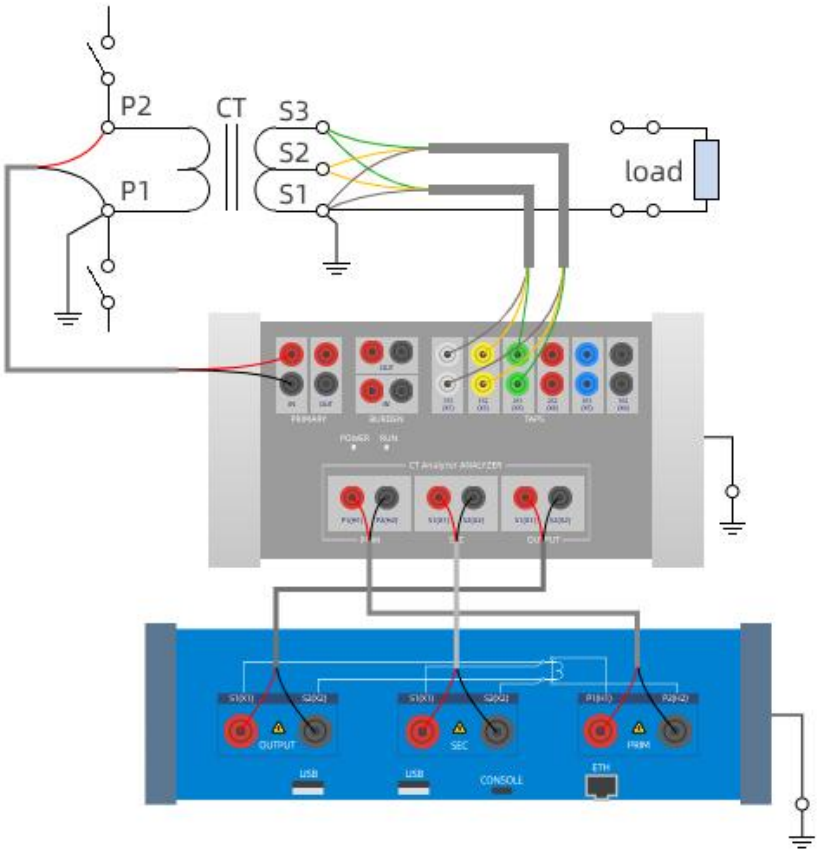


Figure 4-4 Independent Multi-Winding CT Wiring Diagram

Wiring steps:

1. Turn on 'Multiple Cores' and select 'Number of Cores'

2. Select the number of windings (2 or 3)

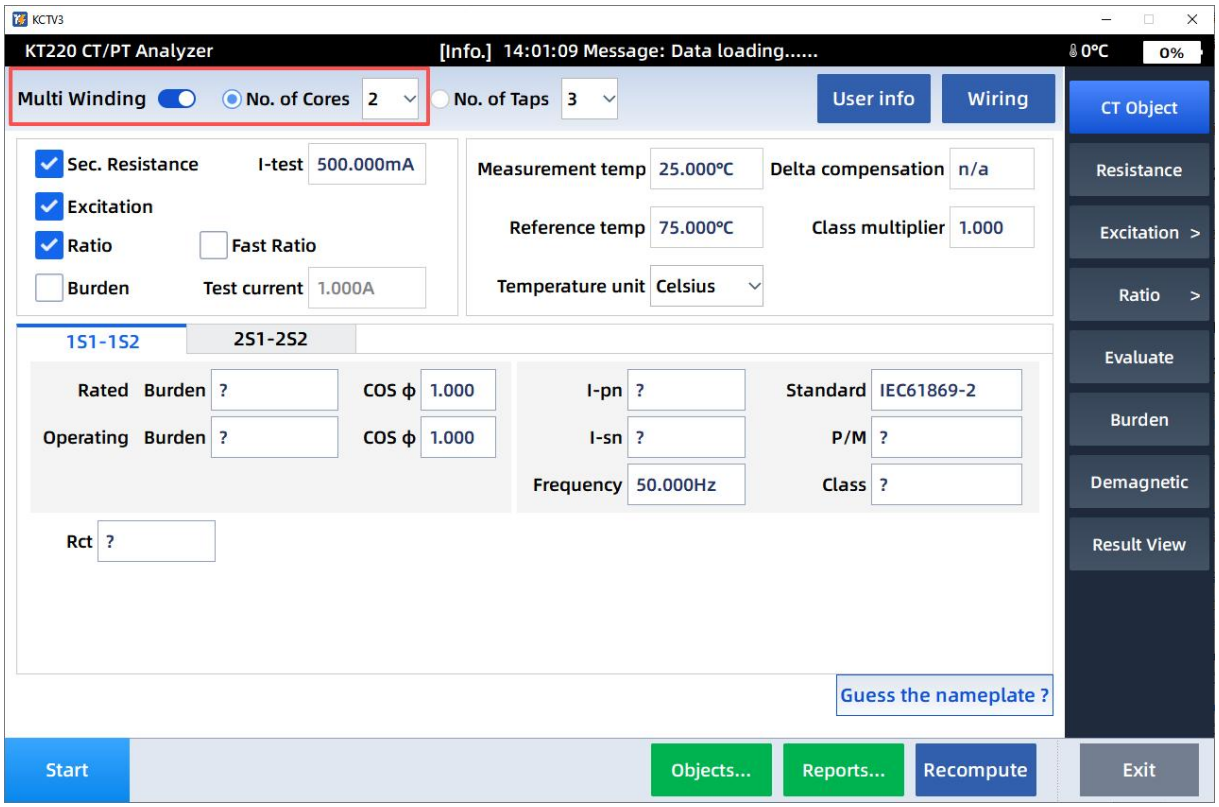


Figure 4-5 Independent Multi-Winding CT Operation Diagram

3. Connect the junction box to the USB port of the KT220 using a USB A-to-B cable. The POWER indicator lights up, as shown in Figure 4-6

Figure 4-6 USB Connection to Junction Box

4. Connect the OUTPUT, SEC, and PRIM terminals at the bottom of the junction box to the corresponding OUTPUT, SEC, and PRIM terminals of the KT220, respectively

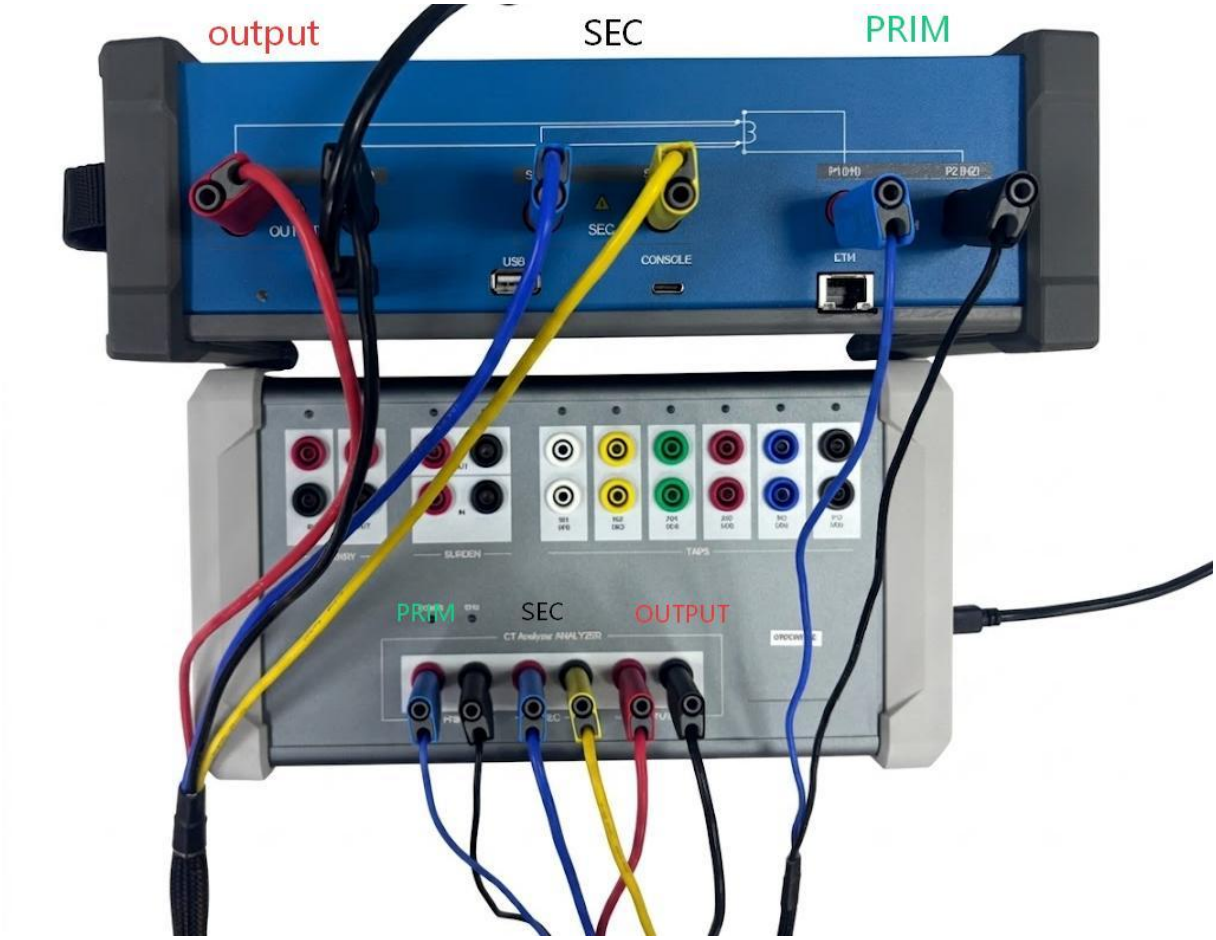


Figure 4-7 Junction Box Terminals Connected to Analyzer

5. Connect the primary of the junction box to the transformer primary side. The upper terminal of 'PRIM' corresponds to transformer P1, and the lower terminal corresponds to P2, following the rule of P1-in and P2-out. The 'TAPS' at the upper right of the junction box connect to the transformer secondary side: 1S1, 1S2 correspond to transformer 1S1, 1S2, and similarly for other windings.

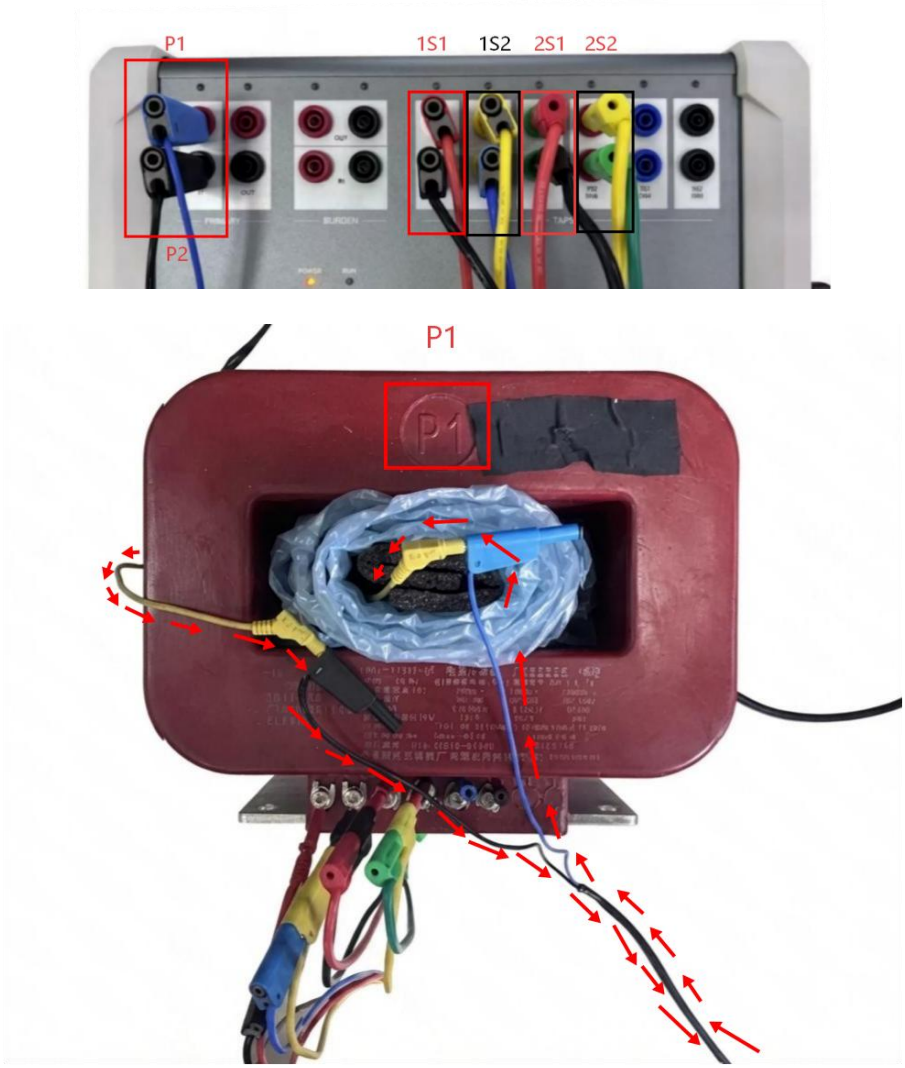


Figure 4-8 Junction Box Connected to Transformer

4.2.2 Multi-Ratio CTs with Common Tap

The KT220 Comprehensive CT Analyzer can test multi-tap CTs. An external expansion box is required during testing, and the number of taps (3–6) can be selected in the software.

Wiring steps:

1. Turn on 'Multiple Cores' on the KT220 and select 'Number of Taps'

2. Select the number of taps (3–6) and the common tap

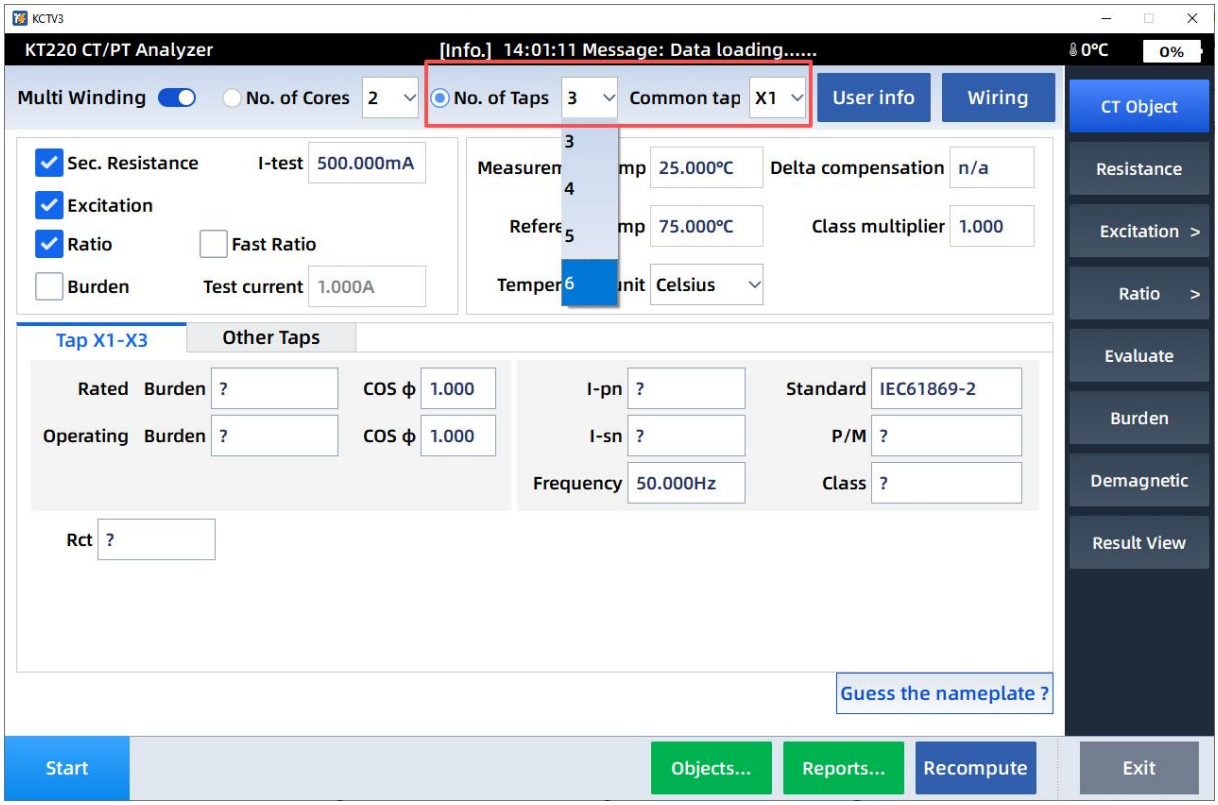


Figure 4-9 Common Tap Multi-Winding CT Operation Diagram

3. Connect the junction box to the USB port of the KT220 using a USB A-to-B cable

4. Connect the OUTPUT, SEC, and PRIM terminals at the bottom of the junction box to the corresponding OUTPUT, SEC, and PRIM terminals of the KT220

5. Connect the taps of the junction box to the corresponding secondary side of the transformer, and the primary to the primary side, similar to independent winding transformers, except that the common tap must be noted when connecting the secondary side.

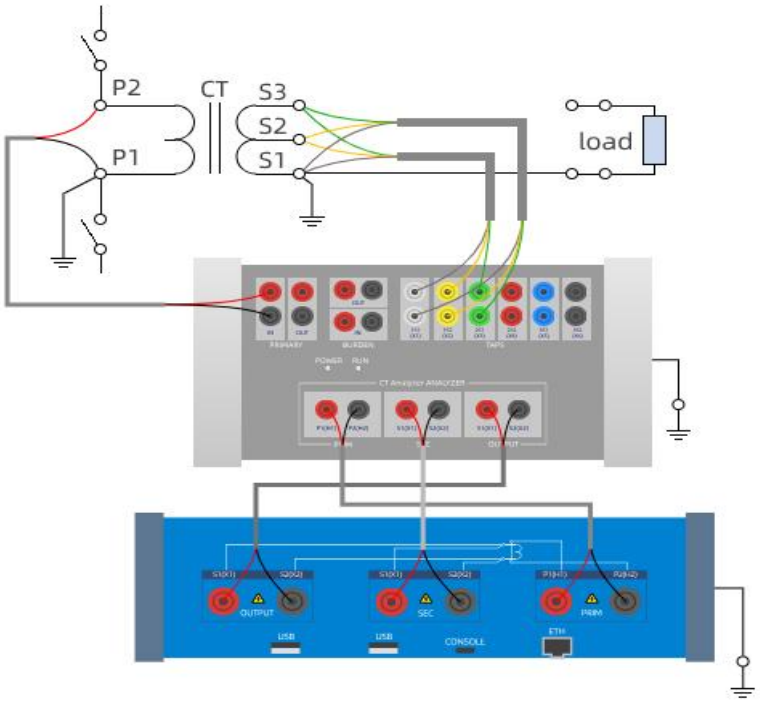


Figure 4-10 Common Tap Multi-Winding CT Wiring Diagram

Chapter 5 CT Testing and Nameplate Guessing Function

The KT220 Comprehensive CT Analyzer software is divided into host software and slave software. Both have essentially the same interface and operation. In the system options, the slave has an "Online" command (see 7.9). After the test process is complete, test reports can be imported or exported in the software for easy viewing and operation.

5.1 Connecting the CT

As shown in Chapter 4, connect the CT to the CT analyzer and ensure correct wiring.

1. Connect the CT secondary side to the "output" and "sec" of the CT analyzer.

2. Connect the CT primary side to the "prim" of the CT analyzer.

5.2 Preparing for Testing

If the CT analyzer is already powered on

1. Click "CT" on the main interface

2. The CT object card appears on the screen, ready to start a test

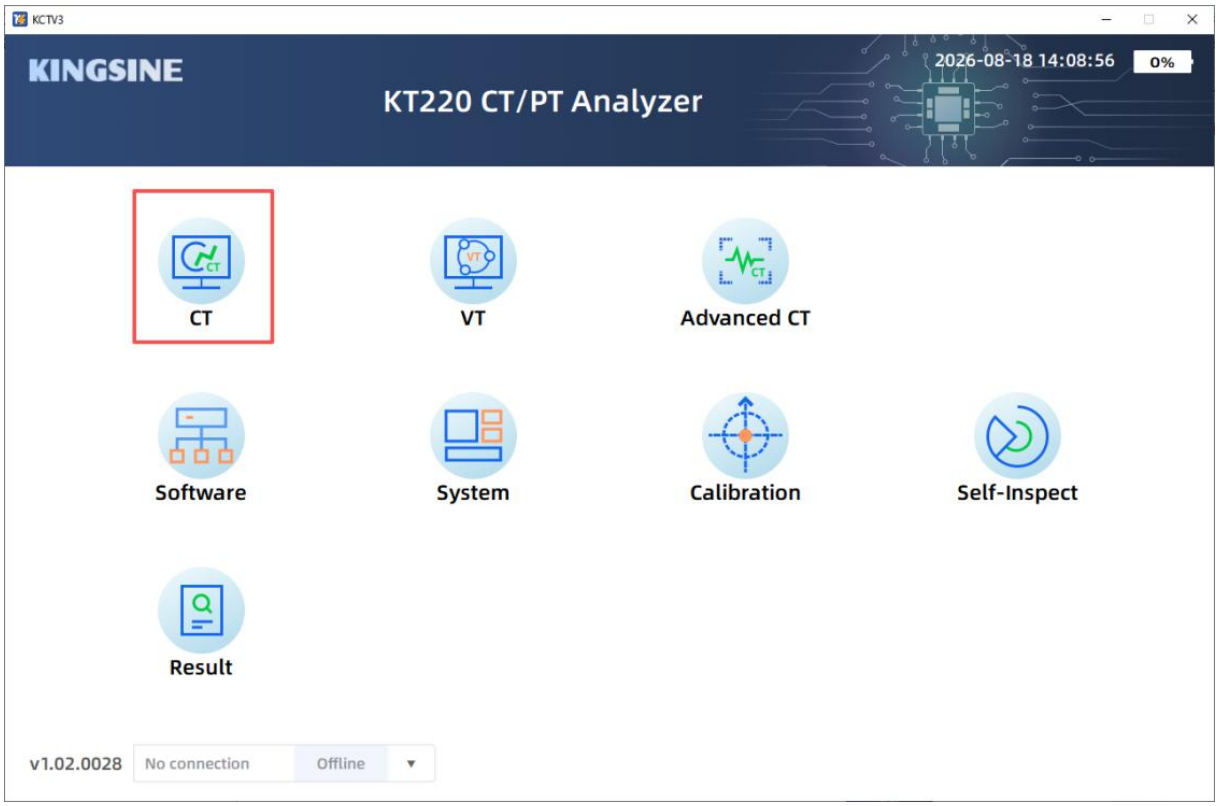


Figure 5-1

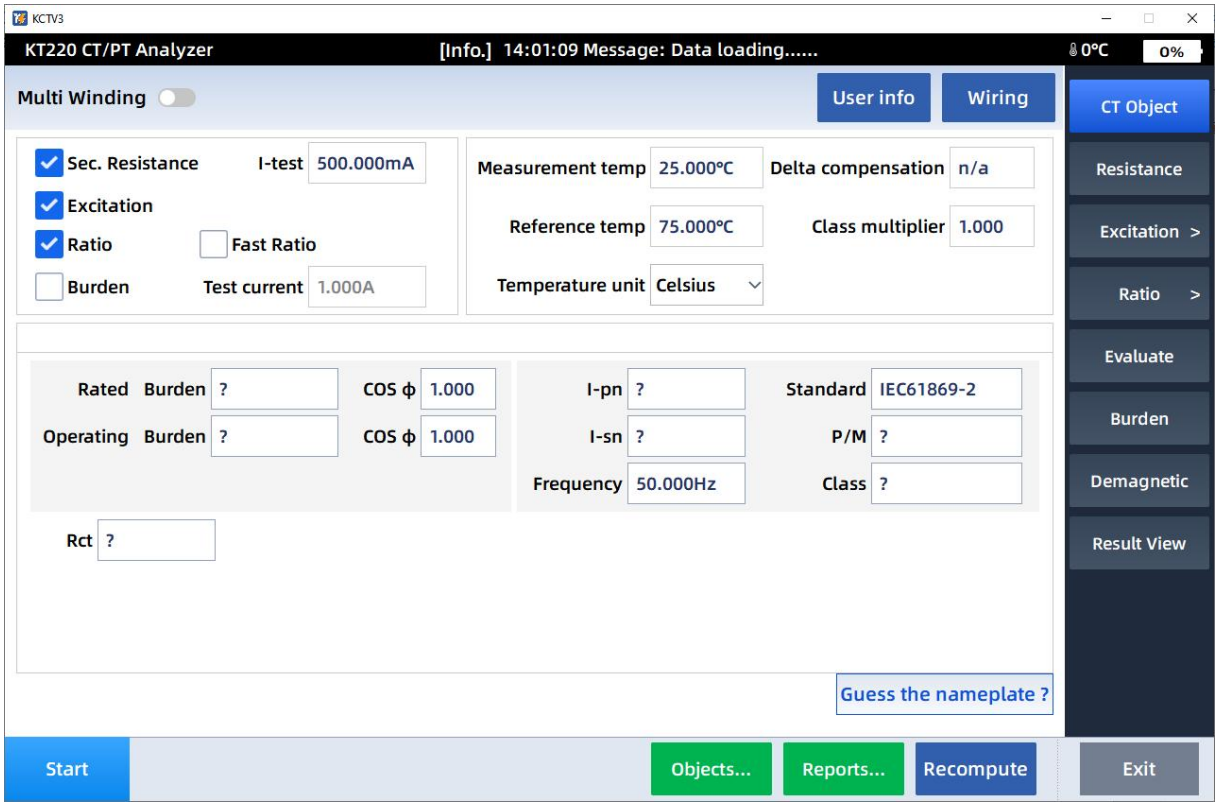


Figure 5-2

If the CT analyzer is powered off

1. Press and hold the power button (approximately 3s), wait until the top LED changes from red to green, and the boot screen appears

Figure 5-3

Figure 5-4

2. Click "CT" on the main interface

3. The CT object card appears on the screen, ready to start a test

5.3 Running a Test

Enter the CT object card to set basic information

1. Click User Information

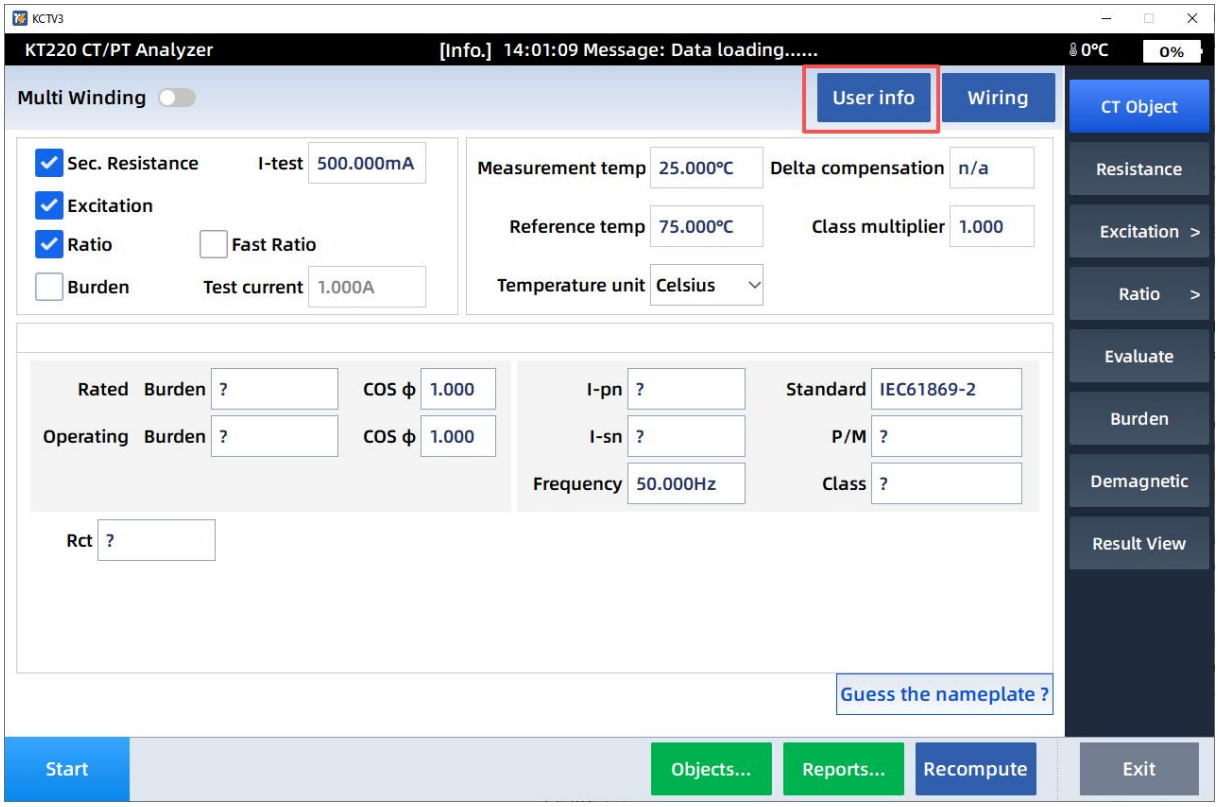


Figure 5-5

2. Fill in basic information

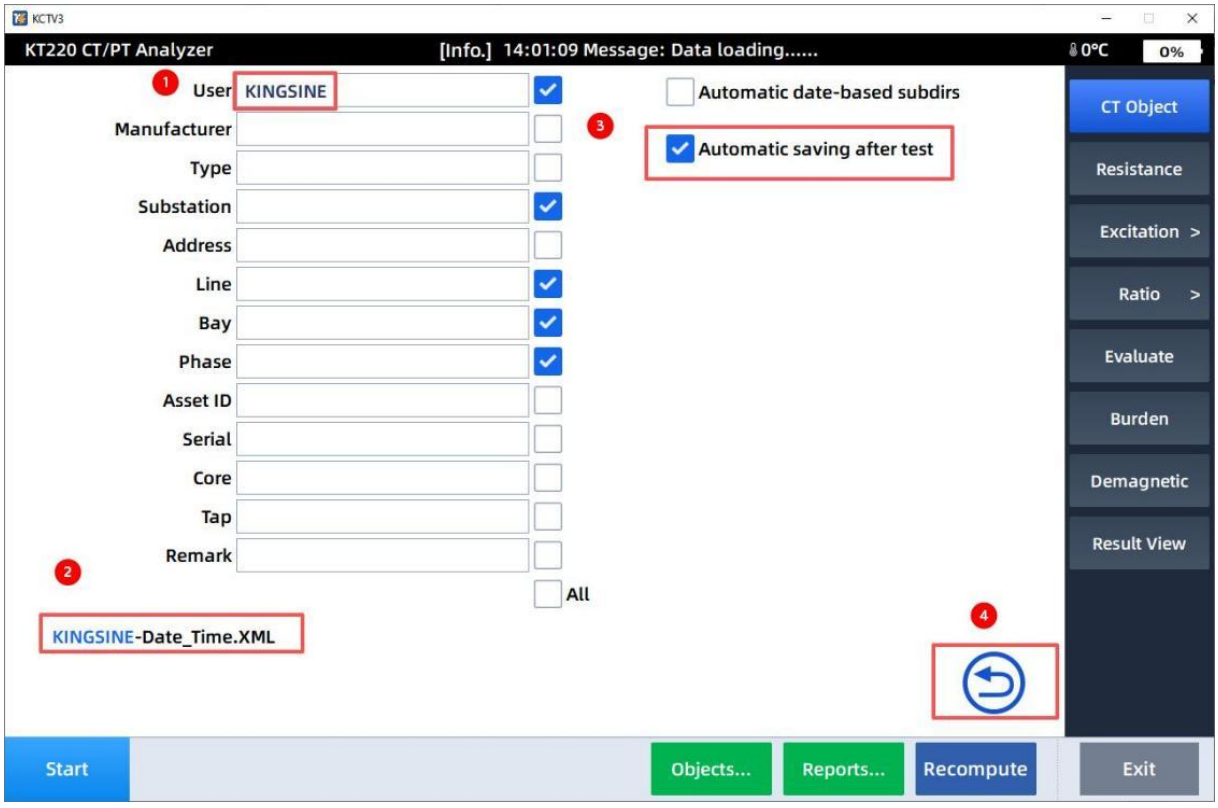


Figure 5-6

Note: (1) Fill in basic information: Customer, Manufacturer, Type, Substation, Address, Line, Bay, Phase, Asset No., Serial No., Core, Tap, Remarks — each has a check box behind it. Checking and entering content will be reflected in the file name.

(2) The device will default to using basic information as the file name.

(3) After checking, test results will be automatically saved after each test.

(4) Click to return to the CT object card.

Setting Parameters

1. Select test items

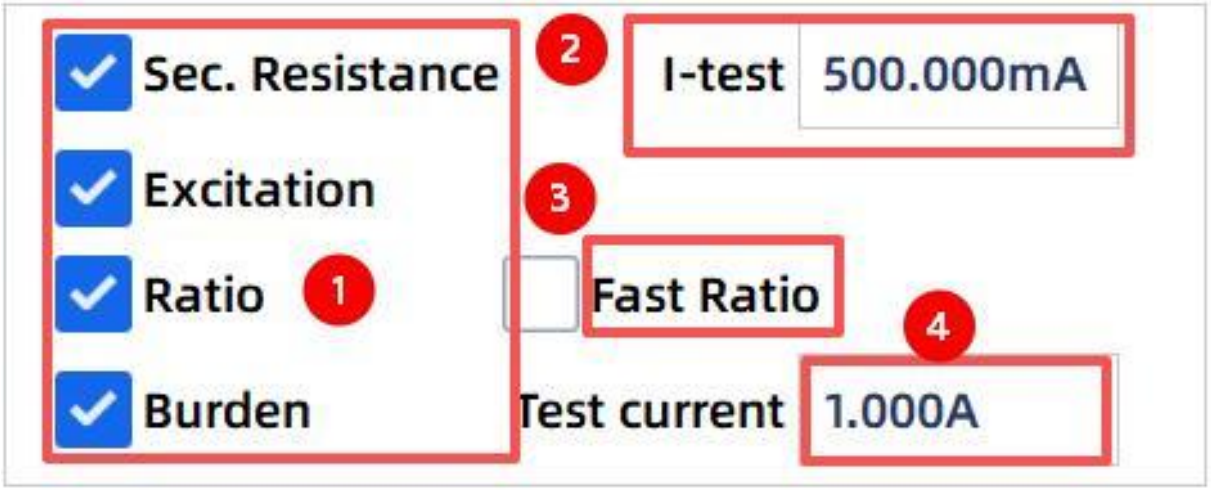


Figure 5-7

Note: (1) Check the four test items "Secondary Winding Resistance", "Excitation", "Ratio", and "Burden" for testing. Note that after the analyzer completes the "Secondary Winding Resistance", "Excitation", and "Ratio" tests, rewiring is required for the "Burden" test. The device will display the wiring diagram and ask whether to continue testing.

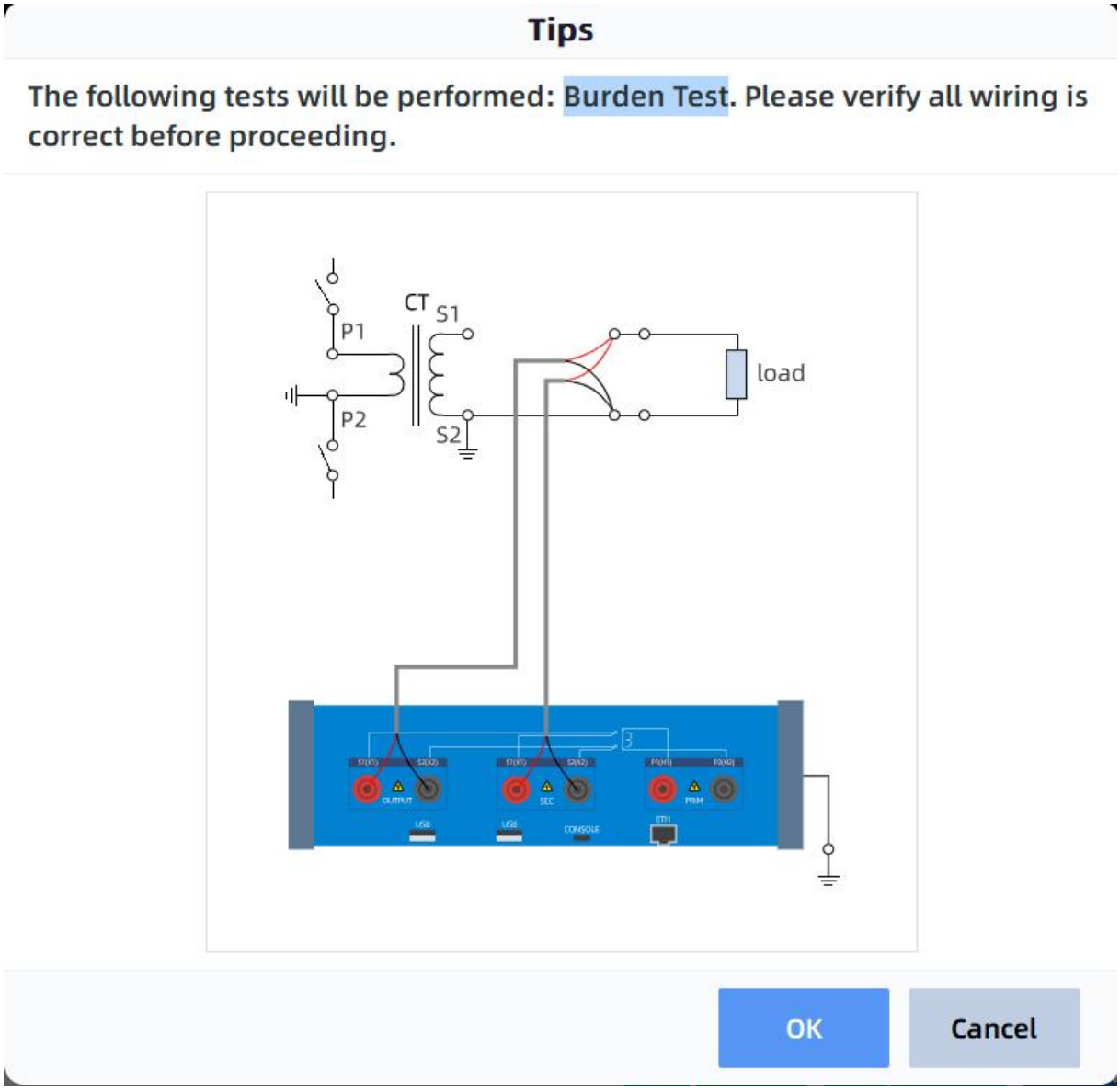


Figure 5-8

(2) I-test is the test current for this test. Currently the analyzer supports a range of 0.1–2A, default 1A.

(3) Quick ratio is used for rapid CT ratio measurement, but no evaluation results are provided.

(4) test current is the current for burden testing. The burden test current defaults to I-test.

2. Set general parameters

Figure 5-9

Note: (1) Reference temperature is required by various CT standards, typically 75°C. For CTs recently removed from the operating grid, set the test temperature and reference temperature to the same value. For CTs removed from the grid for more than 12 hours or new CTs, the test temperature is the ambient temperature.

(2) Delta compensation defaults to 'n/a'; other parameters are required for delta-connected wiring.

(3) The multiplication factor is used to enlarge or reduce the accuracy class standard. The final judgment standard is 'accuracy class × multiplication factor'. When the customer requires stricter accuracy, a smaller multiplication factor can be used to raise the standard.

3. Set CT nameplate parameters

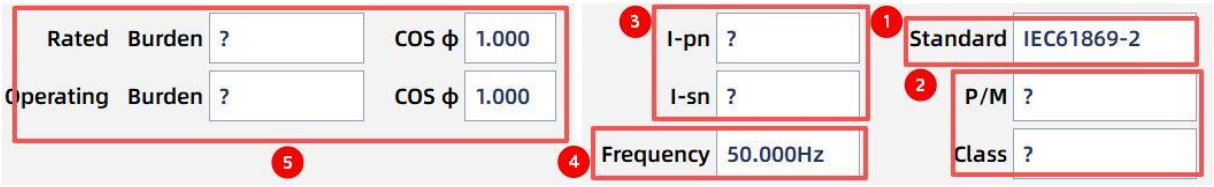


Figure 5-10

Note: (1) Standard options include IEC 61869-2 (current latest international standard), IEC 60044-1 (older standard for general CTs), IEC 60044-6 (older standard for transient performance of protective CTs), and IEEE C57.13 (mandatory in North America). IEC 61869-2 is selected by default.

(2) P/M selects whether the CT is metering class or protection class. This can usually be determined from the accuracy class marked on the CT nameplate: accuracy classes 0.1, 0.2, 0.2S, 0.5, 0.5S, 1 are metering class (with S indicating special metering class with wider range); accuracy classes 5P10, 5P20, 10P10, 10P20 are protection class (interpretation format: example， 5P10:composite error ≤5% at 10 times rated

primary current). We can also make a preliminary judgment based on CT size: larger units are usually protection class, smaller units are usually metering class.

(3) I-pn and I-sn are the primary and secondary currents of the transformer, usually expressed on the CT in the format 600/5A (example).

(4) Frequency is set according to the transformer nameplate marking; frequencies may vary by country.

(5) Rated burden is marked on the CT. Operating burden is usually less than or equal to rated burden, and they are equal by default. cosϕ is the phase difference angle between current and voltage, ranging from 0 to 1, where 1 is the ideal condition.

4. Set other parameters

Figure 5-11

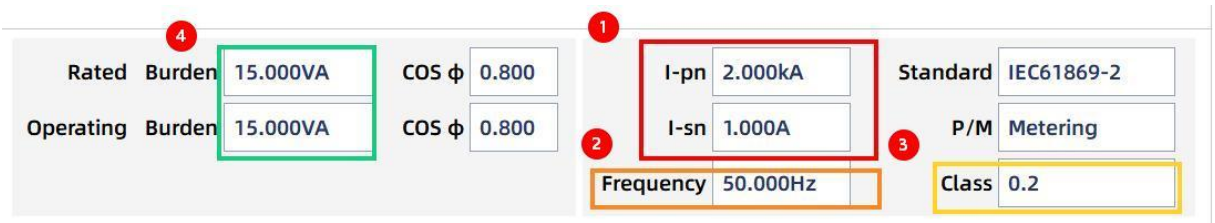
Note: (1) RCT is the CT secondary winding resistance, i.e., the resistance of the CT internal winding itself referred to 75°C. Some CTs mark this on the nameplate; if not marked, select '?' on the analyzer, and the instrument will calculate it after testing.

(2) FS is the instrument security factor, present only in metering CTs, default 10, indicating that the CT becomes significantly saturated when the primary current reaches 10 times the rated primary current.

(3) ext is the extended current range. The accuracy error limits are satisfied from 5% primary current to ext × primary current. Default value is 120%.

Example

Example of nameplate parameter input; corresponding parameters are indicated with boxes of the same color



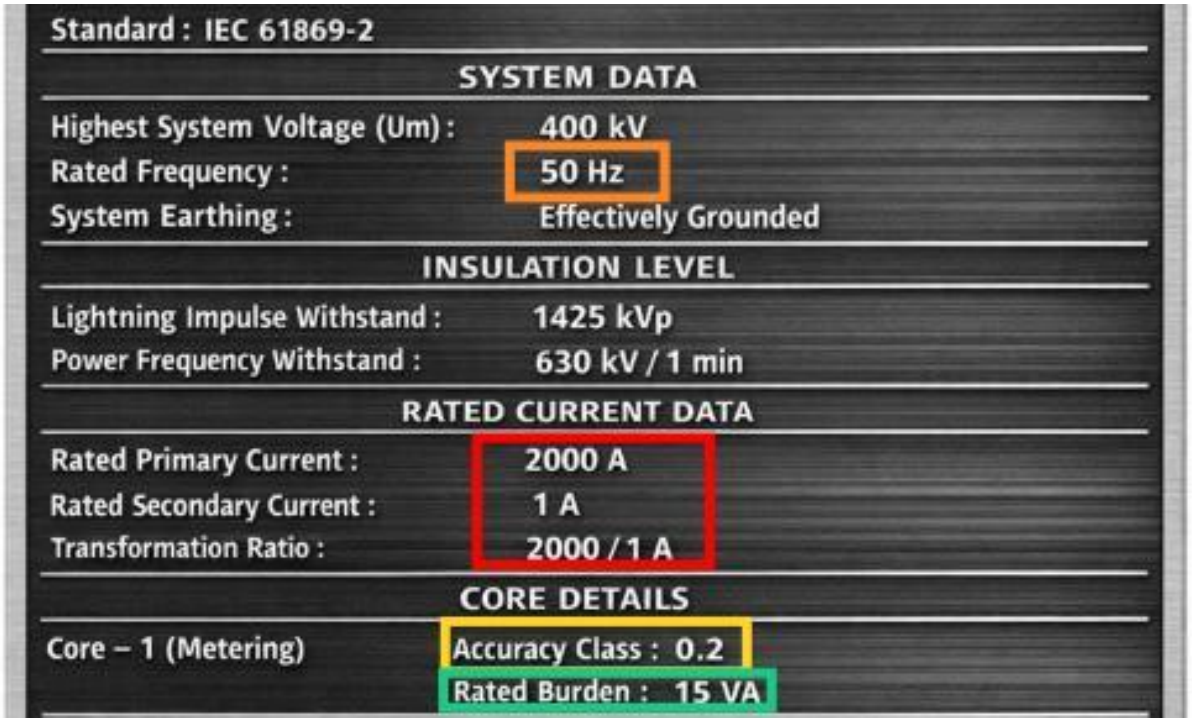


Figure 5-12

Note: (1) Current ratio 2000/1A indicates I-Pn=2000A, I-Sn=1A.

(2) frequency=50Hz

(3) Accuracy class 0.2S indicates this transformer is metering class with accuracy class 0.2S.

(4)rated burden=15VA

(5)If cos ϕ is not shown on the nameplate, the default value shall be 0.8 lagging.

Start Testing

1. Click "Start" at the bottom left

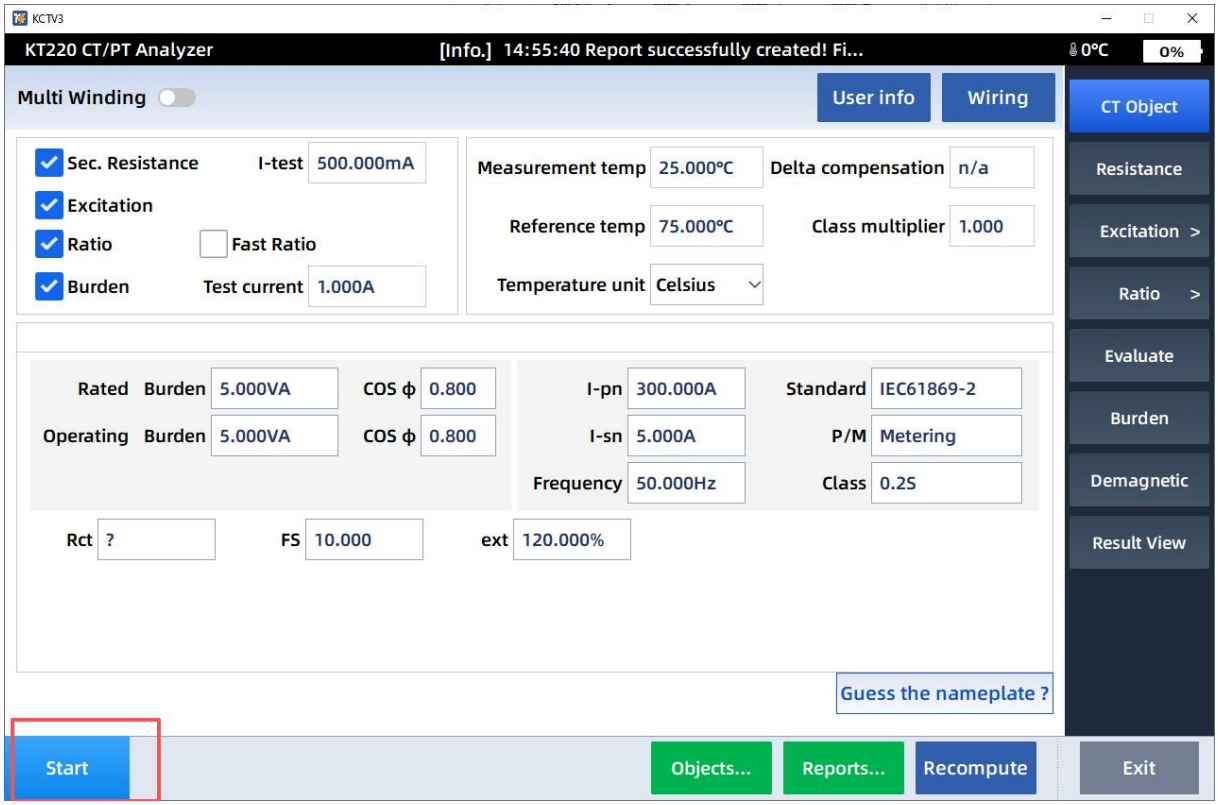


Figure 5-13

2. Confirm wiring

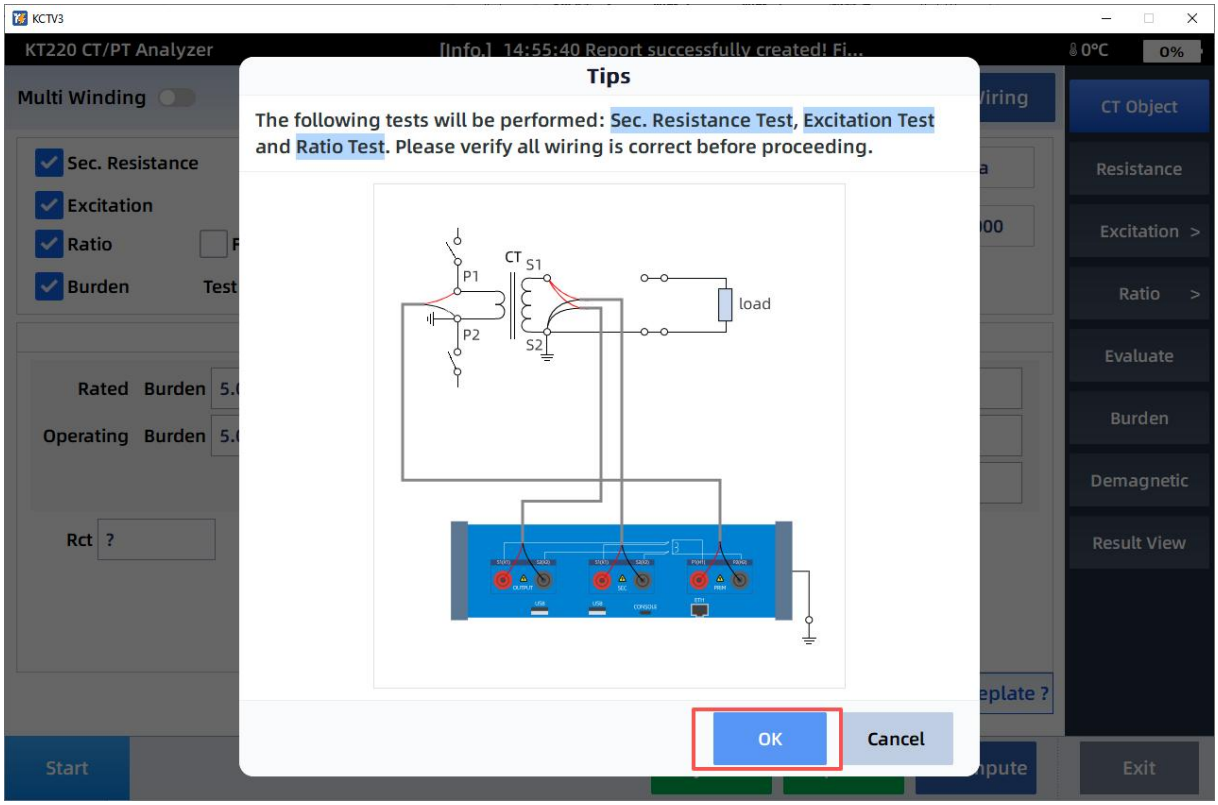


Figure 5-14

3. The button turns red and timing begins

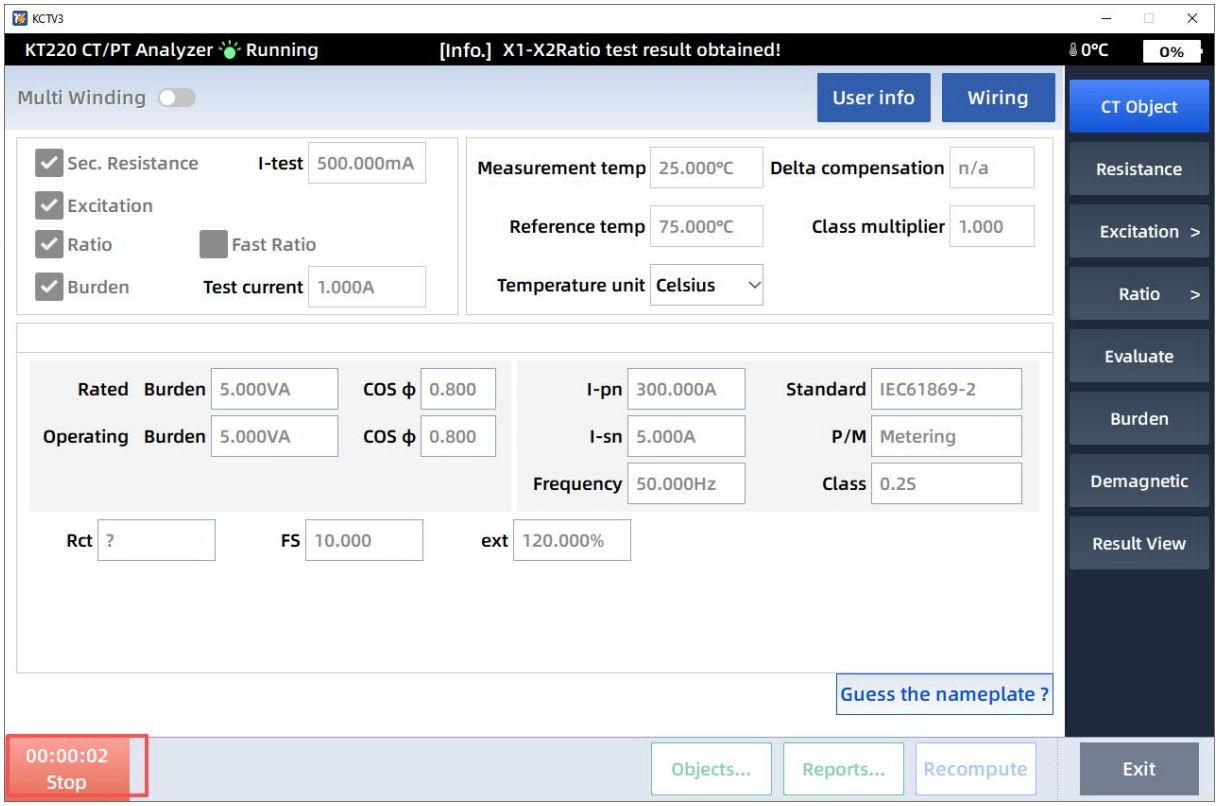


Figure 5-15

5.4 Nameplate Guessing

For standard current transformers defined per IEC 60044-1, the KT220 Comprehensive CT Analyzer can perform testing even without any CT data under test.

Note: Although the KT220 Comprehensive CT Analyzer can determine CT parameters (primary current, secondary current, class, ratio, etc.) and evaluate whether the CT meets standards, the nameplate guessing function is only intended as an auxiliary tool for users to discover parameters of unknown CTs. Parameters obtained from the nameplate guessing function are not guaranteed to be correct and require further verification by the user.

1. Click "Nameplate Guess"

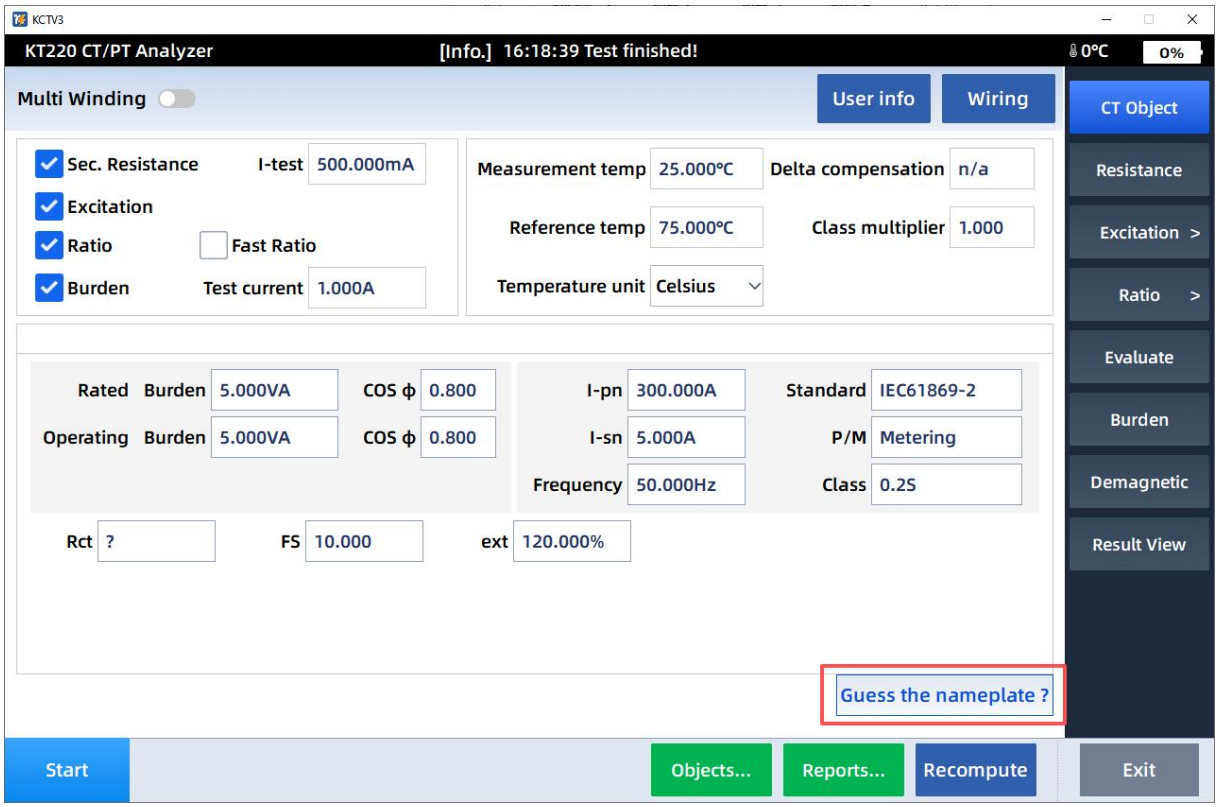


Figure 5-16

2. Nameplate guessing will clear existing parameters; click "OK"

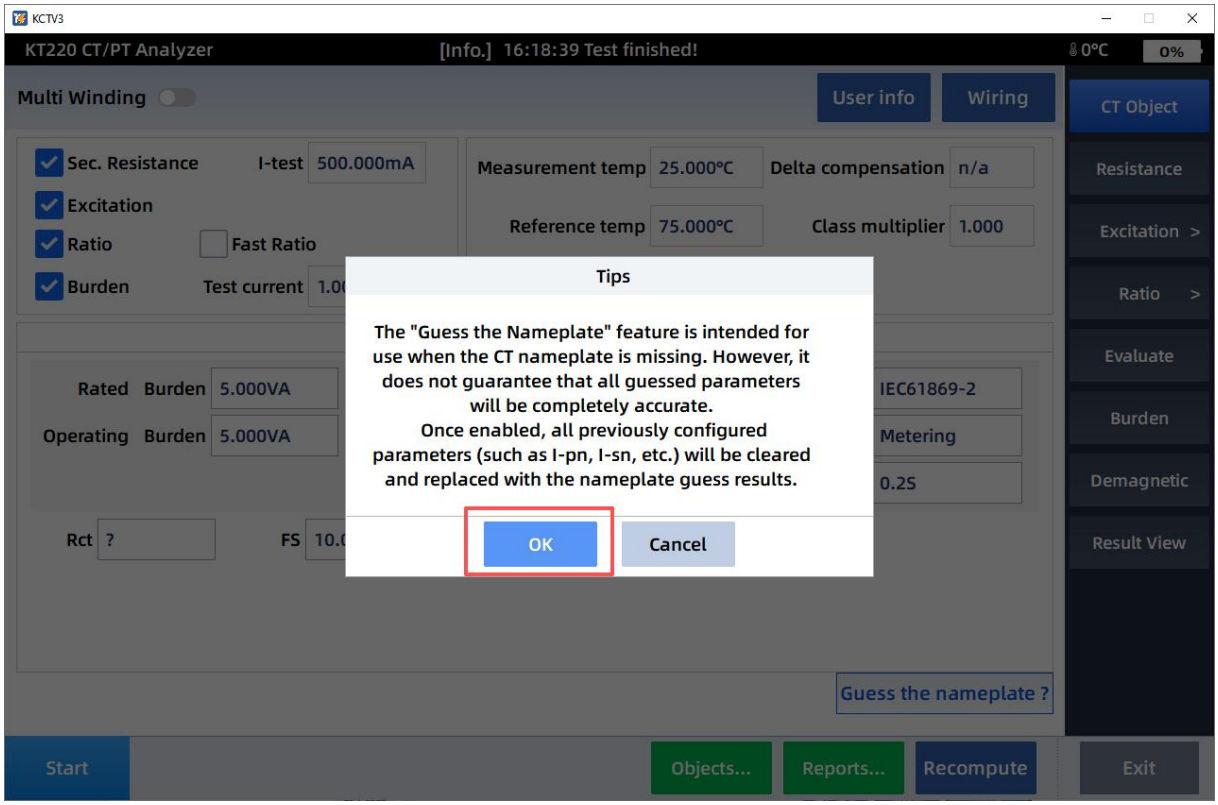


Figure 5-17

3. Click Start

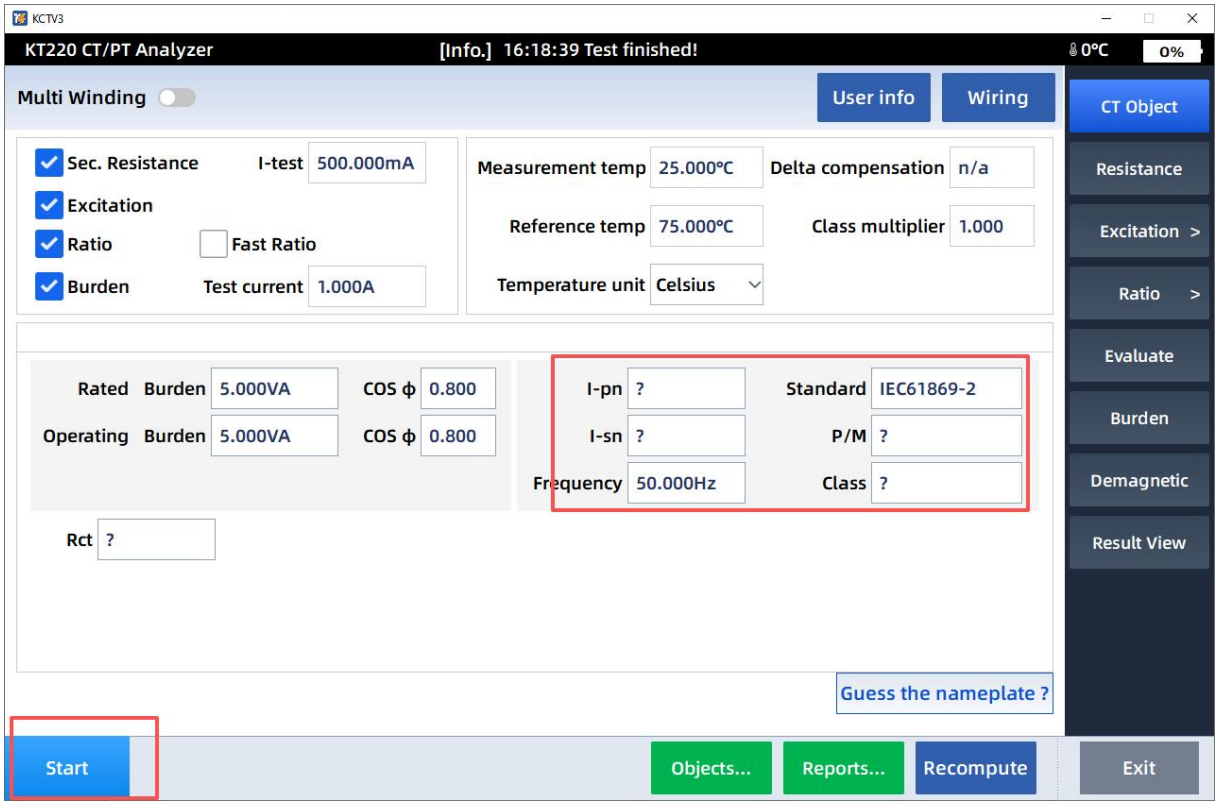


Figure 5-18

5.5 Parameter Explanation Tables

Main Parameters

Multiple Cores	Whether to select multiple cores
Test Options	Secondary winding resistance, excitation, ratio, quick ratio, burden, manual demagnetization
Temperature	Measurement temperature, reference temperature, temperature unit
Delta Compensation	Correction factor for ratio measurement, selectable 1, 1/3, 2/3
Multiplication Factor	This factor is used to increase the evaluation level of the ratio test. For example, a multiplication factor of 0.5 means the acceptable maximum ratio error tolerance is half of the standard tolerance.
Rated Burden	Secondary circuit rated burden, range: 0–400VA
Operating Burden	Secondary circuit actual burden, range: 0–400VA
CosΦ	Power factor of secondary circuit burden, range: 0–1
I-pn	Rated primary current, range 0–100kA
I-sn	Rated secondary current, range 0.1–10A
Frequency	Range 16–400Hz
Standard	IEC 61869-2, IEC 60044-1/6, IEEE C57.13
P/M	Protection type or measurement type
Accuracy Class	Accuracy class
Rct	Winding resistance
?	One-click '?'; parameters marked with '?' will be guessed during testing

Table 5-1

Special Parameters

Standard	CT Type Selection	Accuracy Class	Parameters to Fill
IEC 60044-1 (GB 1208-2006)	P	5P/10P	ALF: Accuracy Limit Factor
		PR	ALF: Accuracy Limit Factor Ts: Secondary Time Constant

		PX	Kx: Specific Area Factor Ek: Specific Accuracy Limit Voltage Ie: Specific Accuracy Limit Current E1: User-defined e.m.f., excitation current checked at this specific e.m.f. Ie1:Maximum permissible excitation current under E1 condition
	M	0.1/0.2S/0.2/0.5S/0.5/1.0/3.0/5.0	FS: Instrument Security Factor ext: Rated Continuous Thermal Current Ith

Table 5-2

Standard	CT Type Selection	Accuracy Class	Parameters to Fill
IEC 60044-6 (GB 16847-1997)	P	TPX	Kssc: Rated Symmetrical Short-Circuit Current Factor Tp: Primary Time Constant Ktd: Transient Area Factor Cycle: Duty Cycle t1: Set Duration t-all: Set Accuracy Limit Time
		TPY	Kssc: Rated Symmetrical Short-Circuit Current Factor Tp: Primary Time Constant Ktd: Transient Area Factor

			Ts: Secondary Time Constant Cycle: Duty Cycle t1: Set Duration t-all: Set Accuracy Limit Time
		TPS	Kssc: Rated Symmetrical Short-Circuit Current Factor Tp: Primary Time Constant K: Set Area Factor V-al: Set Accuracy Limit Voltage I-al: Set Accuracy Limit Current E1: User-defined e.m.f., excitation current checked at this specific e.m.f. Ie1: Maximum permissible excitation current under E1 condition
		TPZ	Kssc: Rated Symmetrical Short-Circuit Current Factor Tp: Primary Time Constant Ktd: Transient Area Factor Ts: Secondary Time Constant

Table 5-3

Standard	CT Type Selection	Accuracy Class	Parameters to Fill

ANSI 30/45	P	C	Vb: Rated Secondary Terminal Voltage
		X	
		T	
	M	0.3/0.6/1.2	RF: Continuous Rated Thermal Current

Table 5-4

Chapter 6 Test Card Introduction and Result Analysis

After testing is complete, "Test Complete" will be displayed at the top of the screen, and the button at the bottom left changes from "Stop" to "Start".

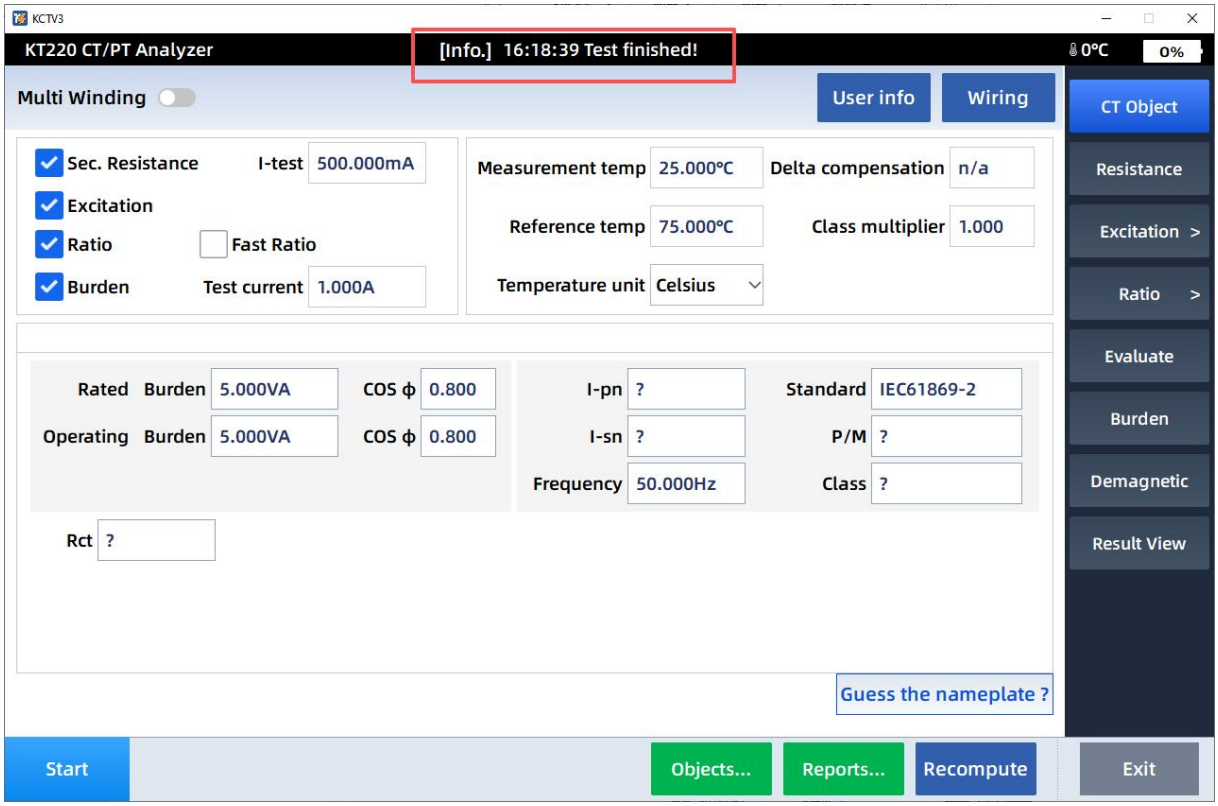


Figure 6-1 Test Complete

6.1 Resistance Test

1. Click Resistance to display the CT secondary winding DC resistance test results.

2. Resistance test parameters are those previously set in the CT object panel.

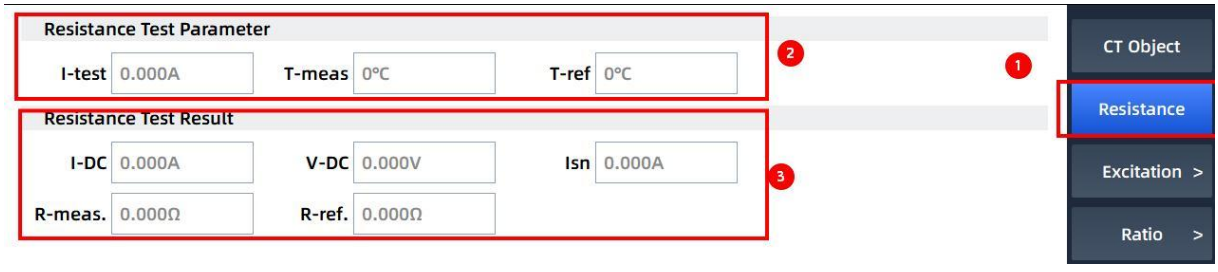


Figure 6-2 Resistance Interface

3. CT secondary winding resistance test results:

I-DC	Actual test current during resistance testing
V-DC	Actual test voltage during resistance testing
R-meas	Resistance at current test temperature
R-ref	Resistance value referred to reference temperature
Isn	Rated secondary current

Table 6-1

Note: Since various CT standards require that the measured resistance be referred to the reference temperature, the reference resistance here is calculated based on the measured resistance, test temperature, reference temperature, and the resistance temperature coefficient of copper. The reference resistance will be used for excitation characteristic testing and ratio testing. Therefore, the reference temperature and test temperature must be set correctly, otherwise the accuracy of excitation characteristic testing and ratio testing will be affected.

6.2 Excitation Test

The excitation test is used for CT secondary winding excitation testing. It is a test specified in the "Electric Power Equipment Handover and Preventive Test Regulations". The purpose of the test is:

(1) Compare the characteristic curve of the CT under test with that of similar transformers or the curve provided by the manufacturer to check for significant differences;

(2) Calculate the 10% (or 5%) error curve based on the excitation characteristic curve for burden comparison in relay protection.

(3) Provide data for the calculation of various CT parameters.

6.2.1 Excitation Test Results

1. Click Excitation; the excitation test results are displayed by default as shown in Figure 6-3.

2. You can click Rated Burden and Actual Burden to switch between excitation results under these two burdens.

3. Excitation test parameters are those previously set in the CT object panel.

4. The meanings of excitation test result parameters are shown in Table 6-2 and Table 6-3.

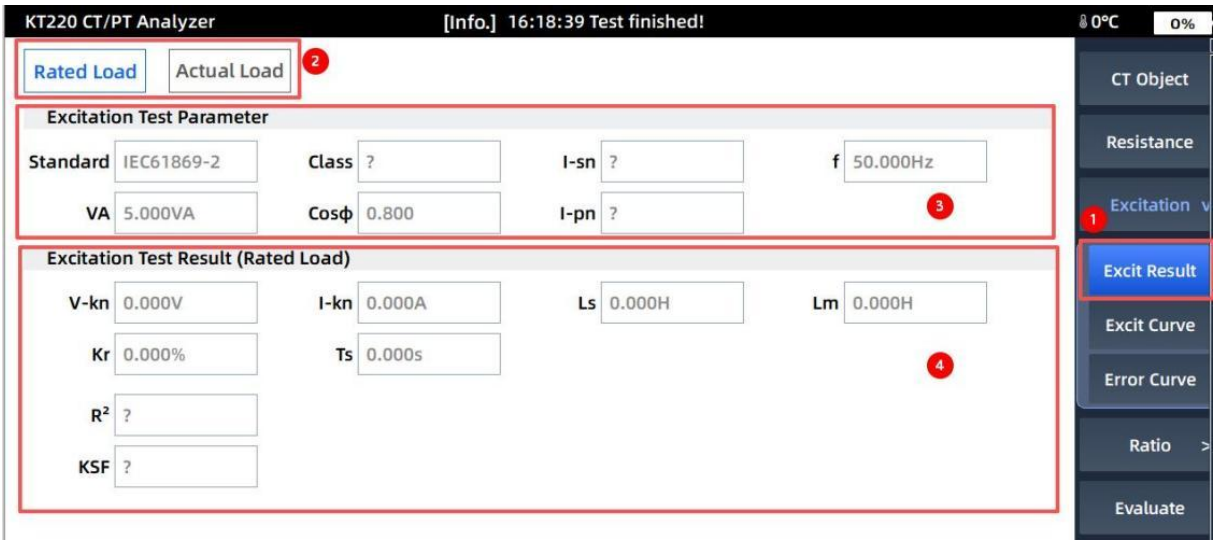


Figure 6-3 Excitation Interface

Standard	CT Type Selection	Accuracy Class	Parameters to Fill
IEC 60044-1 (GB 1208-2006)	P	5P/10P/PR	V-kn: Knee-point voltage I-kn: Knee-point current Ls:Saturated inductance Lm: Unsaturated inductance Ts: Secondary time constant Kr: Remanence factor ALF: Accuracy limit factor (direct method) ALFi: Accuracy limit factor (indirect method)

		PX	V-kn: Knee-point voltage I-kn: Knee-point current Ls: Saturated inductance Lm: Unsaturated inductance Ts: Secondary time constant Kr: Remanence factor Kx: Specific area factor Ek: Specific accuracy limit voltage Ie: Specific accuracy limit current E1:User-defined,e.m.f., excitation current checked at this specific e.m.f. Ie1: Maximum permissible excitation current under E1 condition
	M	0.1/0.2S/0.2/0.5S/0.5/1.0/3.0/5.0	V-kn: Knee-point voltage I-kn: Knee-point current Ls: Saturated inductance Lm: Unsaturated inductance Ts: Secondary time constant Kr:Remanence factor FS:Instrument security factor (direct method) FSi:Instrument security factor (indirect method)

Table 6-2

Standard	CT Type Selection	Accuracy Class	Parameters to Fill
IEC 60044-6 (GB 16847-1997)	P	TPX	Kssc:Rated Symmetrical Short-Circuit Current Factor Tp: Primary Time Constant Ktd: Transient Area Factor Cycle: Duty Cycle t1: Set Duration t-all: Set Accuracy Limit Time
		TPY	Kssc:Rated Symmetrical Short-Circuit Current Factor Tp: Primary Time Constant Ktd: Transient Area Factor Ts: Secondary Time Constant Cycle: Duty Cycle t1:Set Duration t-all: Set Accuracy Limit Time
		TPS	Kssc:Rated Symmetrical Short-Circuit Current Factor Tp: Primary Time Constant K: Set Area Factor V-al: Set Accuracy Limit Voltage I-al:Set Accuracy Limit Current E1:User-defined e.m.f., excitation current checked at this specific e.m.f. Ie1:Maximum permissible excitation current under E1 condition

		TPZ	Kssc: Rated Symmetrical Short-Circuit Current Factor Tp:Primary Time Constant Ktd:Transient Area Factor Ts: Secondary Time Constant

Table 6-3

6.2.2 Excitation Curve

1. Select Excitation Curve to display the excitation curve interface, as shown in Figure 6-4.

2. The knee point is marked on the excitation curve. Before the knee point is the unsaturated region, where voltage increases with current in a linear relationship. After the knee point is the saturated region, where the curve is smooth and voltage barely changes with increasing current. If the curve fluctuates after the knee point, the CT is abnormal.

3. Standard is the standard set in the CT object panel. V-meas and I-meas are measured values; V-ref and I-ref are reference values after loading a reference.

4. Click any data in the table to display the corresponding point on the curve, as shown in Figure 6-5, for convenient knee point comparison.

5. Object: When testing multi-winding CTs, switch between excitation curves of different windings.

Coordinates: Switch between linear and logarithmic coordinates.

Measure Knee Point: Click to display only the knee point.

Load reference: Load a previously tested excitation curve as shown in Figure 6-6. The reference curve and the current test curve will be displayed in the same coordinate system, with the reference curve in yellow. This is mainly used to check for discrepancies between two tests of the same CT. If the two test curves of the same CT do not coincide, it is abnormal.

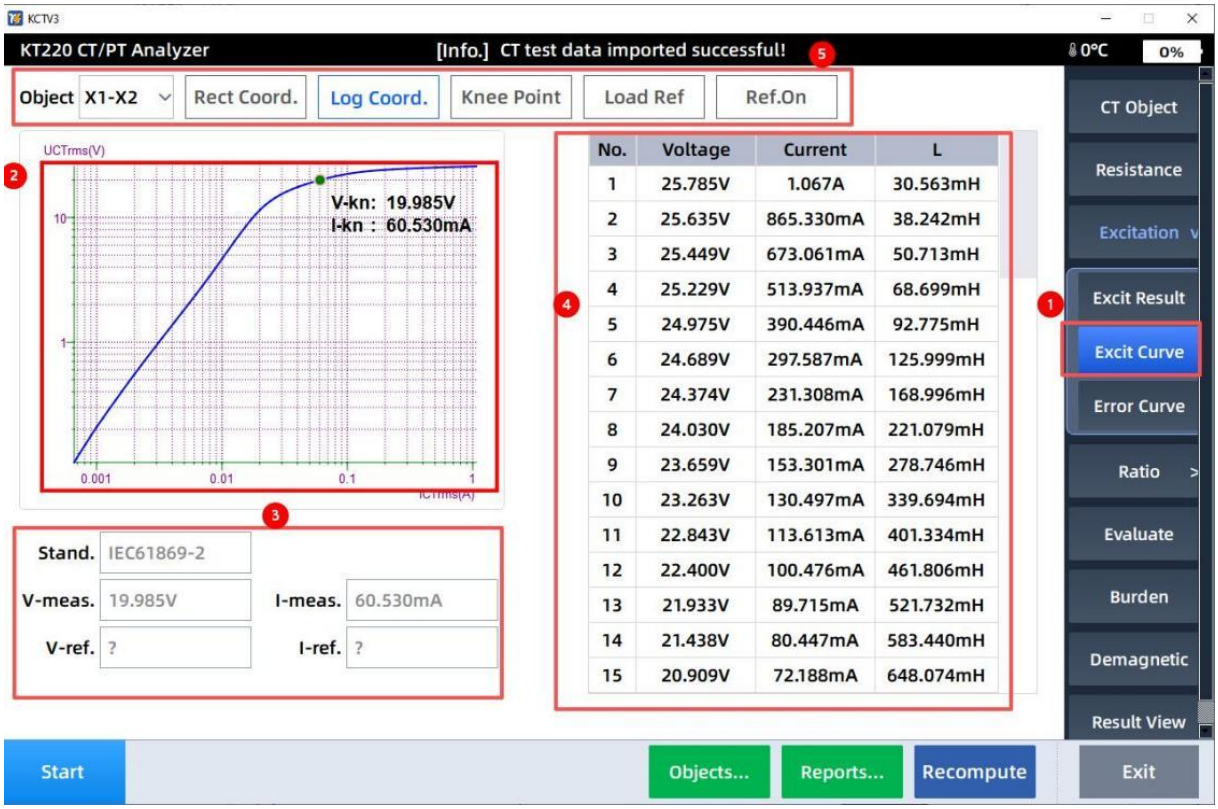


Figure 6-4 Excitation Curve Interface

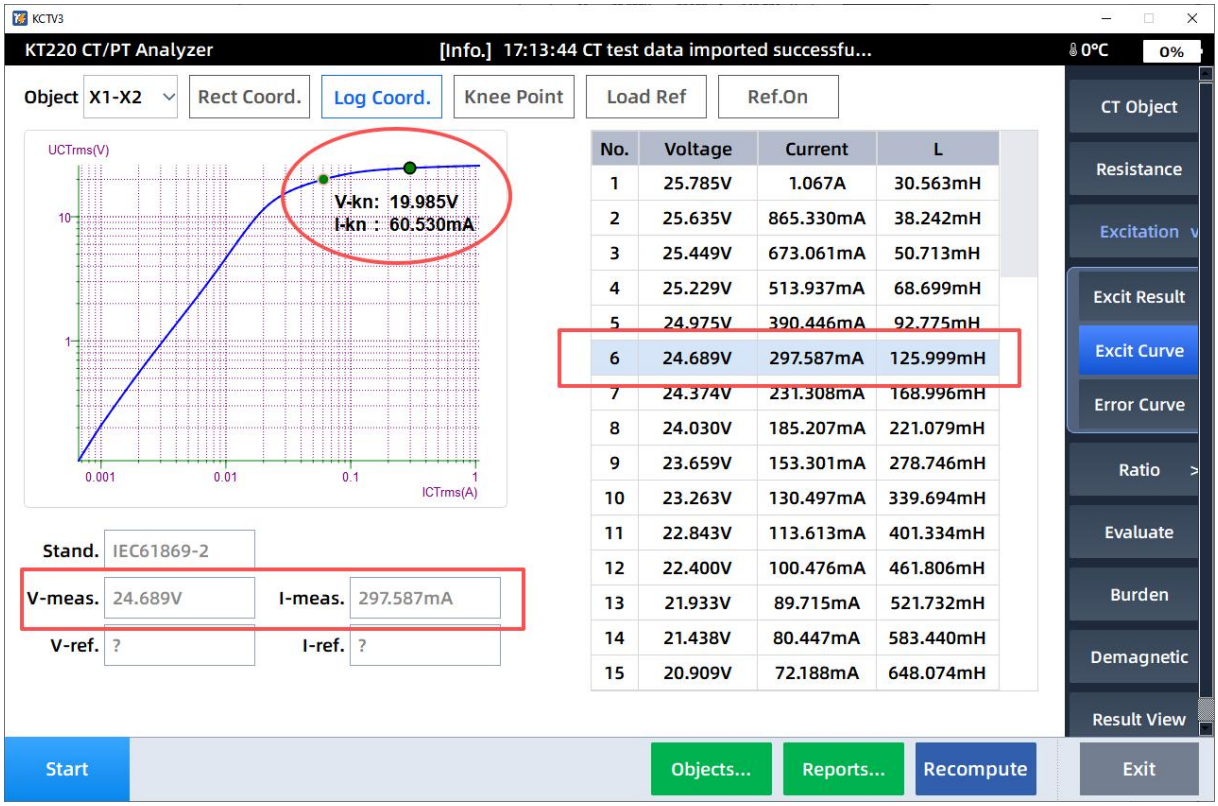


Figure 6-5

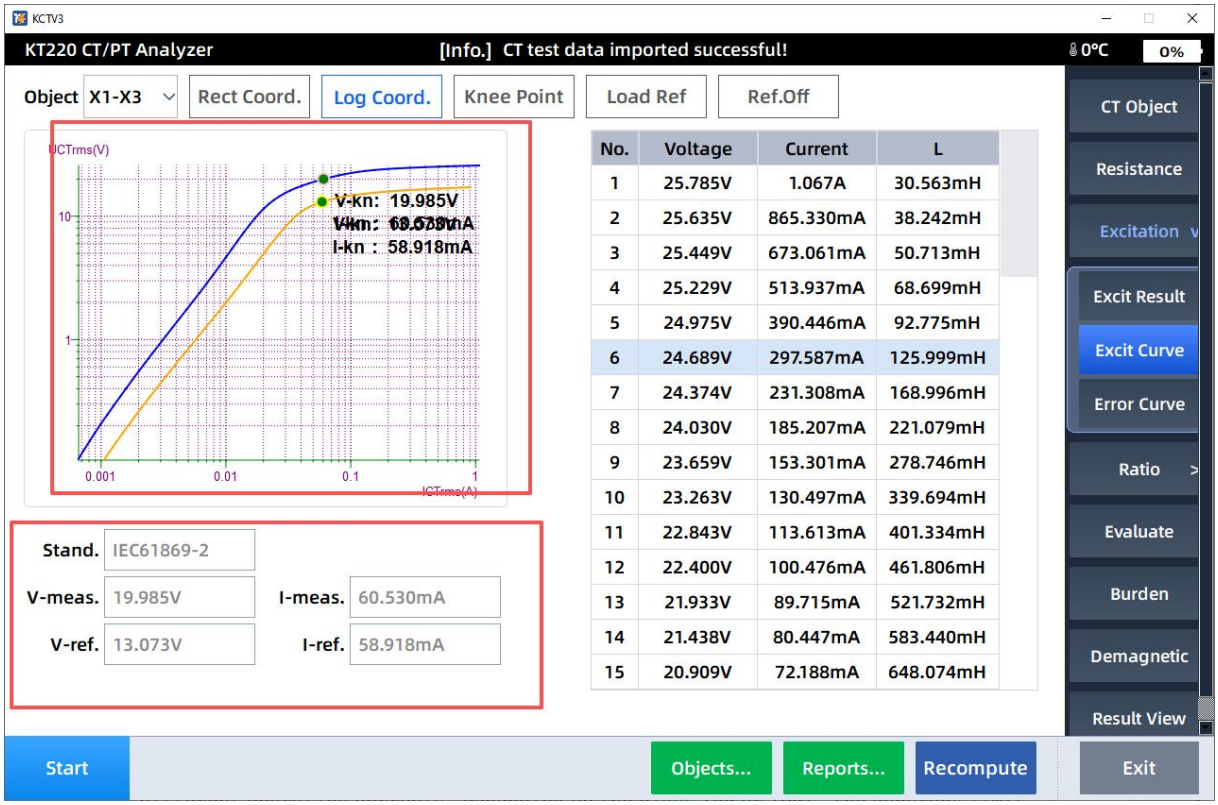


Figure 6-6 Load Reference

6.2.3 Error Curve

Select Error Curve to display the relationship curve between the rated primary current multiple and the maximum burden under 10% or 5% error conditions. It shows how much the CT actual ratio deviates from the nameplate nominal accuracy at different operating currents. Depending on the class (5P or 10P), the accuracy limit is 5% or 10%, as shown in Figure 6-7. In the interface, the horizontal axis is the maximum allowable burden, and the vertical axis is the rated primary current multiple. Click a data point on the right to locate the corresponding point on the error curve for easy data observation; logarithmic and linear coordinates can be switched.

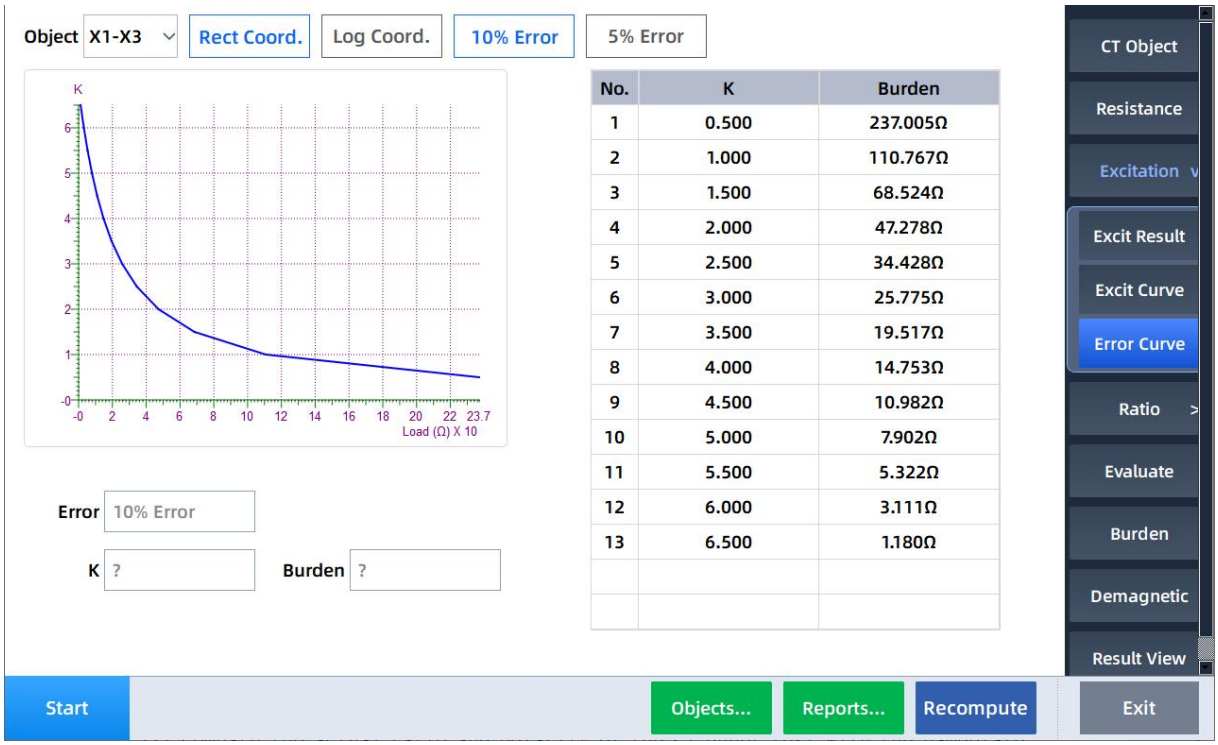


Figure 6-7 Error Curve Interface

6.3 Ratio Test

The ratio test is used for ratio and polarity testing, as well as ratio error and phase displacement calculation.

CT ratio and polarity testing is a test item specified in the "Electric Power Equipment Handover and Preventive Test Regulations". The purpose of the test is:

(1) Compare the actual ratio and polarity of the CT under test with the nameplate markings to check for consistency;

(2) Compare the ratio error and phase displacement of the CT under test with the manufacturer's test values to check for significant changes and compliance with class regulations.

6.3.1 Test Results

Based on ratio measurement and the measured excitation characteristics, the KT220 Comprehensive CT Analyzer calculates the ratio error and phase displacement for a specified burden or rated burden. The displayed results are also written into the test report.

1. Click Ratio; the ratio test results are displayed by default.

2. Ratio test parameters are those set in the CT object interface.

3. Ratio test results

Ratio	Actual ratio
Ratio Error	Current ratio error
Polarity	Positive polarity or negative polarity
εc	Composite error
Phase Displacement	Phase difference between primary and secondary current
N	Actual turns ratio
I-p	Primary current value

Table 6-4

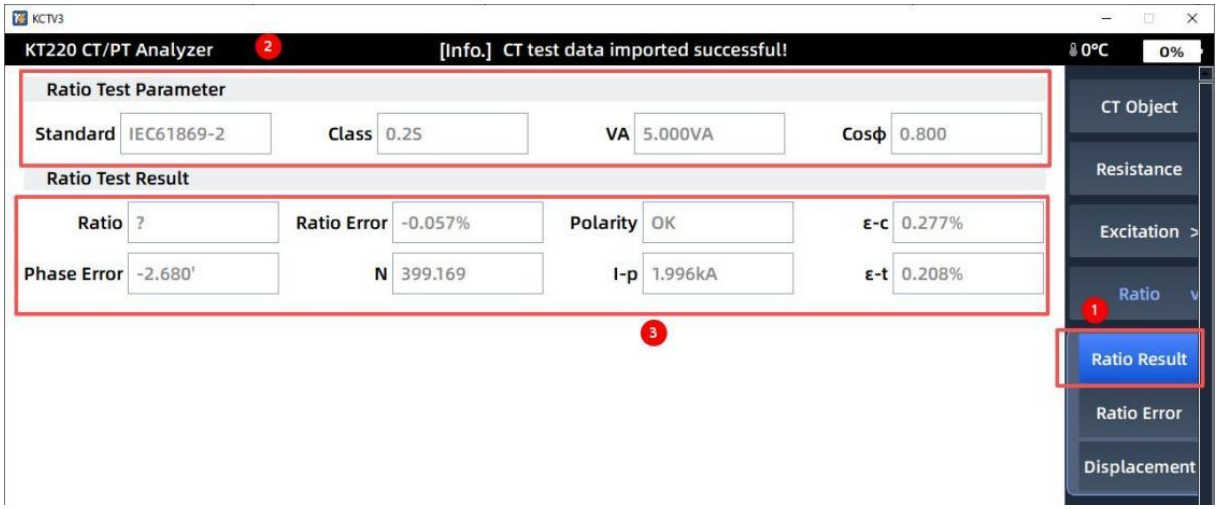


Figure 6-8 Ratio Test Results

6.3.2 Ratio Error List

Click Ratio Error List to display the current ratio error table of the CT under test at different rated current percentages (1%–200%) and different burden values. Typically 100% is used as the reference. Items preceded by "!" are calculated values, while those without are measured values, as shown in Figure 6-9:

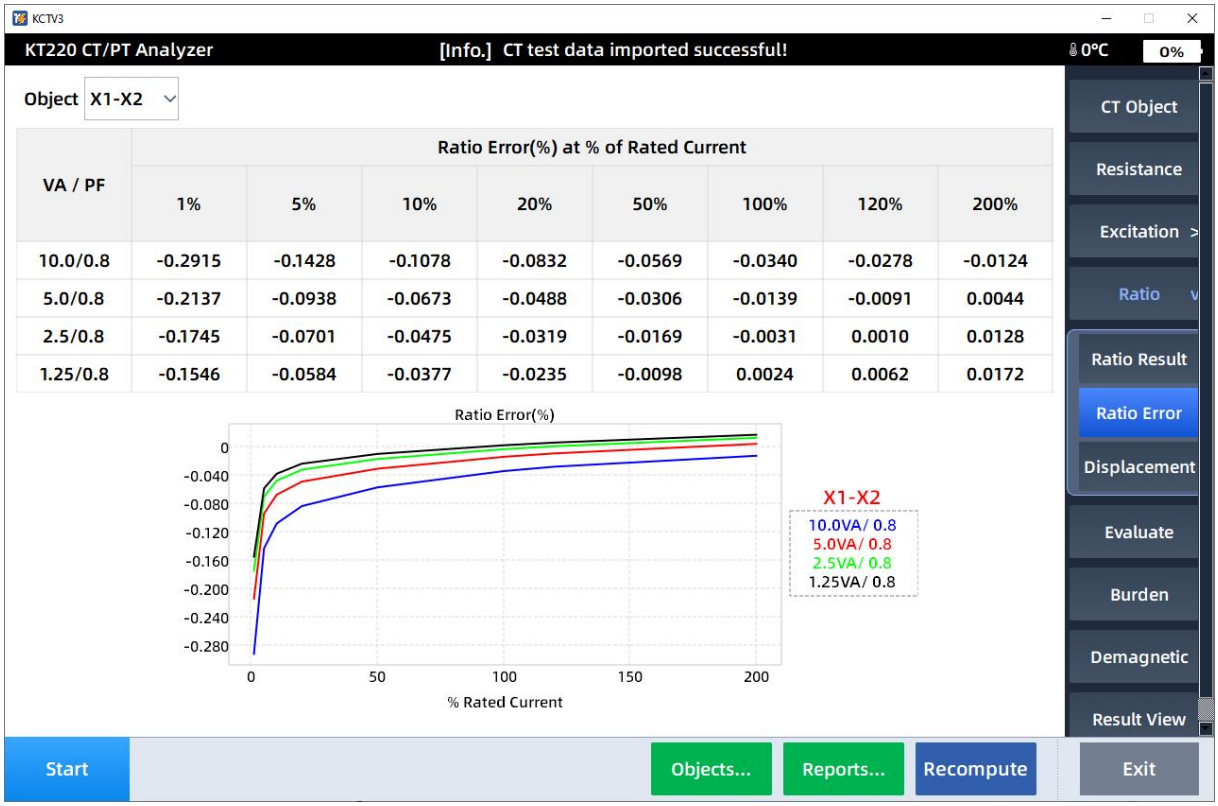


Figure 6-9 Ratio Error List Interface

6.3.3 Phase Displacement List

Click Phase Displacement List to display the phase displacement table of the CT under test at different rated current percentages and different burden values, as shown in Figure 6-10:

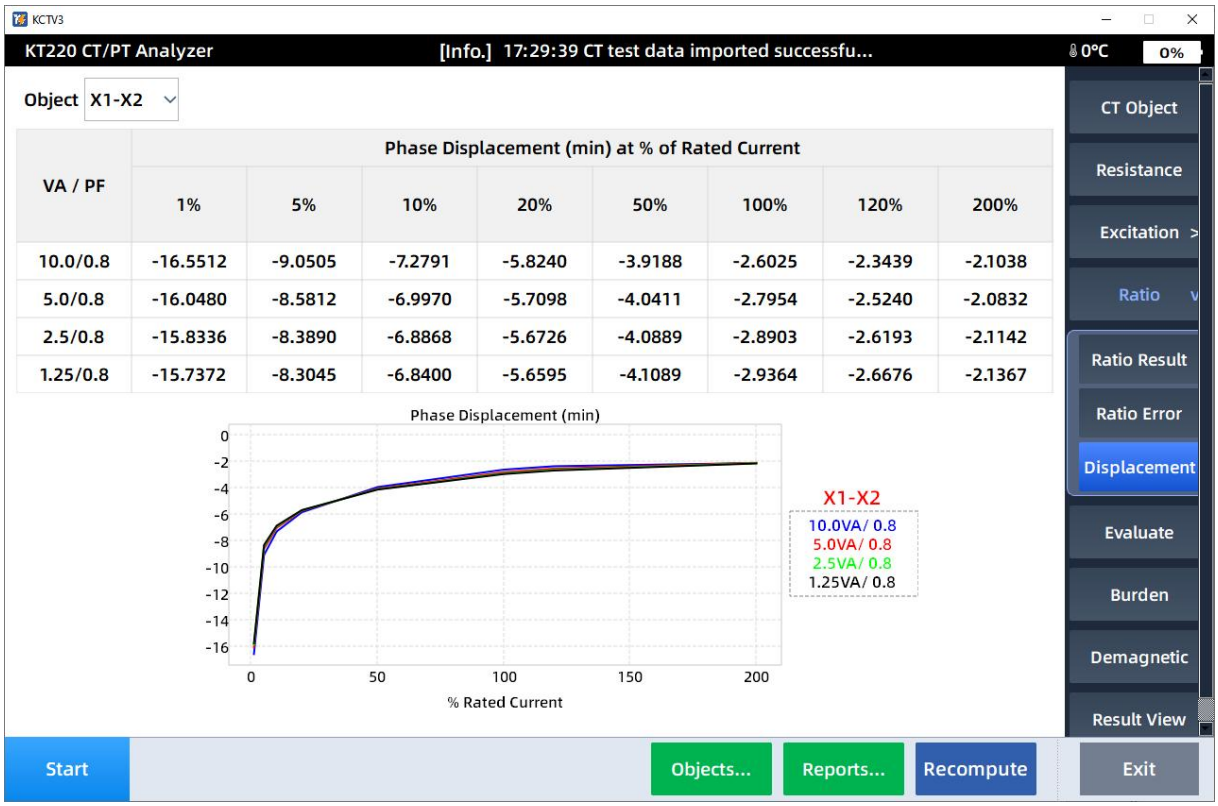


Figure 6-10 Phase Displacement List Interface

6.4 Evaluation

Evaluation is used to compare CT set parameters with measured parameters. The evaluation test interface is shown in Figure 6-11:

1. Click Evaluation to display the evaluation interface.

2. Evaluation test parameters are those set in the CT object interface; automatic evaluation uses these as reference.

3. Evaluation test results

- ✧ Class: Related to phase displacement and ratio error. Passes when both comply with the accuracy class standard.
- ✧ Δϕ: Related to phase displacement in the ratio test. Passes when the phase displacement is less than the value specified by the CT accuracy class.
- ✧ ε: Related to ratio error in the ratio test. Passes when the ratio error is less than the value specified

by the CT accuracy class.

✧ FSi: Passes when the FSI measured by the instrument is less than or equal to the FS marked on the nameplate.

4. Manual evaluation is available. Turn on Manual Evaluation as shown in Figure 6-12, and you can select 'Pass', 'Fail', or '?'.

Note: "Pass": The measured results of the parameters comply with the standard parameters set in the CT object card.

"Fail": The results do not meet the requirements.

"?": 1. Cannot be compared with input parameters; 2. Due to incorrect polarity or invalid measured values.

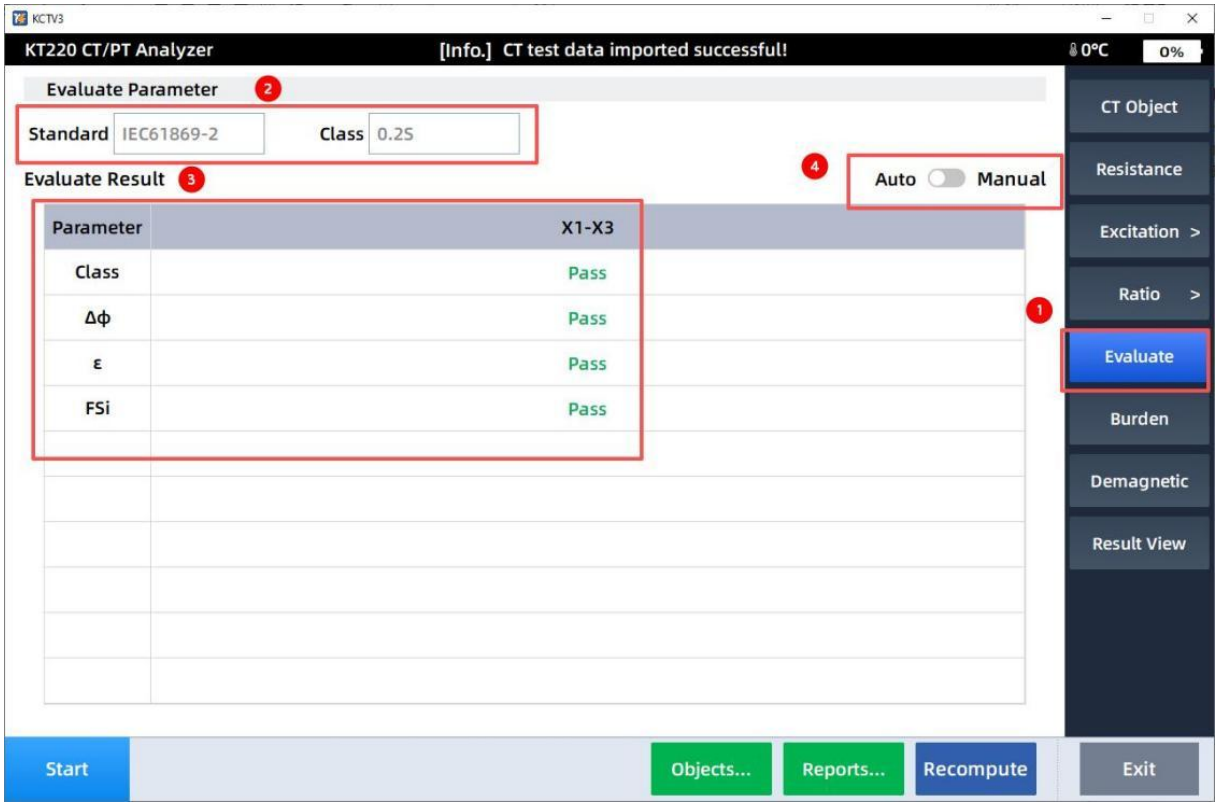


Figure 6-11 Evaluation Interface

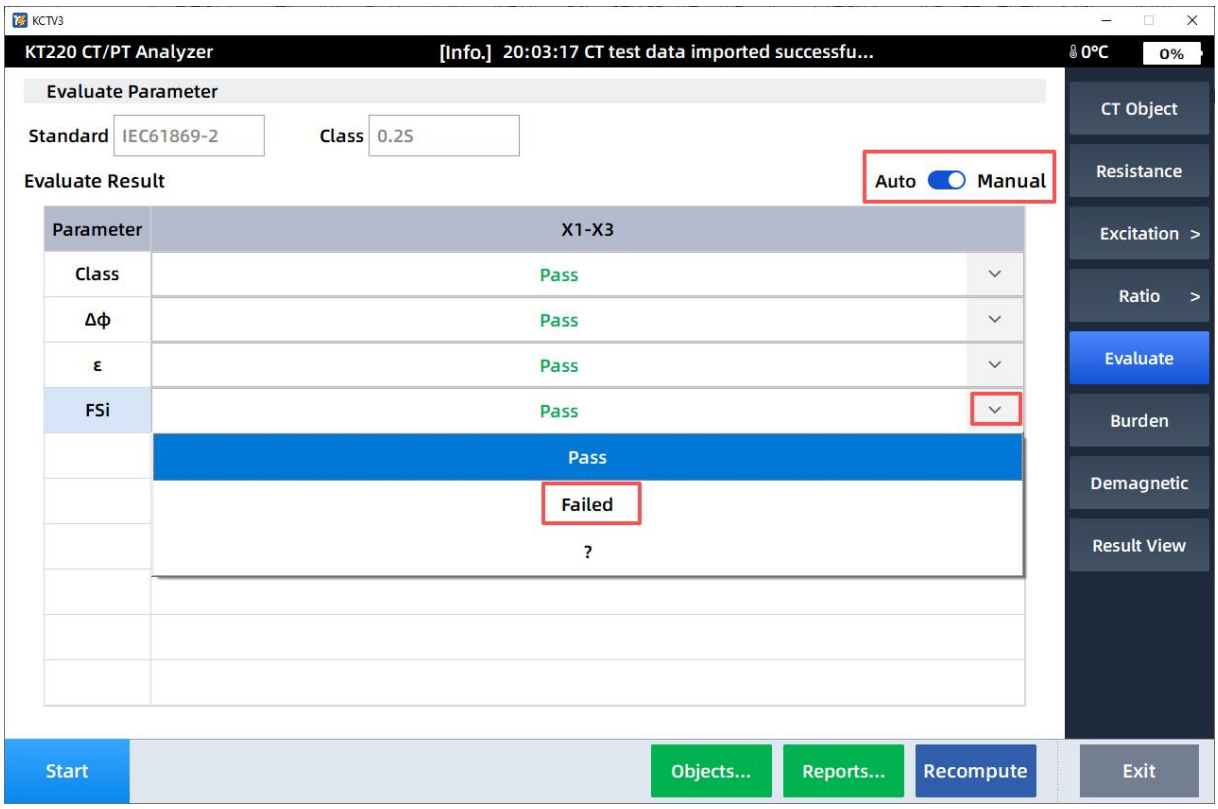


Figure 6-12 Manual Evaluation

6.5 Burden Test

The Burden option is used for CT secondary burden testing. The CT secondary burden impedance refers to the burden impedance presented at the secondary terminals of the current transformer. It includes relay impedance and connecting lead impedance. In relay protection, when the maximum short-circuit current flows through the CT, the maximum allowable burden under 10% (or 5%) error must be greater than the actual secondary burden. Therefore, the purpose of the CT secondary burden test is to provide measured secondary burden values for relay protection calculations and burden comparison.

The CT secondary burden test interface and wiring diagram are shown in Figure 6-13:

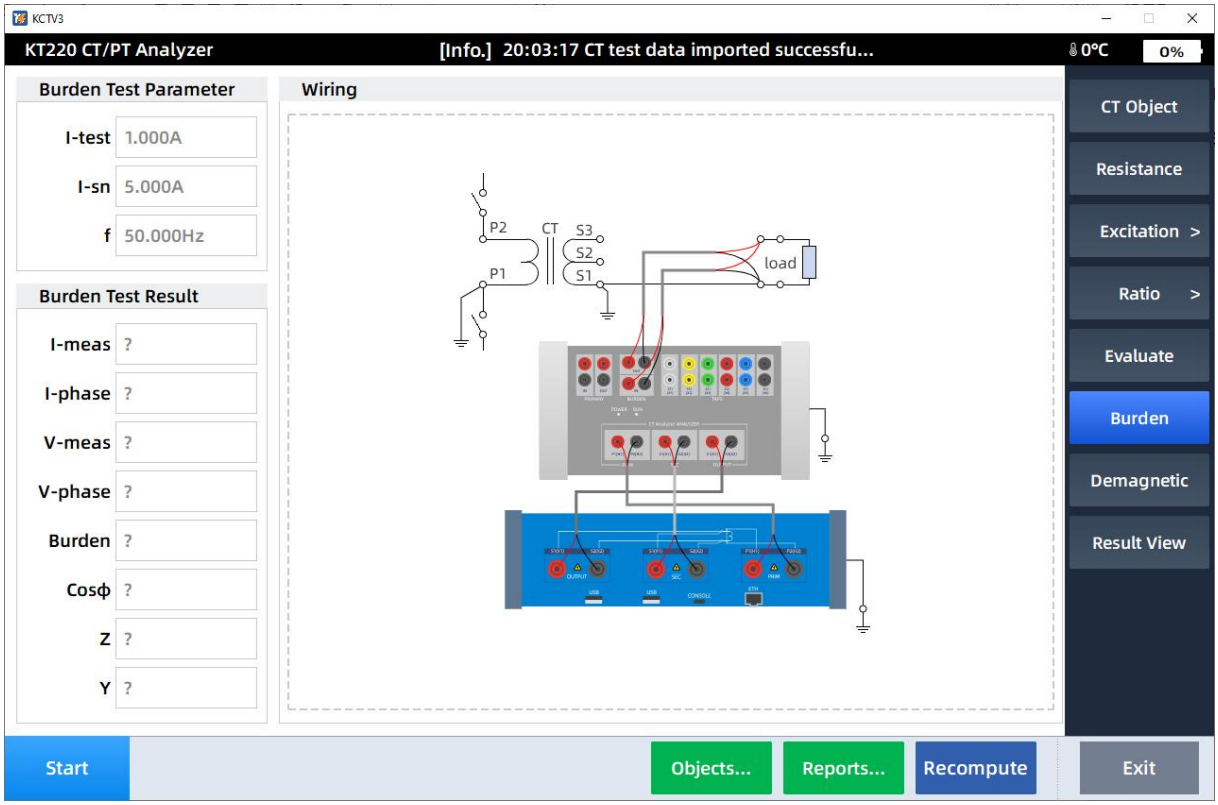


Figure 6-13 Burden Test Interface

Connect the CT according to the above wiring method;

Set CT parameters as described in Section 5.3;

Select the Burden option in CT-Object and press the Start button to begin testing.

If a test current is set, the burden test is performed at the input test current.

If no test current is set, the burden test is performed at 1A.

All currents are at the rated frequency.

CT burden test results are shown in the following table:

I-meas	Current used for CT burden testing, range 0.1–2A, default 1.0A
I-phase	Current phase
V-meas	Voltage RMS value
V-phase	Voltage phase
Burden	Burden
CosΦ	Power factor
Z	Impedance
Y	Admittance

Table 6-5

6.6 Manual Demagnetization

The KT220 automatically demagnetizes upon test completion.

Manual demagnetization is required in the following situations:

1. Large discrepancies between consecutive tests

2. The previous test was interrupted

Click Manual Demagnetization on the right, click Start, and wait for manual demagnetization to complete.

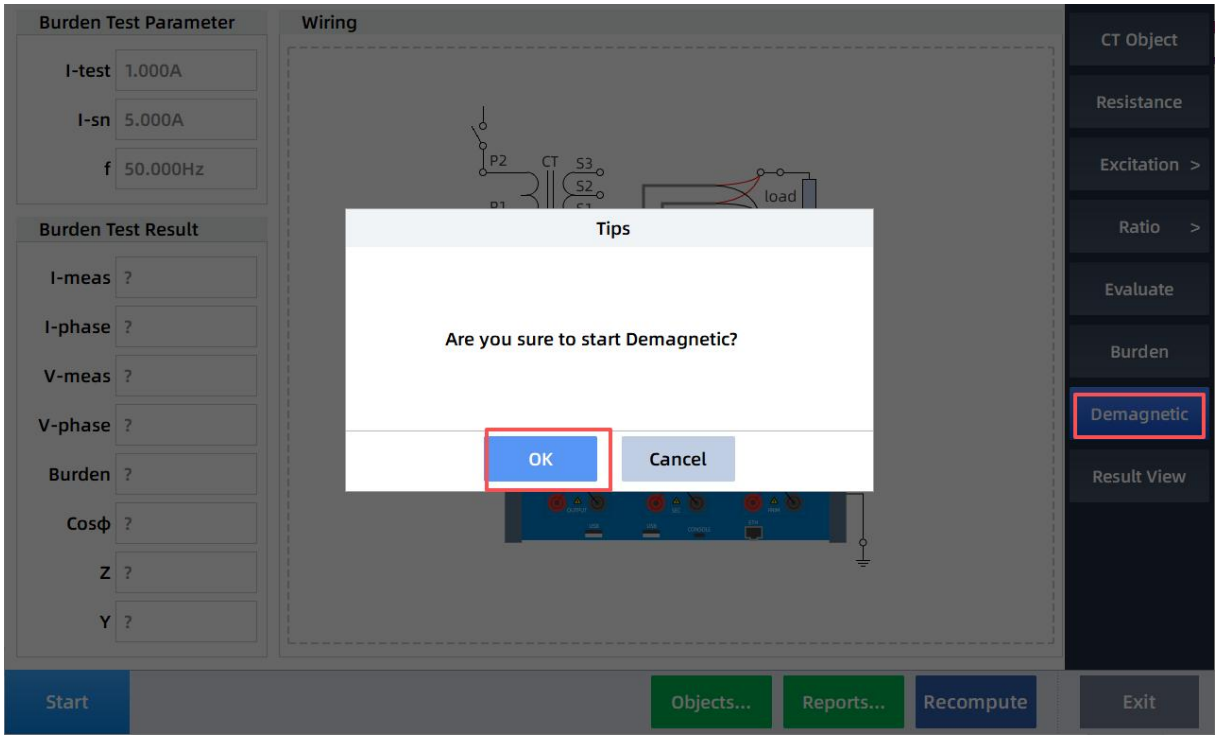


Figure 6-14 Manual Demagnetization

6.7 Object and Report

Click Object or Report in any test interface to save or import reports and CT objects at any time, as shown in Figure 6-15.

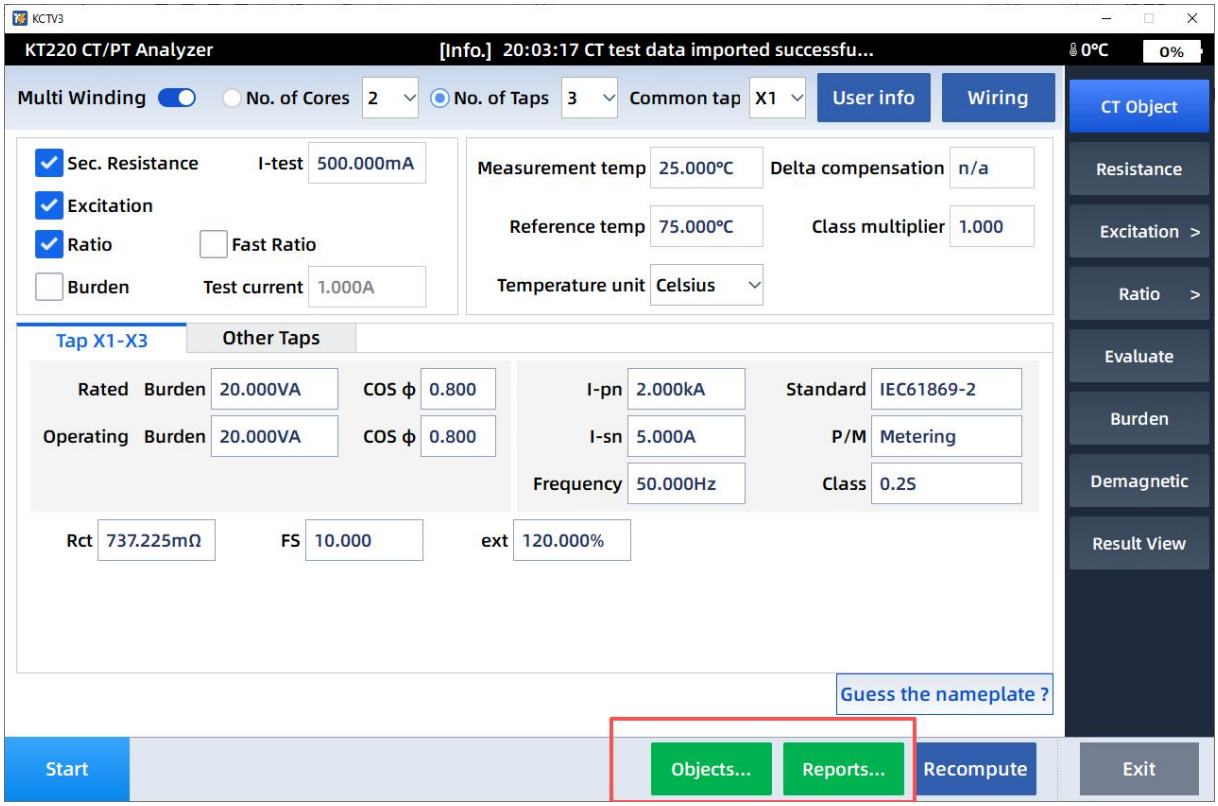


Figure 6-15 Object Save/Load and Report Save/Load

6.7.1 Object Save/import:

1. Fill in the parameters to be saved and click Object

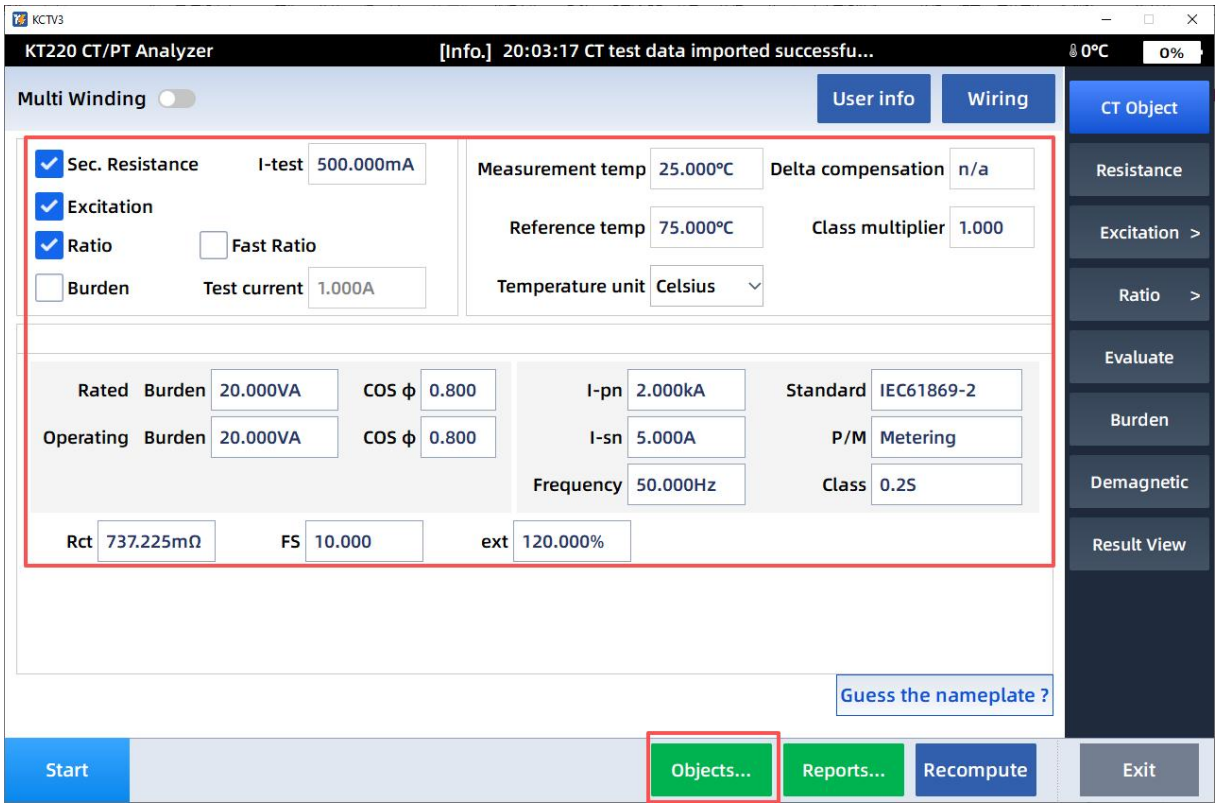


Figure 6-16 Save Parameter Settings

2. Name the file and click Save.

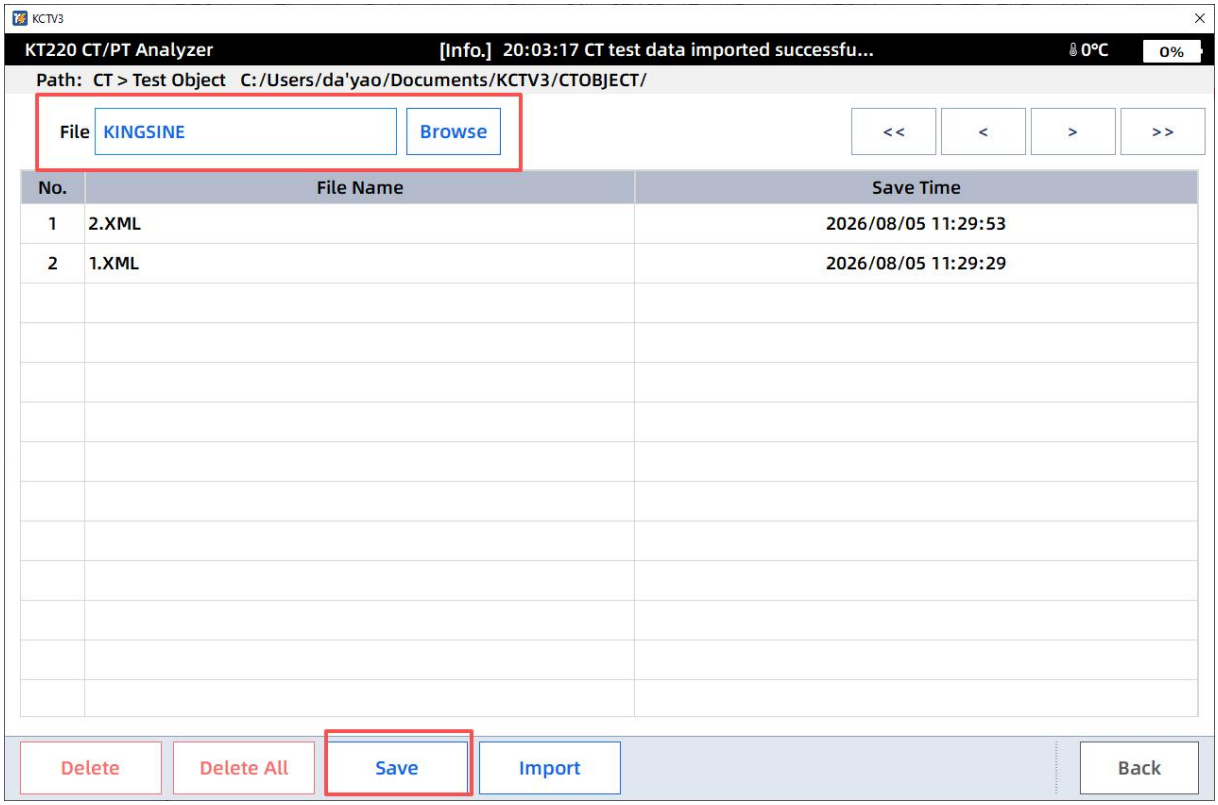


Figure 6-17 Click Save

3. Import file: Select any file, click Import, and the CT object card will automatically fill in these parameters.

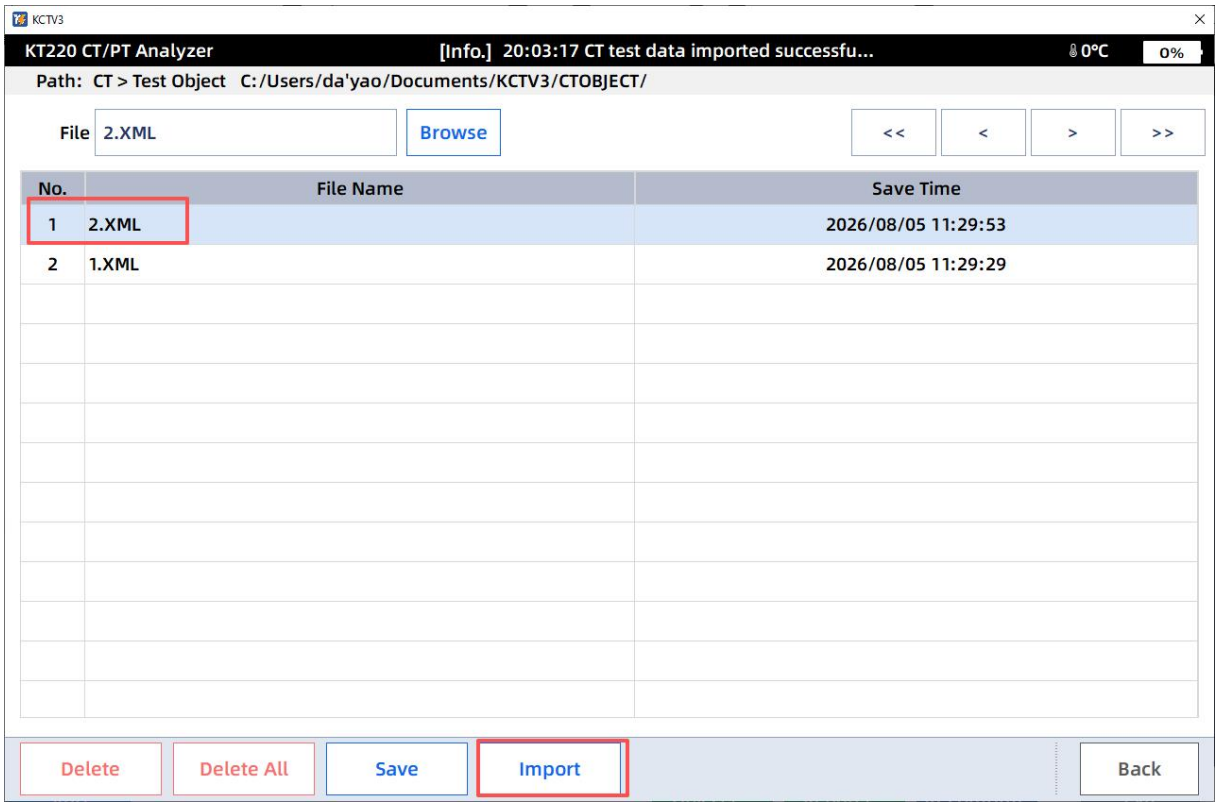


Figure 6-18 Import File

6.7.2 Report Save/Load

Report Save/Load is similar to Object Save/Load in save and import methods, except that the report view can be used in this interface to preview reports.

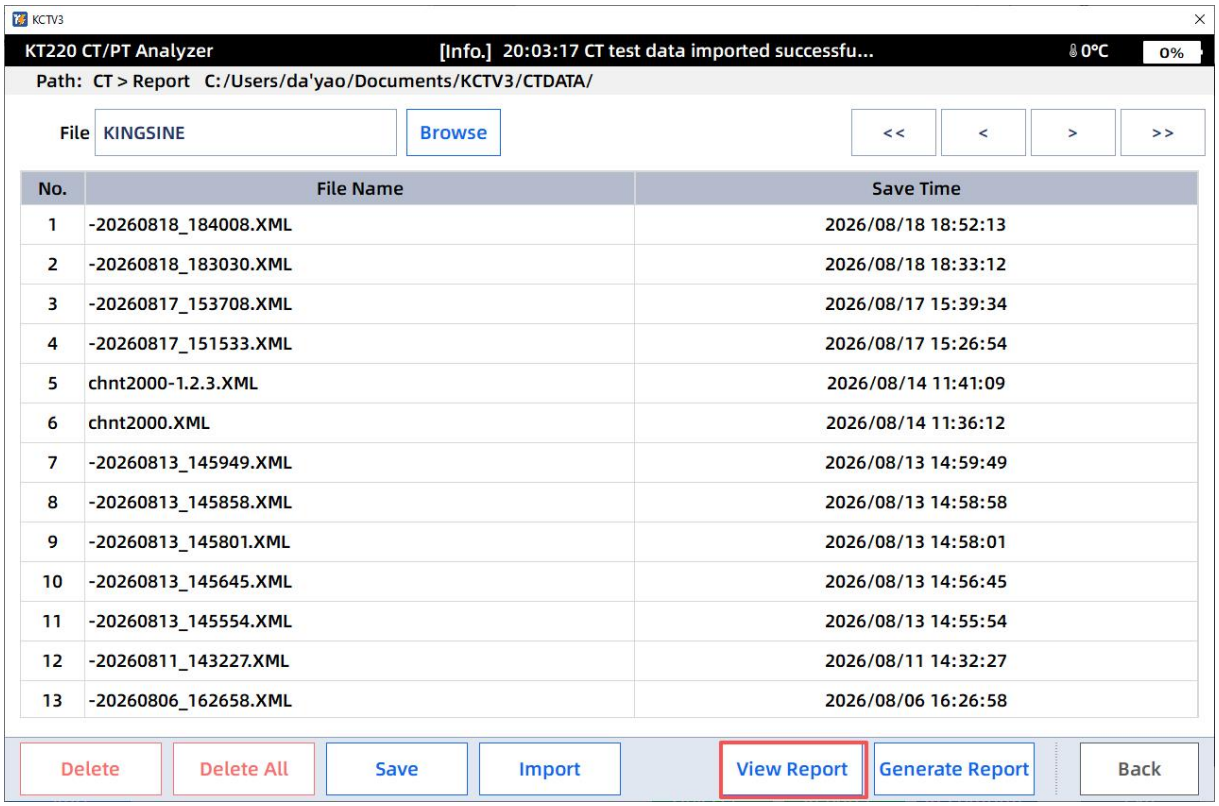


Figure 6-19

After entering the report view:

1. Click any test result under Basic Information to jump the report interface to that result.

2. You can customize the content displayed in the report, including excitation curve, excitation error, ratio error, phase displacement, evaluation, etc., as well as the display of figures and tables.

Note: On the PC side, the report preview automatically refreshes after each check. On the slave side, manual refresh is required; after refreshing, if no check operation is performed, the refresh button will be grayed out.

3. The report preview can be scrolled up and down.

Figure 6-20 Report View

6.7.3 Generate Report

The analyzer can generate RTF format reports and export them to a USB drive, while the PC side can generate RTF, PDF, and Excel formats.

1. Click "Generate Report"

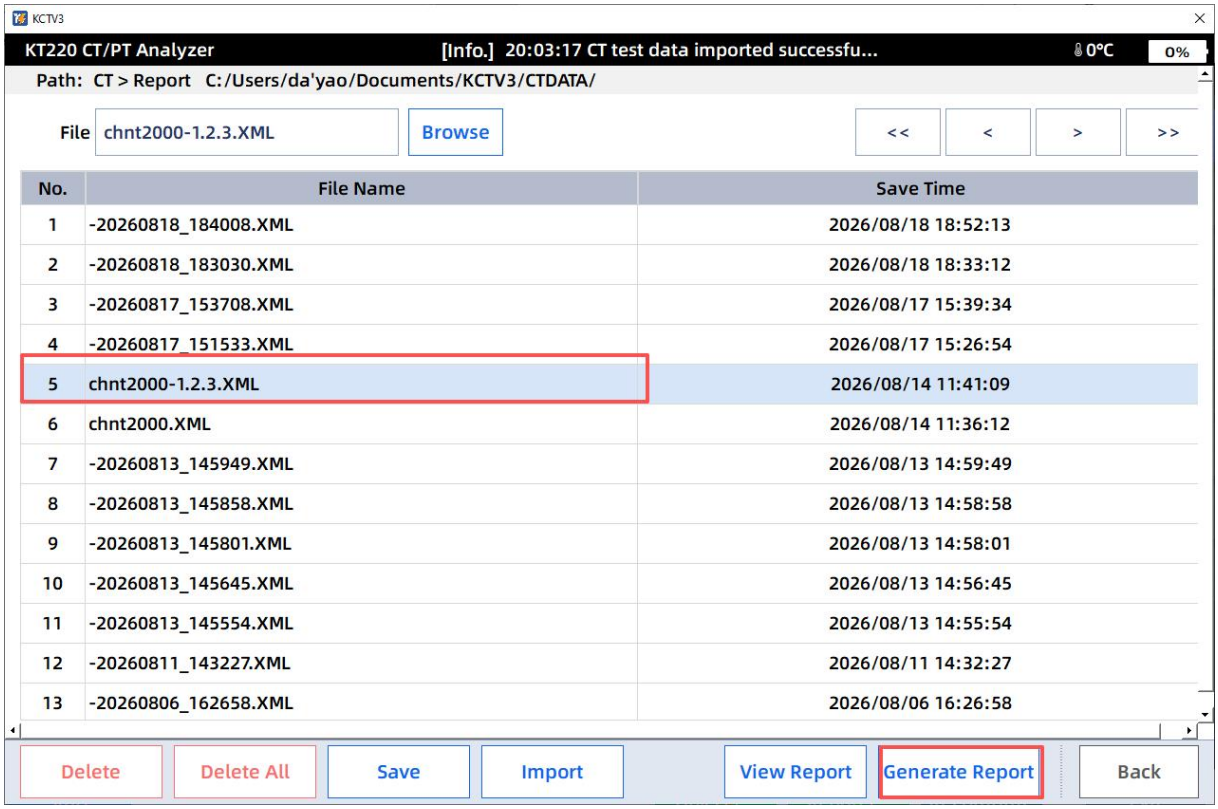


Figure 6-21 Generate Report

2. For PC-side reports, directly select the format and save on the computer.

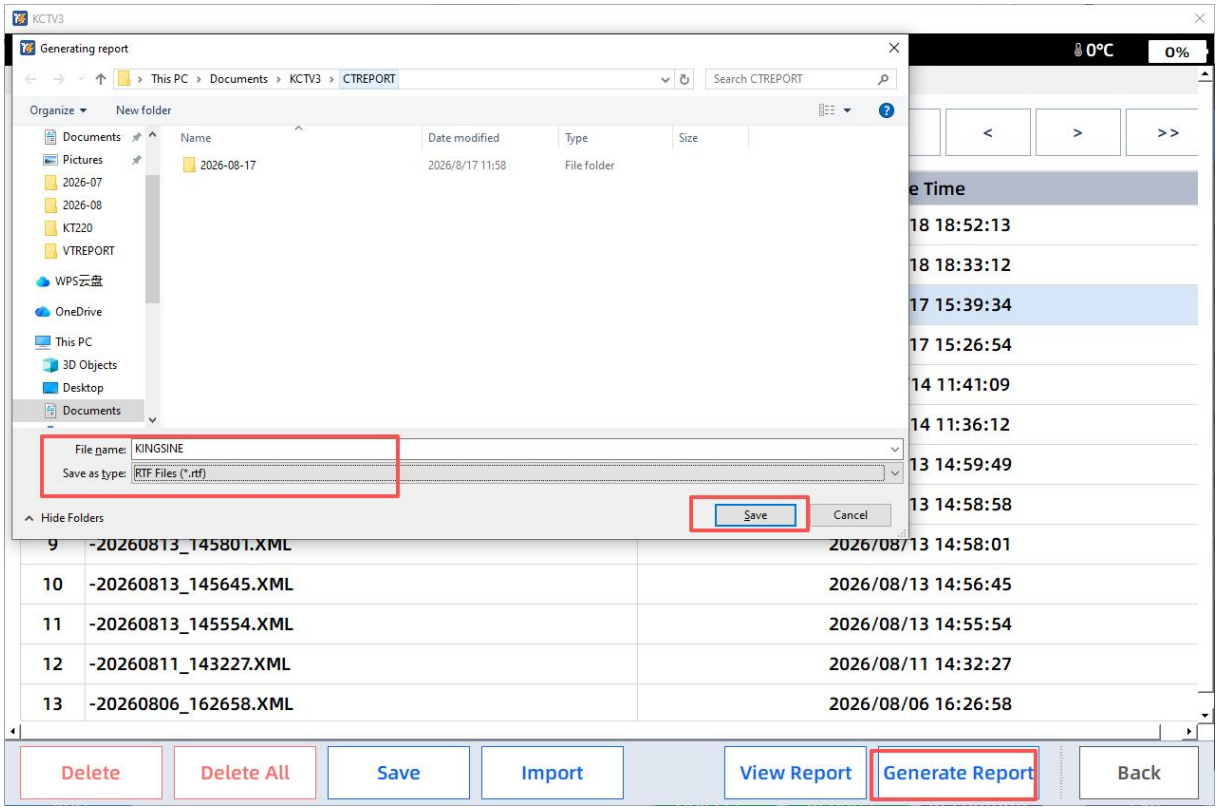


Figure 6-22 PC-side Save

3. For the analyzer, save to a local file.

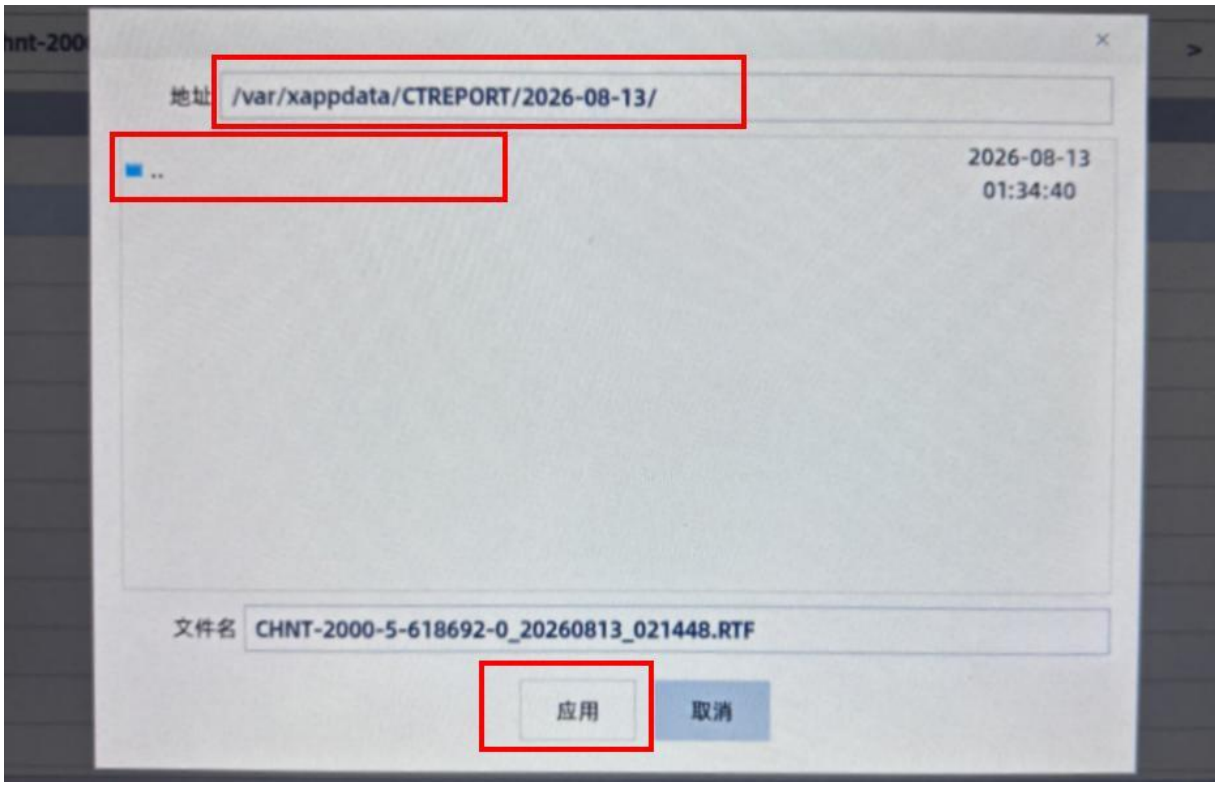


Figure 6-23 Save File

Note: Click the folder and select the file storage location.

4. Export to USB drive

Figure 6-24 export

Note: (1) Select the report to be exported.

(2) Insert the USB drive and select the USB drive folder to receive the file.

(3) Click the right-pointing button to export to the USB drive. Similarly, use the left-pointing button to import files from the USB drive to local storage.

Chapter 7 System Introduction

The KT220 Comprehensive CT Analyzer software includes host software and slave software, with essentially the same operating interface（except advanced CT）.

The host software system interface includes operation options such as software, system, calibration, self-inspect, Results; as shown in Figure 7-1:

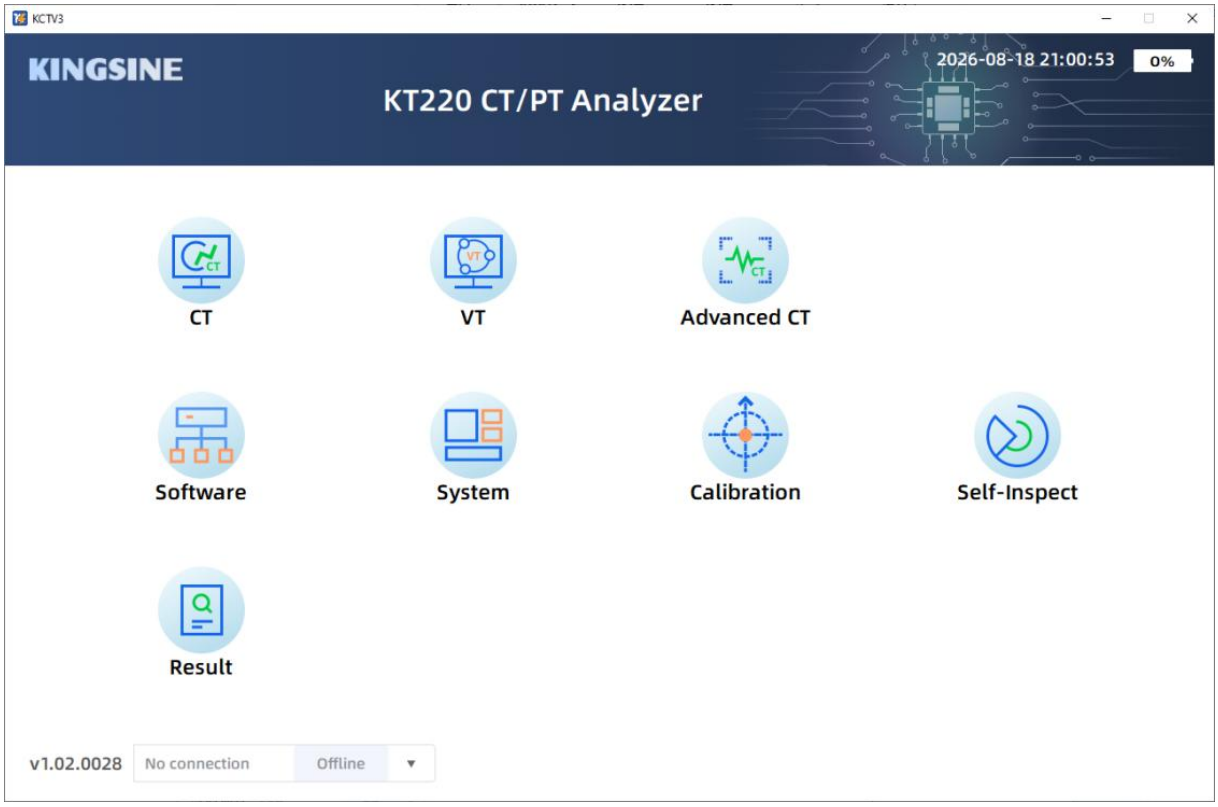


Figure 7-1 Main Interface

7.1 Software

1. Enter the Software Configuration interface to view and modify CT decision thresholds, with descriptions of these thresholds on the right.

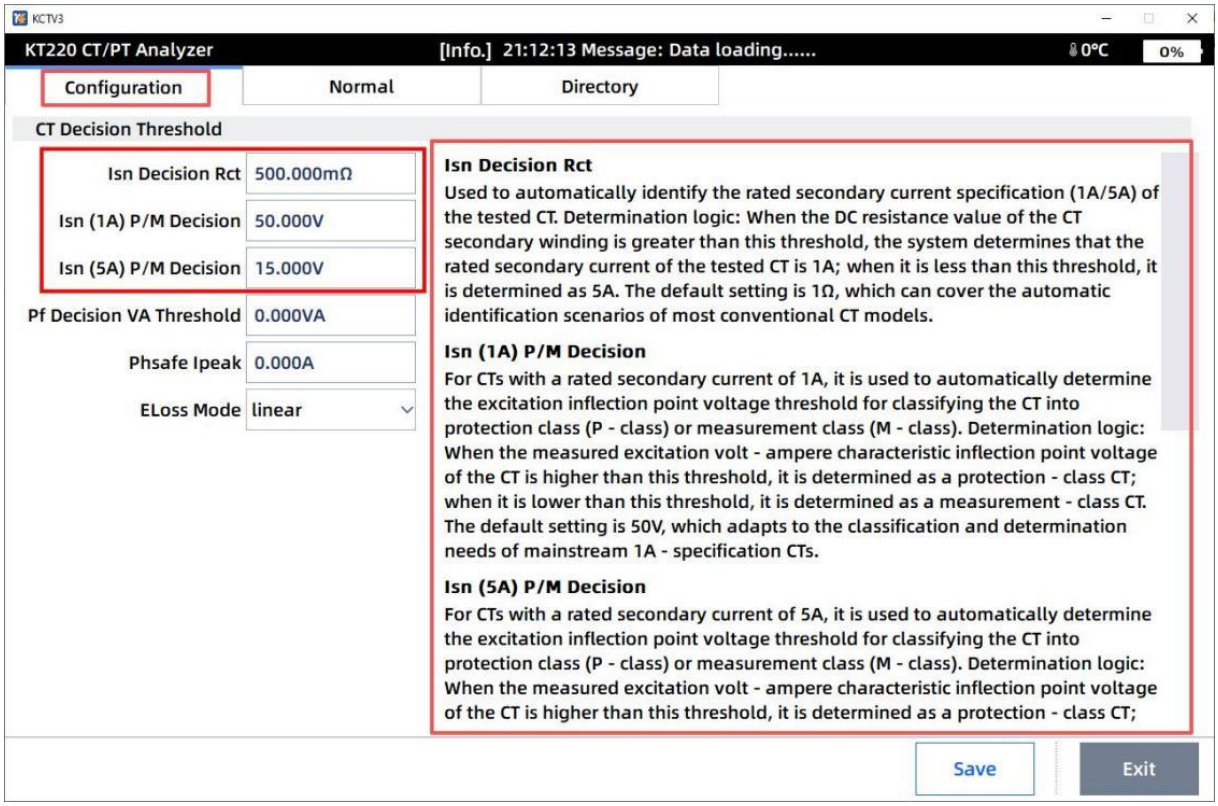


Figure 7-2 Software Configuration Interface

2. Click 'General' to select the system theme (blue, green, yellow);

- ✧ General settings: includes key tone enable (when checked, clicking produces a key sound effect);
- ✧ System language: can switch to other languages (Chinese, English);
- ✧ System time: time setting;
- ✧ Screen brightness: enter a brightness percentage to adjust screen brightness;
- ✧ Auto power-off time: device auto power-off time;
- ✧ Screen timeout: set the screen-on time
- ✧ Battery strategy: can select conservative mode and aggressive mode
- ✧ Working environment: Embedded, PC-side

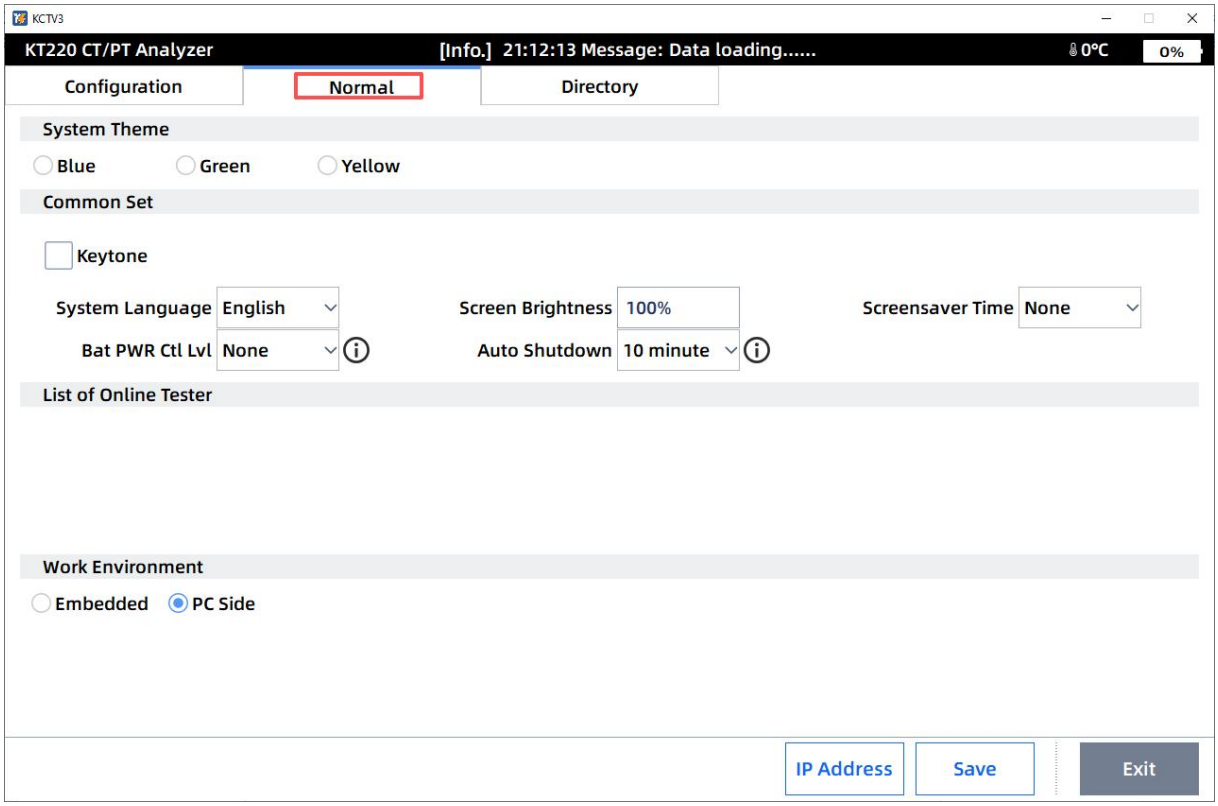


Figure 7-3 General Configuration Settings Interface

7.2 System

1.system

click system to view CT decision threshold

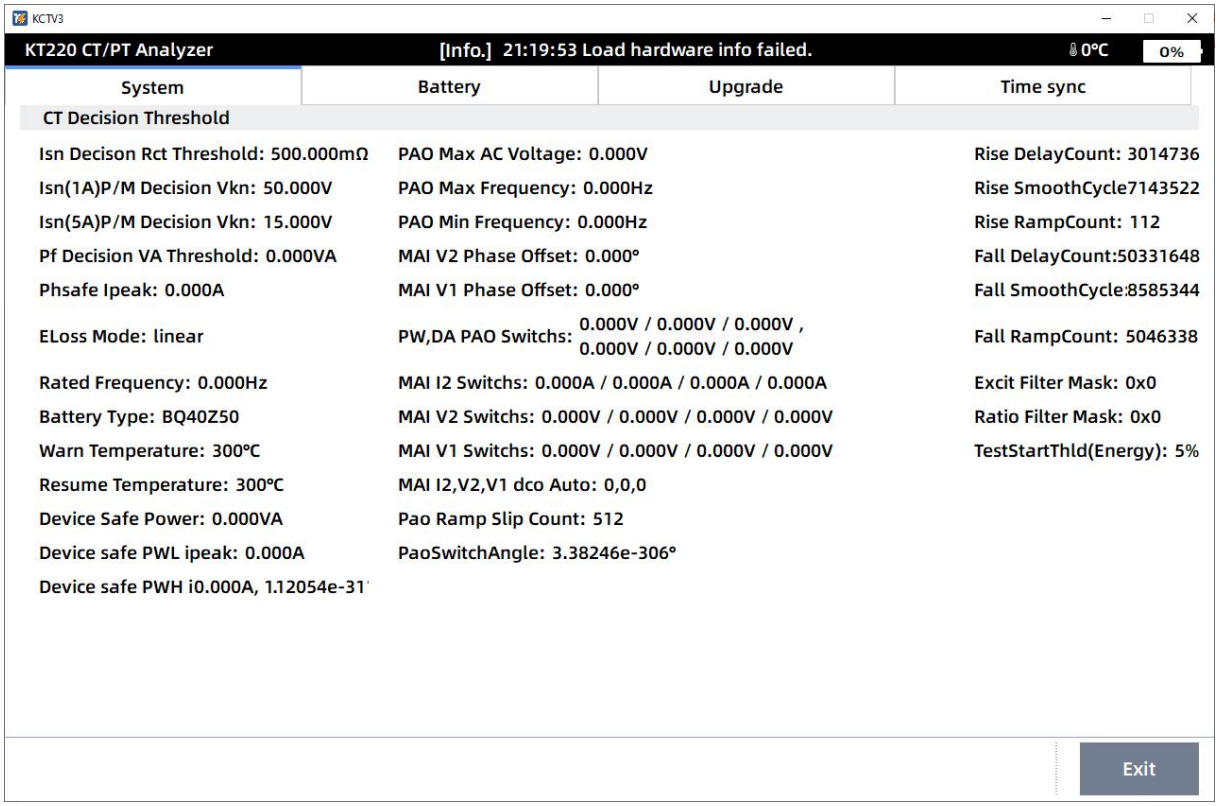


Figure 7-4 CT decision threshold Interface

2.battery

Displays battery parameter information of the analyzer. You can view battery sampling values, status, MOS status, etc., as shown in Figure

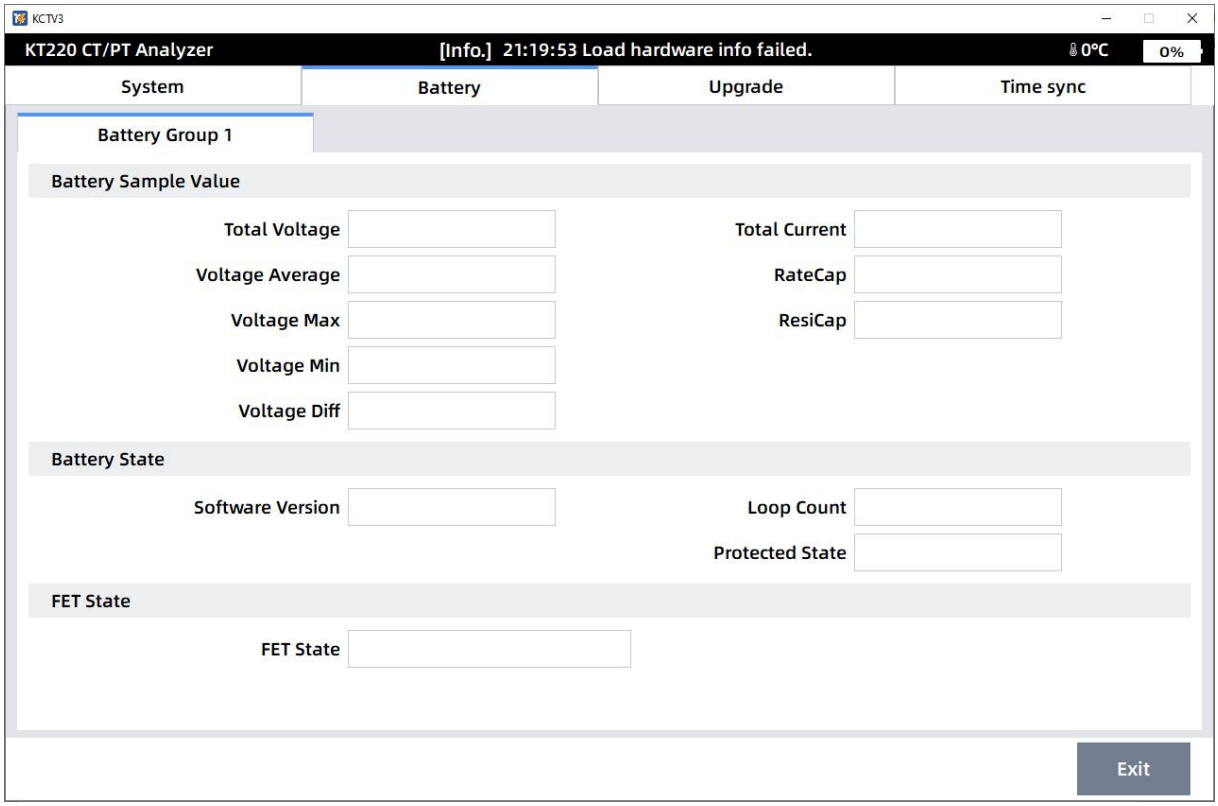


Figure 7-5 Battery Information

3.upgrade

Click upgrade to enter the software upgrade interface, used to upgrade the analyzer's firmware and application (available for handheld models).

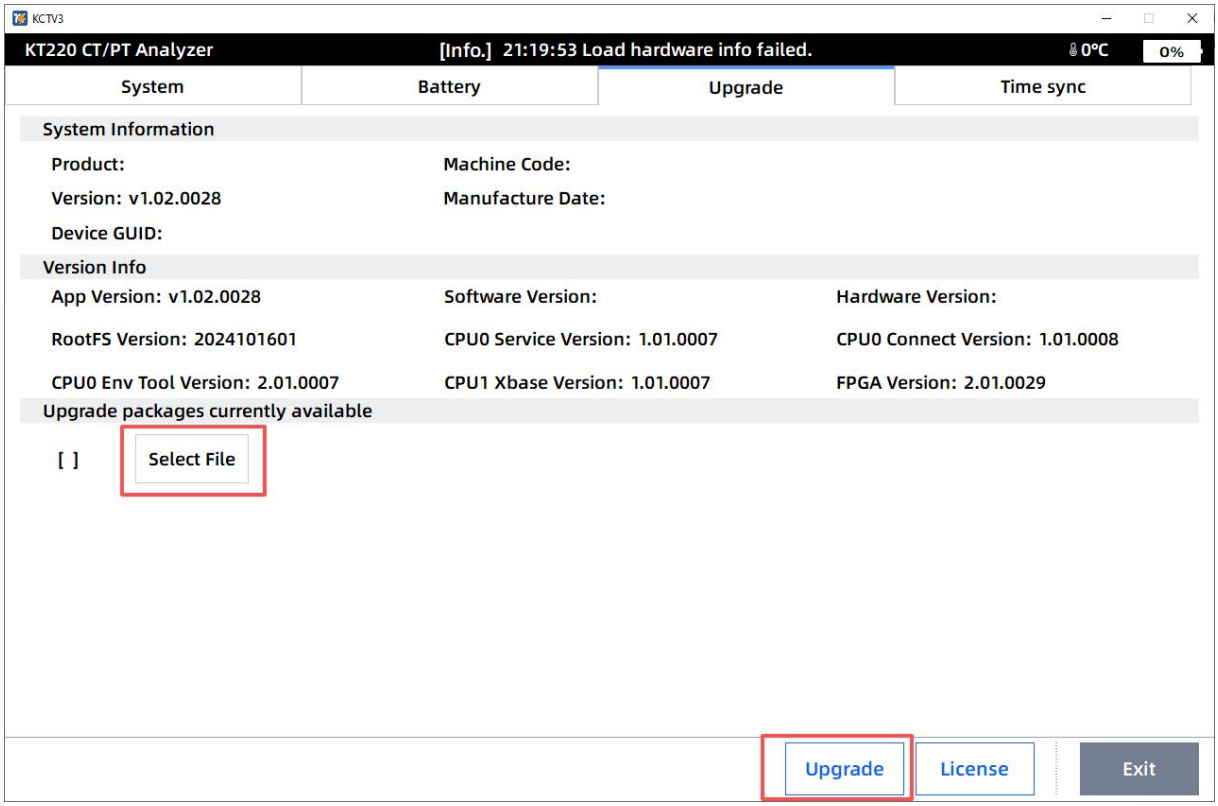


Figure 7-6 upgrade interface

1. Copy the upgrade software to a USB drive.

2. Click 'Select File' in the software to choose the upgrade file.

3. Click Upgrade. The analyzer must not be powered off during the process. After the application is upgraded, the software will restart automatically.

Note: the USB drive used to store the installation package and upgrade the device must be formatted as FAT32 to upgrade the PC application TO latest version,just install the new installation package that we send

4.time synchronization

the device supports time synchronization different time zones

1.select NTP sever

2.select time zones

3.click sync

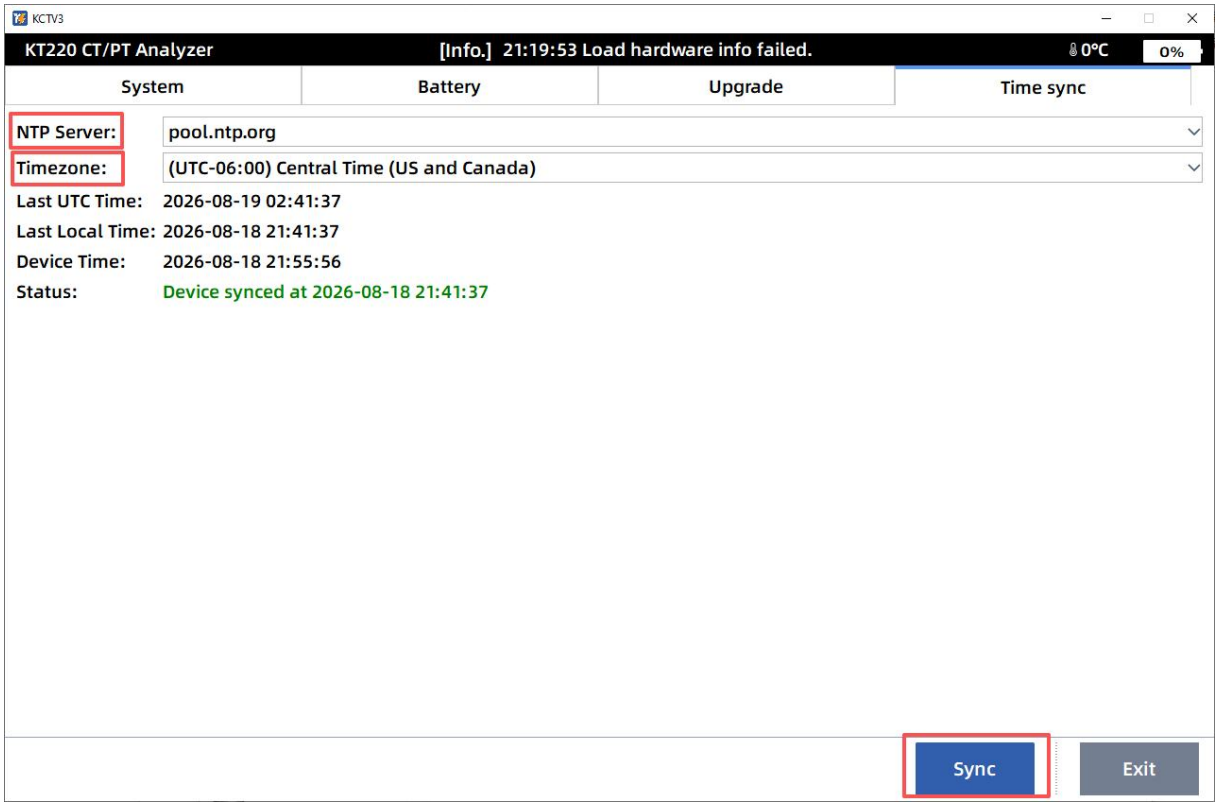


Figure 7-7 time synchronization interface

7.3 Calibration

Calibrate the analyzer to ensure test accuracy, as shown in Figure 7-8:

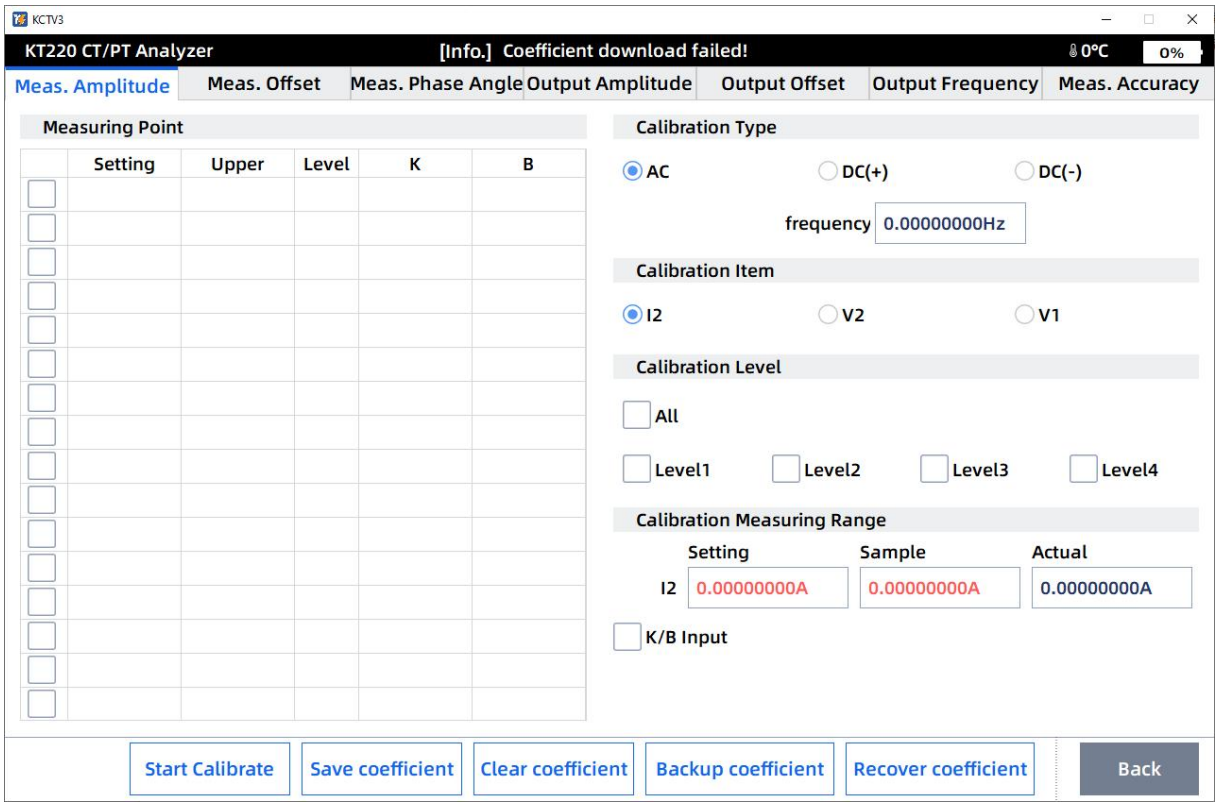


Figure 7-8 Calibration Interface

Calibration must be performed by professional personnel. Entering the calibration interface requires an authorization password. If you are not a professional, do not enter the calibration interface casually, otherwise it may cause deviations or even errors in instrument testing.

7.4 Self-Test

The Self-Test interface is used to check the measurement accuracy of the KT220 Comprehensive CT Analyzer. In the test interface, output modes such as AC, DC, and square wave can be set. When wiring is correct, each measured value will be output and displayed; the operator can inspect them. As shown in Figure 7-9:

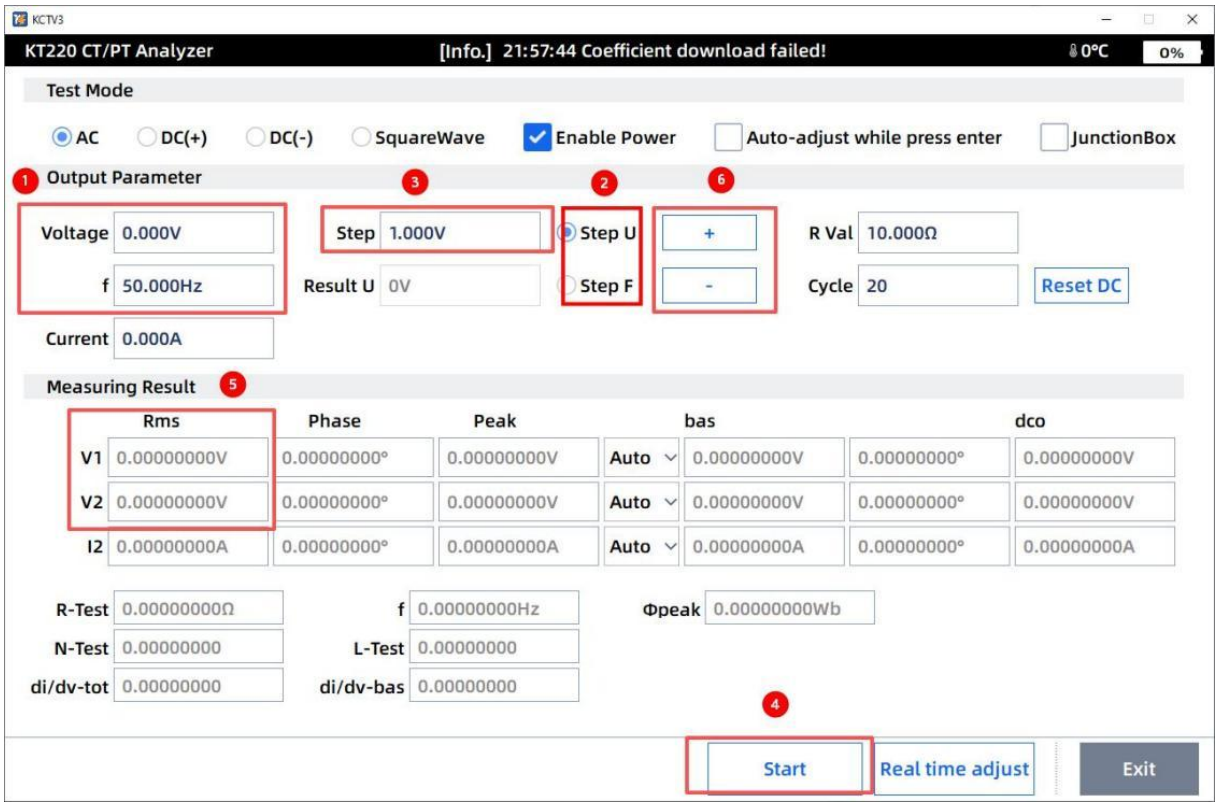


Figure 7-9 Self-Test Interface

Generally, connect a CT, set the output voltage or current, maintain it for a certain time, and observe the ratio value. This is used for checking the measurement accuracy of the KT220 Comprehensive CT Analyzer.

Steps:

1. Set output voltage and frequency

2. Select voltage step or frequency step

3. Set the step

4. Click Start

5. V2 is the voltage value set in the output parameters; V1 is the measured value based on the CT ratio. Calculate V2/V1 and observe the error from the ratio.

6. Add or subtract steps and observe changes in V1, V2, and V2/V1.

7.5 Results

The results are presented in Section 6.7.2

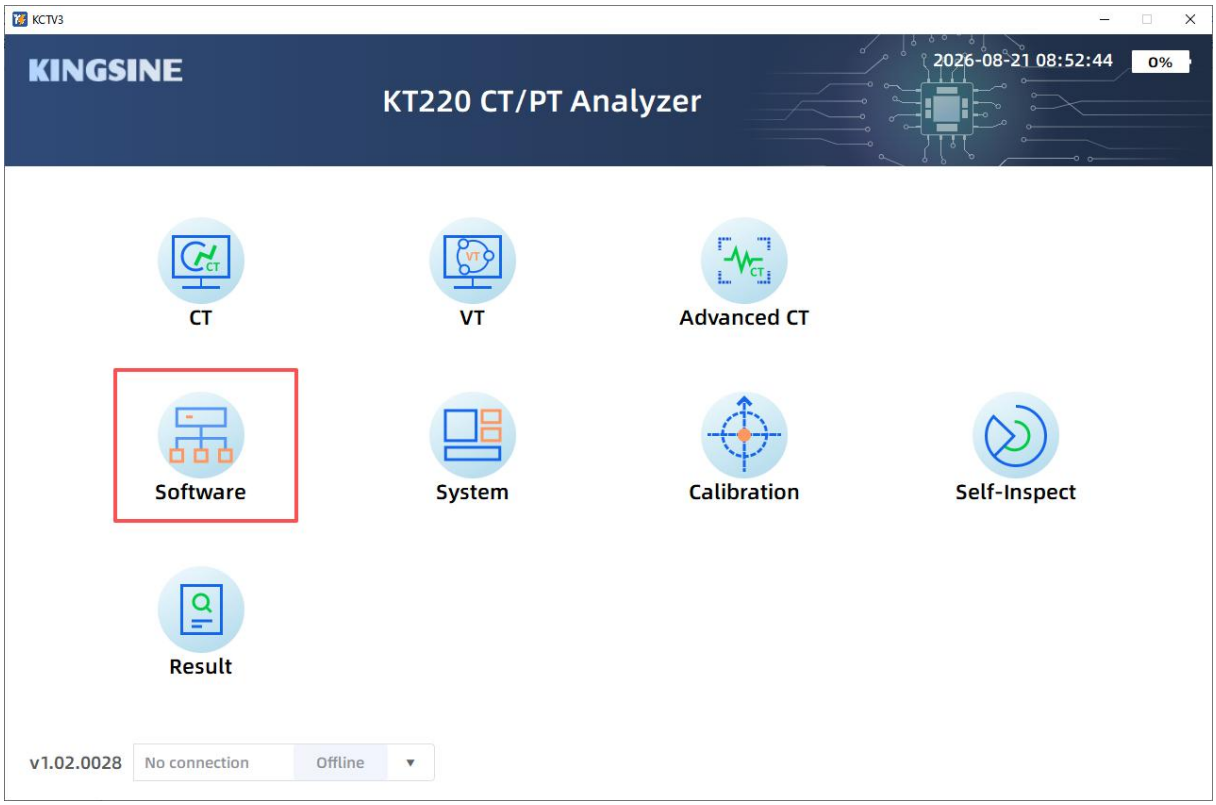
7.6 Files

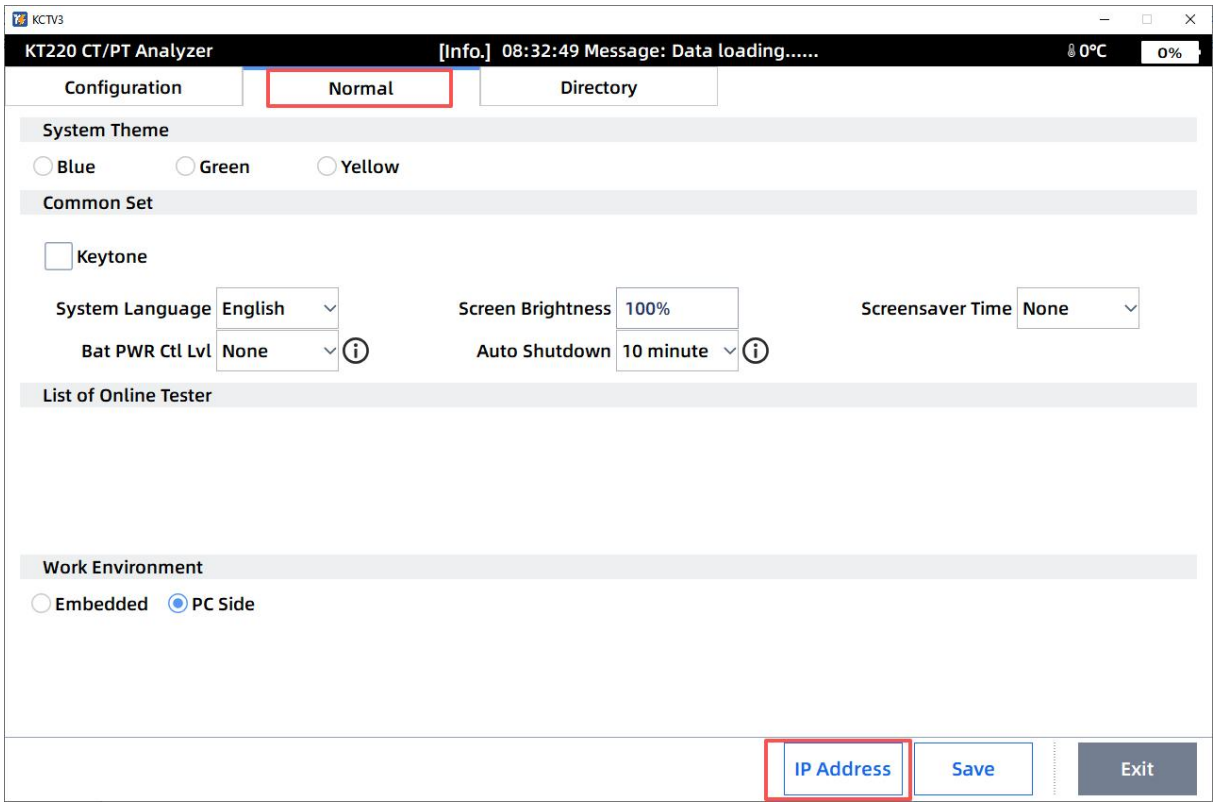
The results are presented in Section 6.7.3

7.7 Online Connection

Online connection steps:

1. View device IP address: Software Configuration --- General --- IP Address




KCTV3
KT220 CT/PT Analyzer
[Info.] 08:32:49 Message: Data loading.....
0°C
0%
Configuration
Normal
Directory
System Theme
Blue
Green
Yellow
Common Set
Keytone
System Language English
Screen Brightness 100%
Screensaver Time None
Bat PWR Ctl Lvl None
Auto Shutdown 10 minute
List of Online Tester
Work Environment
Embedded
PC Side
IP Address
Save
Exit

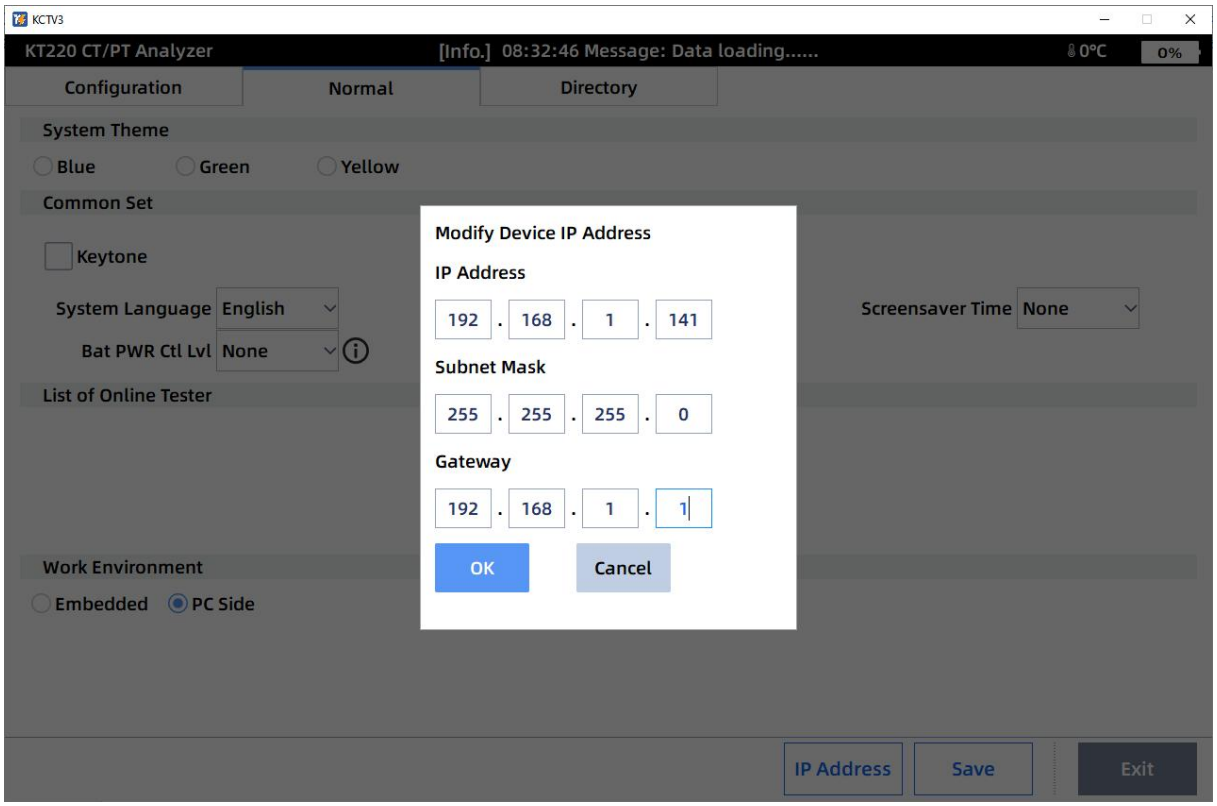

KCTV3
KT220 CT/PT Analyzer
[Info.] 08:32:46 Message: Data loading.....
0°C
0%
Configuration
Normal
Directory
System Theme
Blue
Green
Yellow
Common Set
Keytone
System Language English
Screensaver Time None
Bat PWR Ctl Lvl None
List of Online Tester
Work Environment
Embedded
PC Side
Modify Device IP Address
IP Address
192 . 168 . 1 . 141
Subnet Mask
255 . 255 . 255 . 0
Gateway
192 . 168 . 1 . 1
OK
Cancel
IP Address
Save
Exit

Figure 7-10

2. Set computer IP address: Open File Explorer, right-click and select Properties

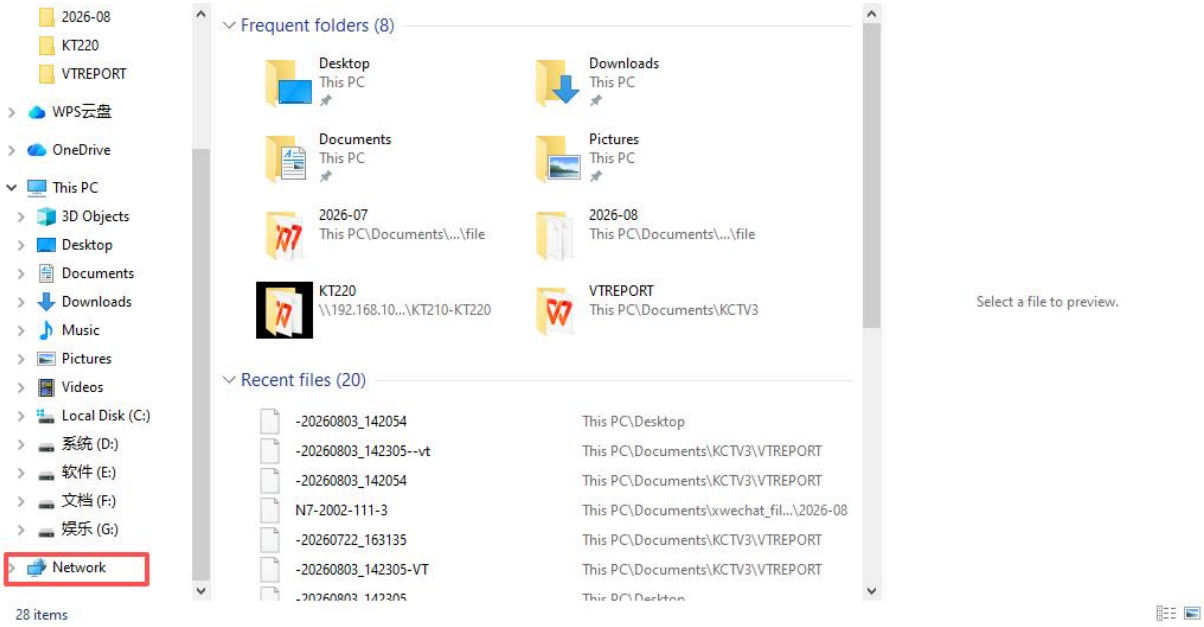


Figure 7-11

Click Ethernet

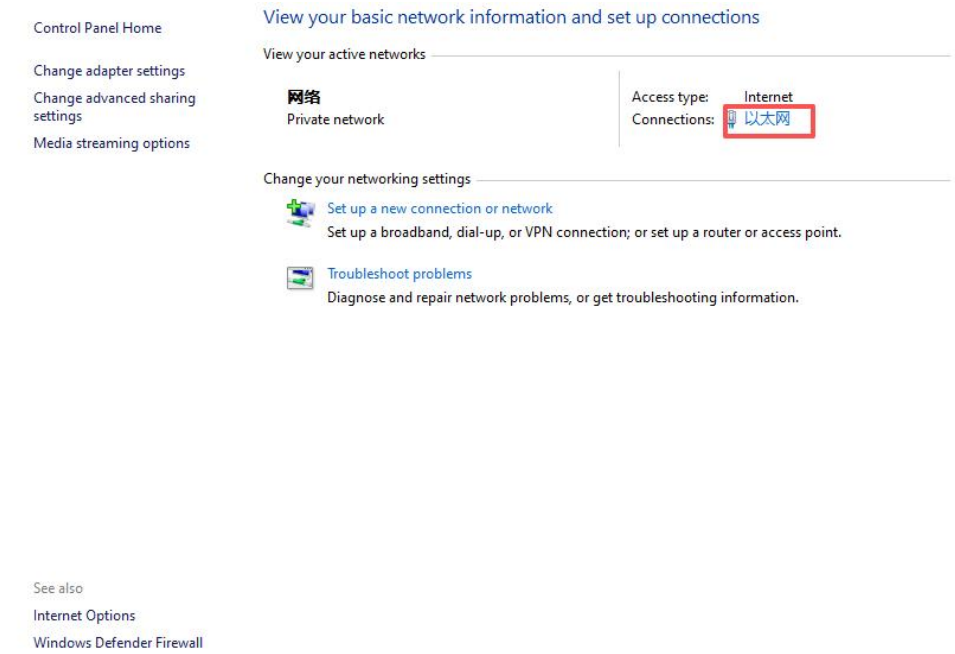


Figure 7-12

Click Properties --- Click Internet Protocol Version 4 --- Manually add address

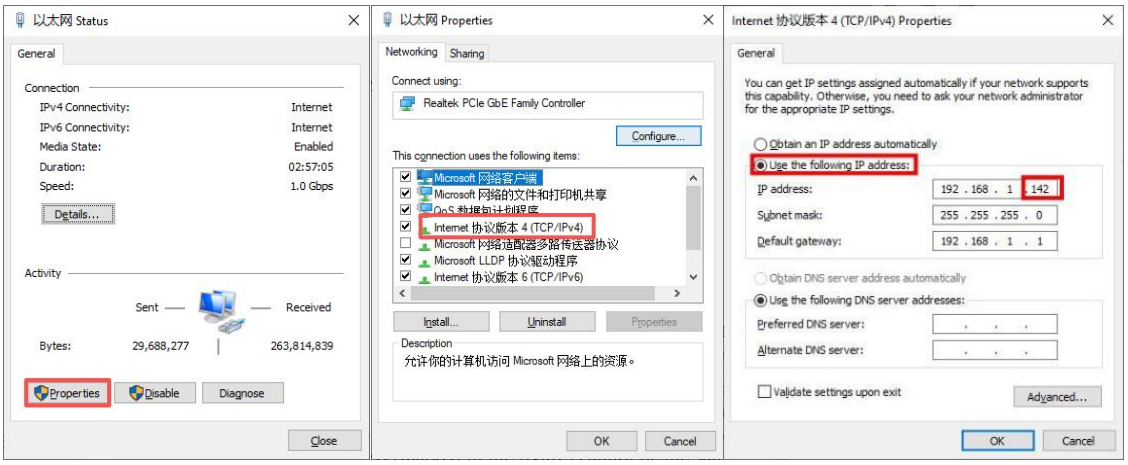


Figure 7-13

Note: The last digit of the IP address (marked in the figure) cannot be the same as the device; any other digit is acceptable.

Turn on the remote control switch at the bottom left of the device --- Click the device list at the bottom left of the computer --- Select the device to connect online

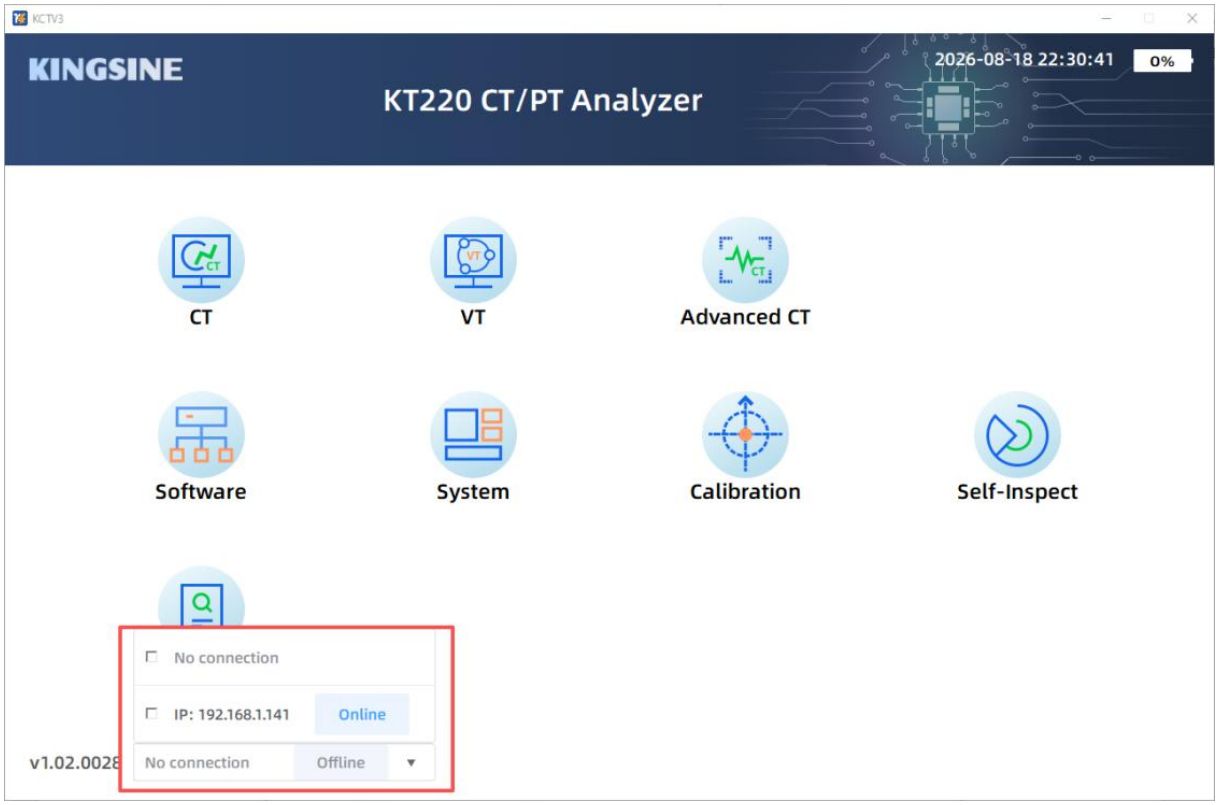


Figure 7-14

3. Device connected successfully

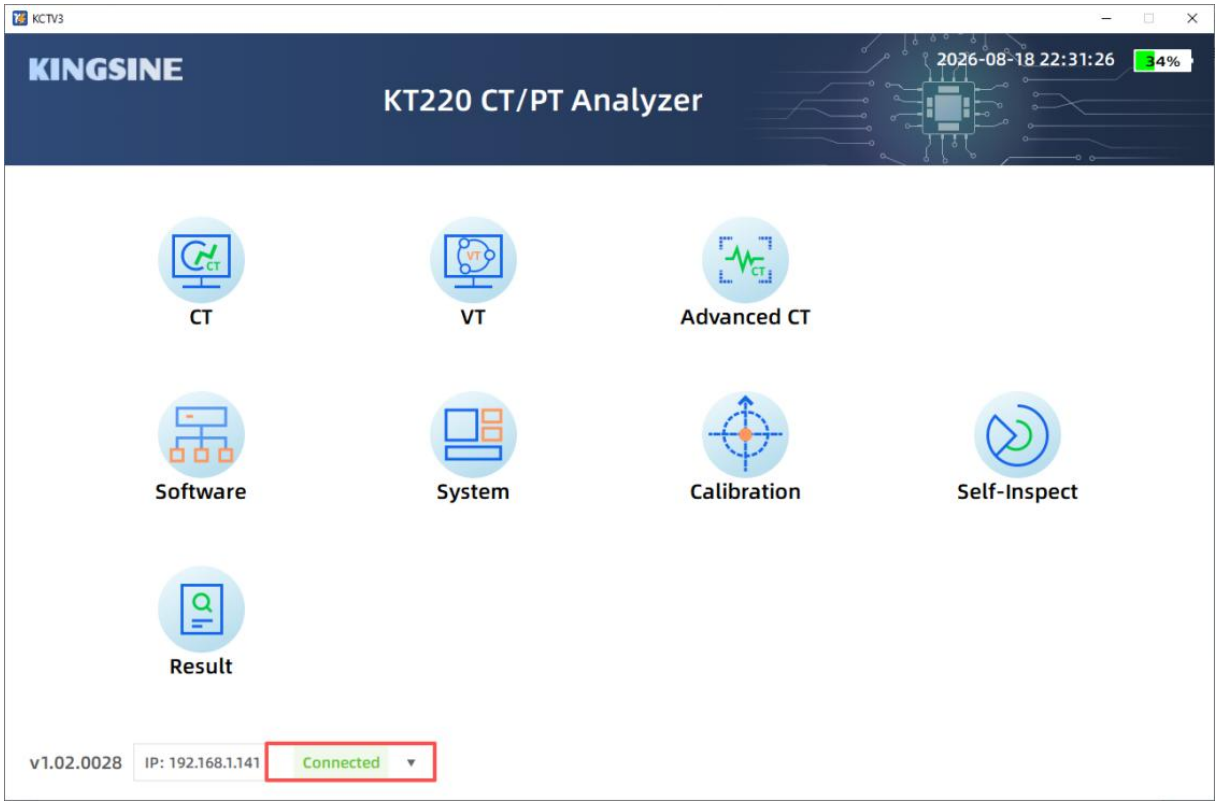


Figure 7-15

Chapter 8 VT Testing

The KT220 Comprehensive CT Analyzer can perform ratio and polarity tests, as well as secondary winding excitation tests, on electromagnetic voltage transformers.

8.1 User Information

You can fill in user information to be displayed in the VT test report. The system will automatically generate the test report file name based on the checked user information and the current date. At the same time, you can check whether to automatically save the report after testing, and whether to automatically generate a folder with the current date to save the report in that folder.

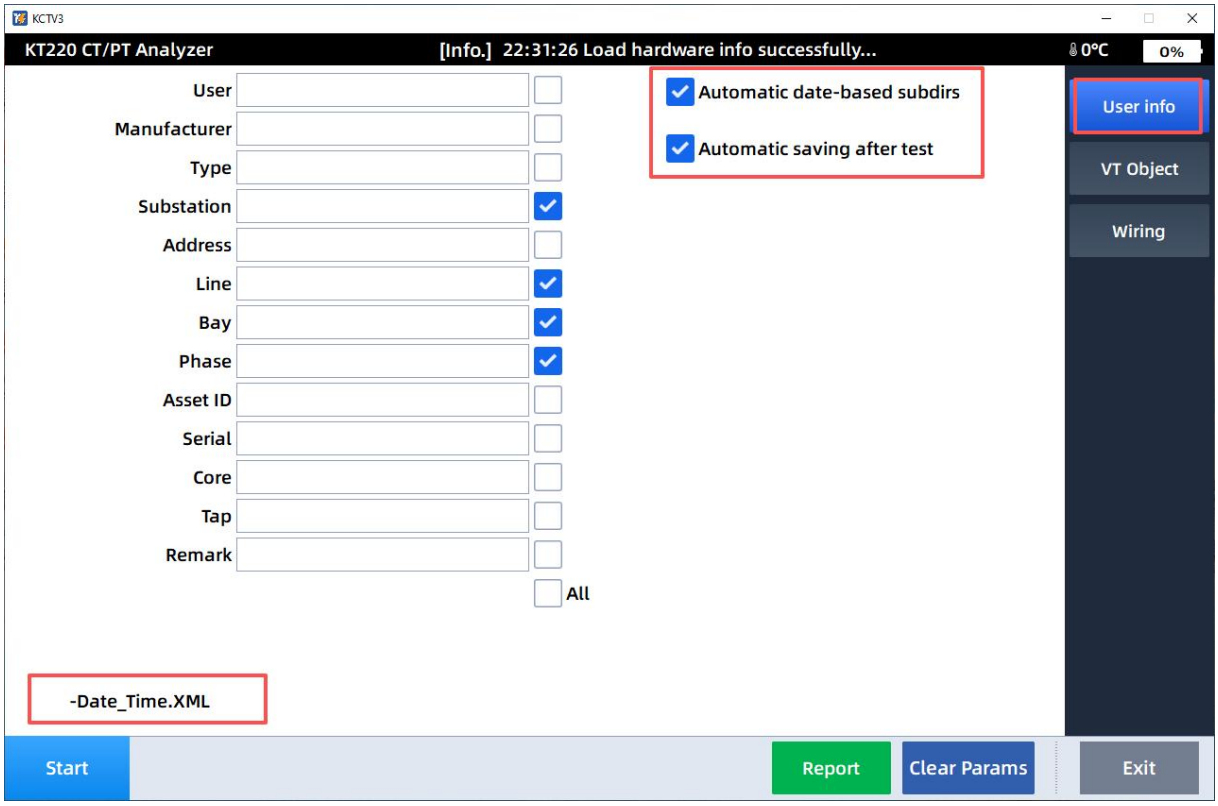


Figure 8-1 User Information

8.2 VT Ratio and Polarity Test Wiring Method

The following figure shows the VT ratio and polarity test wiring diagram:

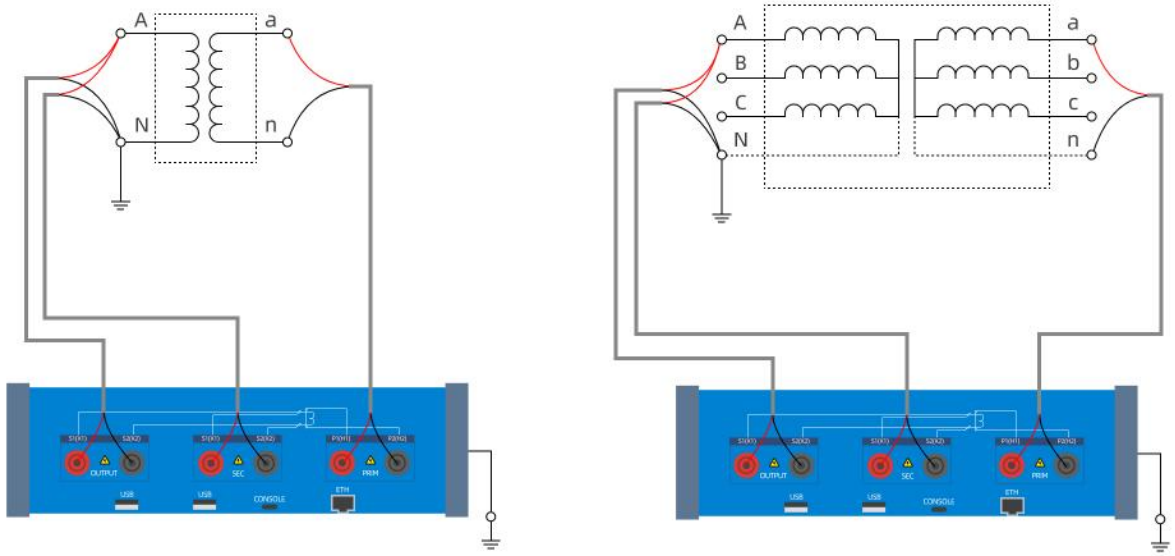


Figure 8-2 VT Ratio and Polarity Test Wiring Diagram

Ratio and polarity test wiring method:

(1) Connect the SEC and output terminals of the KT220 to the primary side of the VT under test;

(2) Connect the PRIM terminal of the KT220 to the secondary side of the VT under test;

Note: Primary and secondary side wiring must be correct, otherwise test errors may occur!

8.3 VT Excitation Test Wiring Method

Excitation measurement performs an excitation test on the VT secondary winding. When wiring is correct, the analyzer applies voltage to the VT secondary winding and plots the excitation curve based on the measured voltage and current. The following figure shows the VT excitation test wiring diagram:

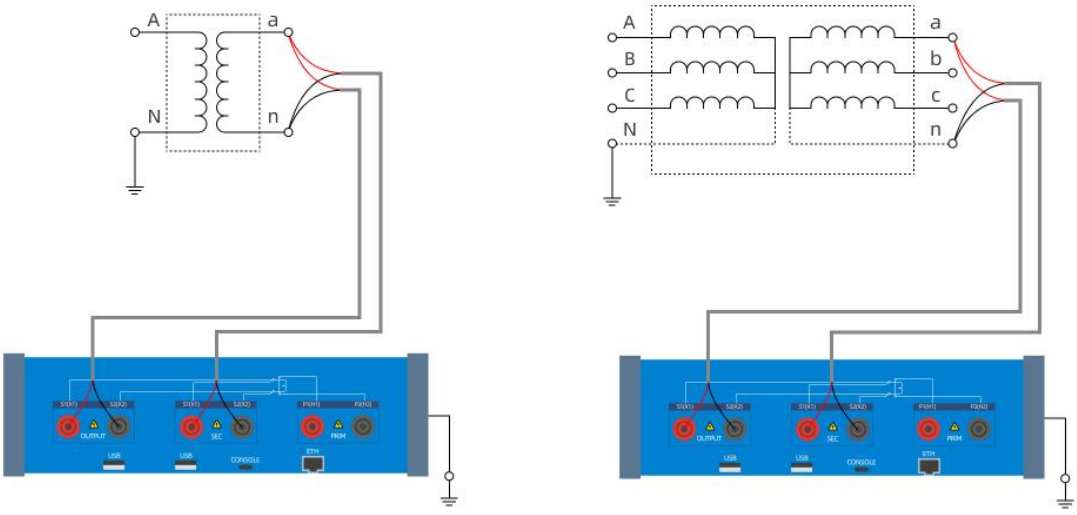


Figure 8-3 VT Excitation Test Wiring Diagram

Excitation measurement wiring method:

(1) Connect the SEC terminal of the KT220 to the secondary side of the VT under test;

(2) Connect the output terminal of the KT220 to the secondary side of the VT under test;

(3) The end of the primary side of the VT under test must be reliably grounded, and other windings must be open-circuited; the primary side of the KT220 does not need to be connected;

Note: During the excitation test, the KT220 applies voltages to the VT secondary side,high voltage included on VT primary side. Please keep away!

8.4 VT Test Software Operation Interface

The VT test software operation interface includes: VT test parameters, VT polarity and ratio results, VT excitation curve, etc.

Operation steps:

1. First select Resistance and Excitation for testing

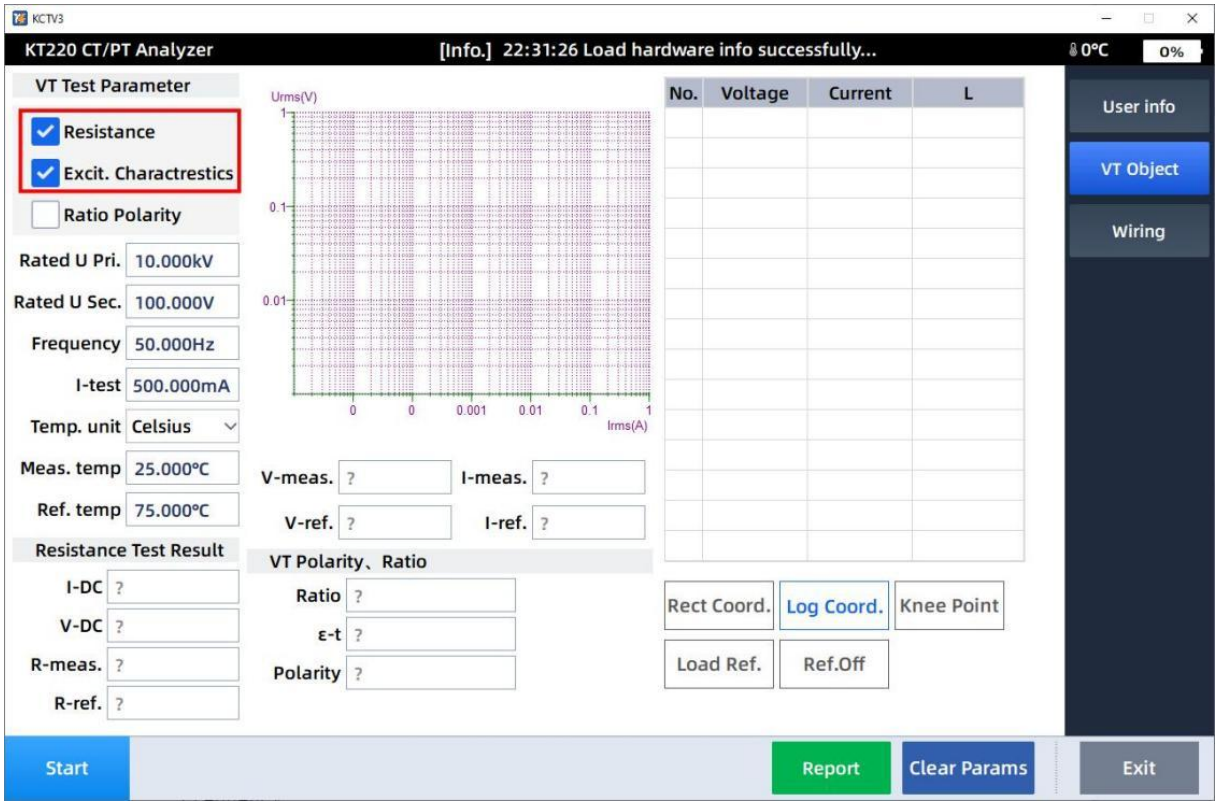


Figure 8-4

2. Set corresponding parameters according to the nameplate:

- ✧ Primary voltage
- ✧ Secondary voltage
- ✧ Frequency
- ✧ I-test range 0.1–2A, default 0.5A for VT testing
- ✧ Measurement temperature range 25–30°C, reference temperature default 75°C

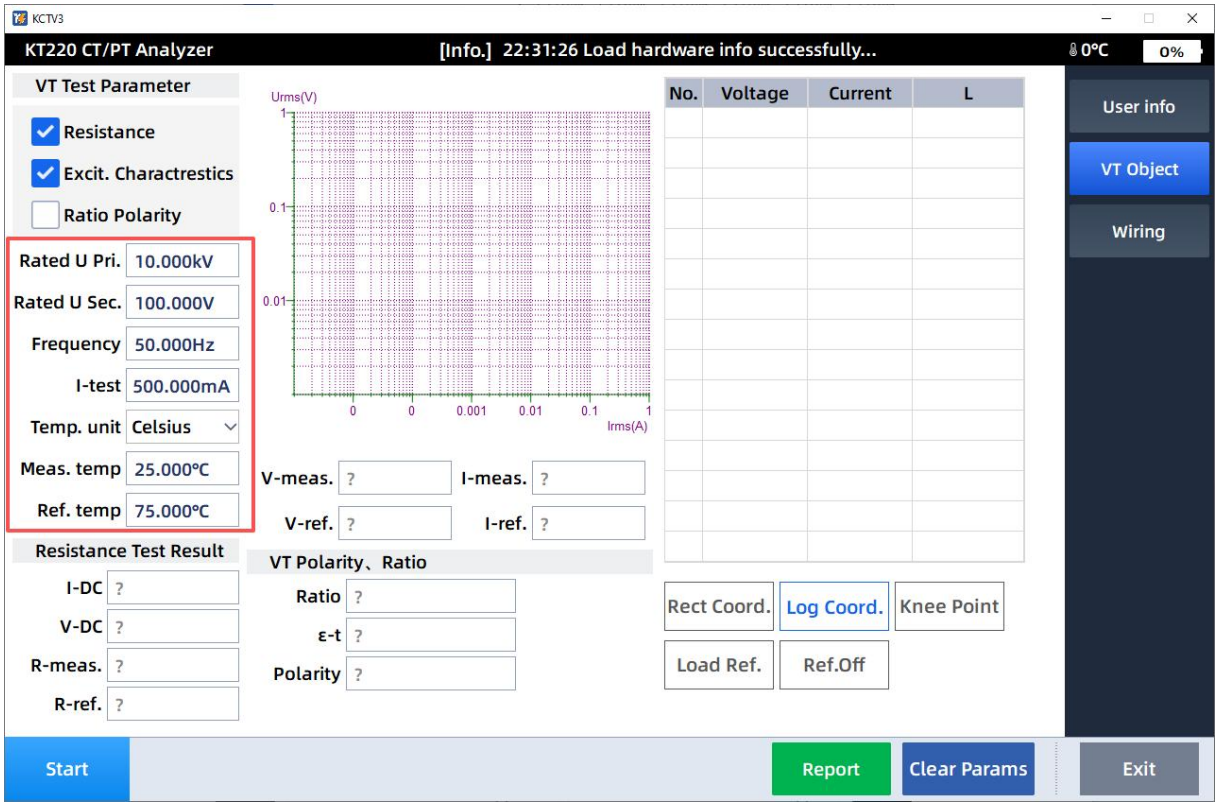


Figure 8-5

3. Start testing, read the safety reminder, and click Confirm

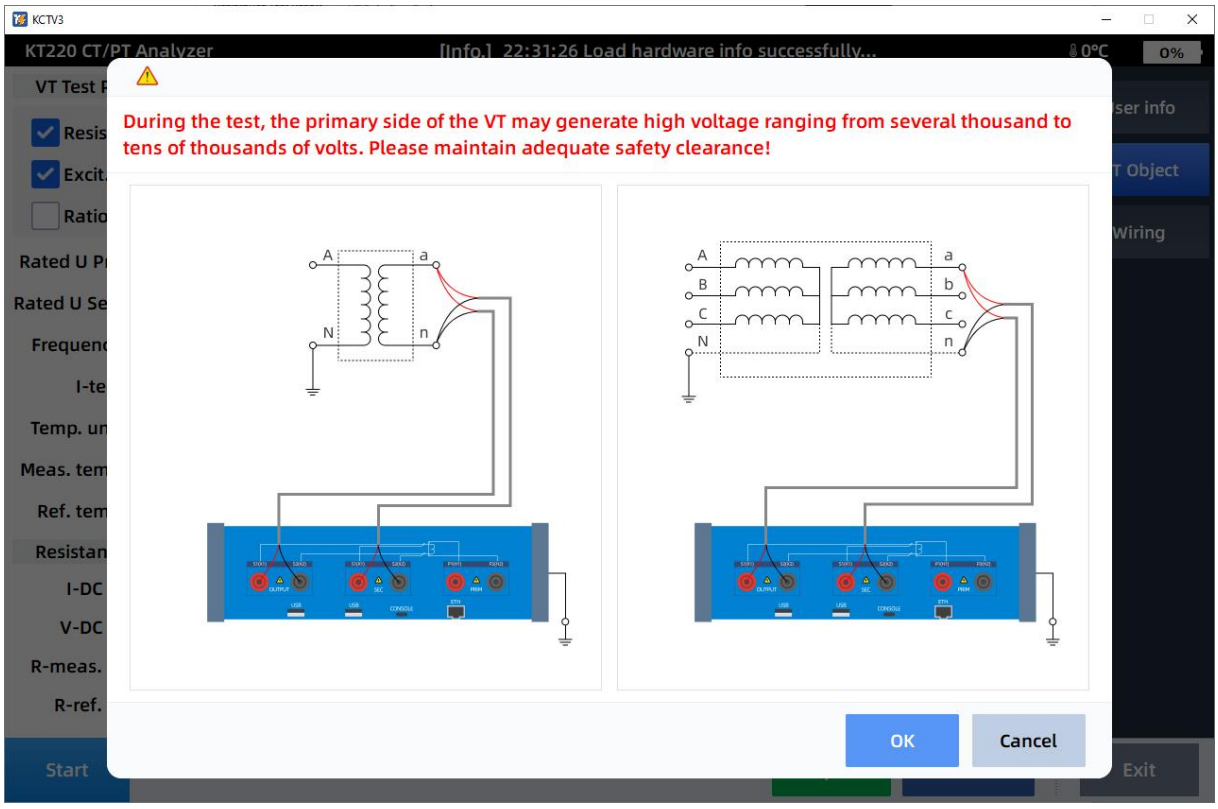


Figure 8-6

4. Testing complete, excitation results appear

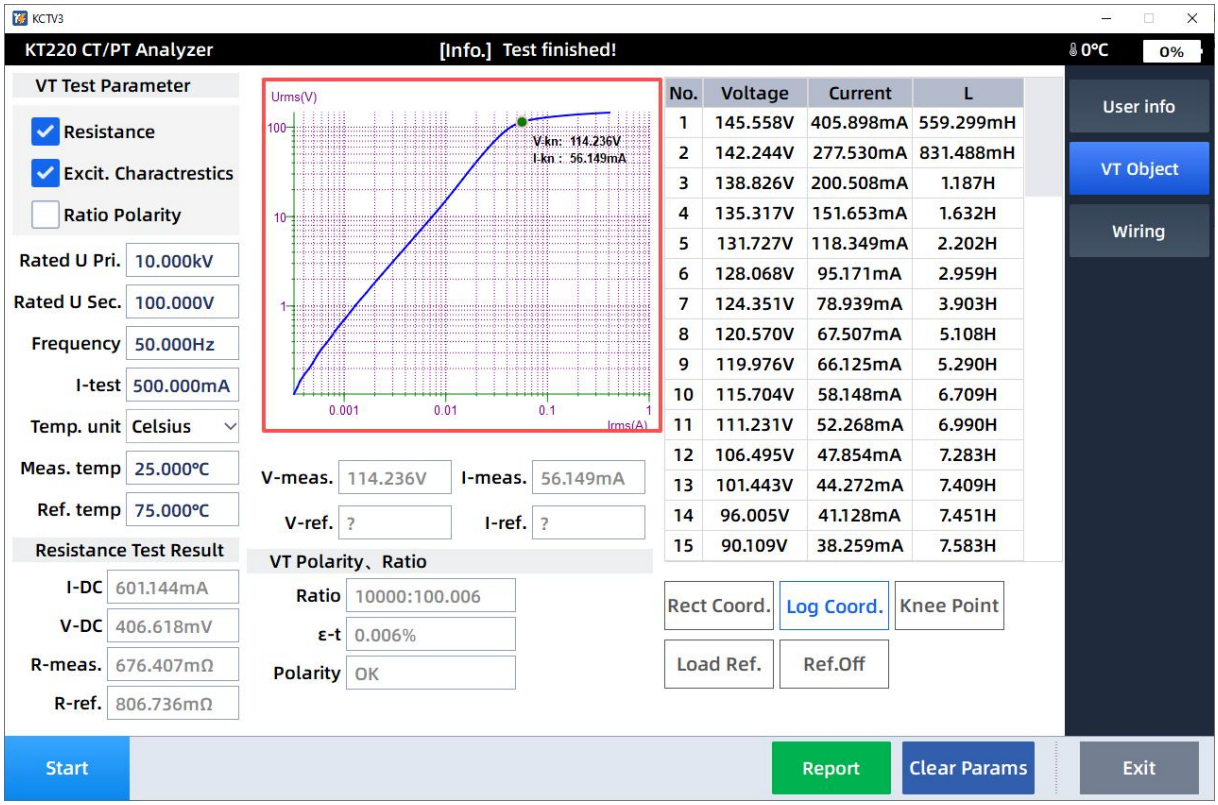


Figure 8-7

5. Rewire, select Ratio test, follow the prompt to check wiring, confirm wiring, then start testing

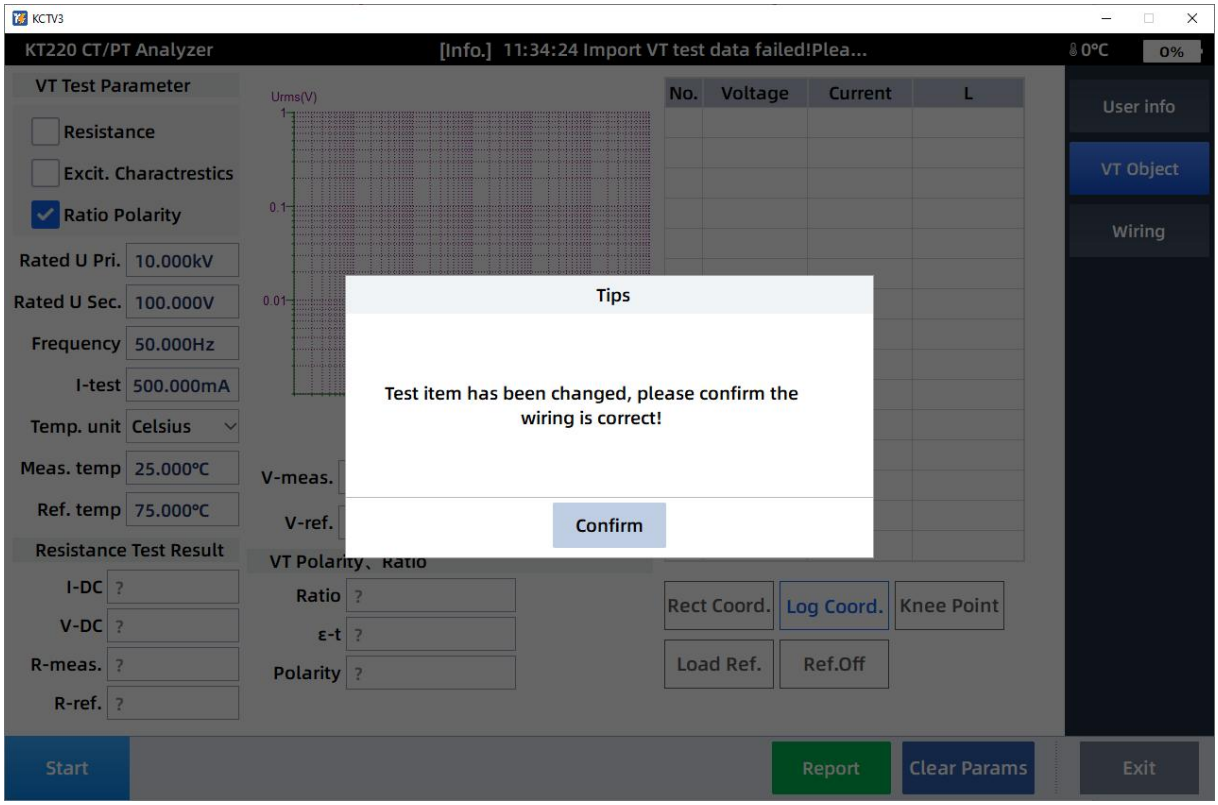


Figure 8-8

6. Testing complete, ratio results appear

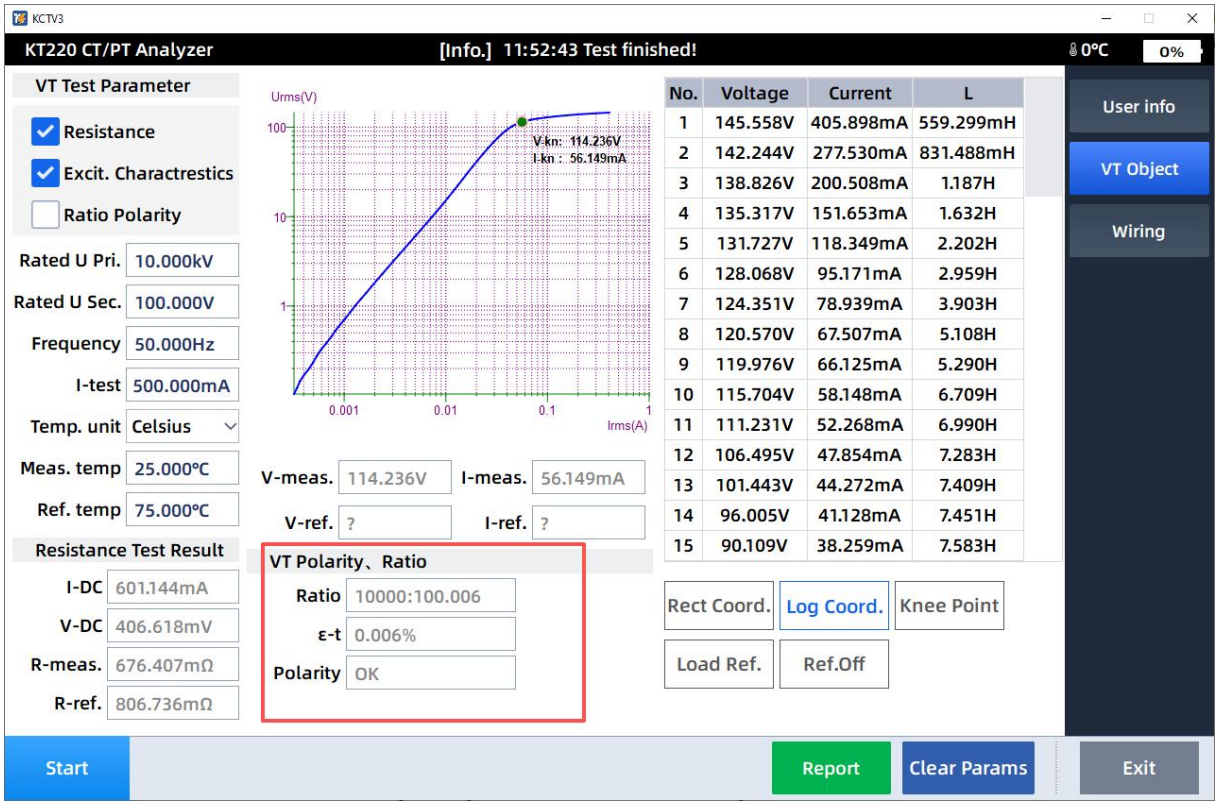


Figure 8-9

Note: Test reports can be viewed through "Report"; test data can be cleared through "Clear Results" for convenient re-entry of parameters.

8.5 Result Viewing

Click the icon below the table on the right to switch between 'linear coordinates' and 'logarithmic coordinates'.

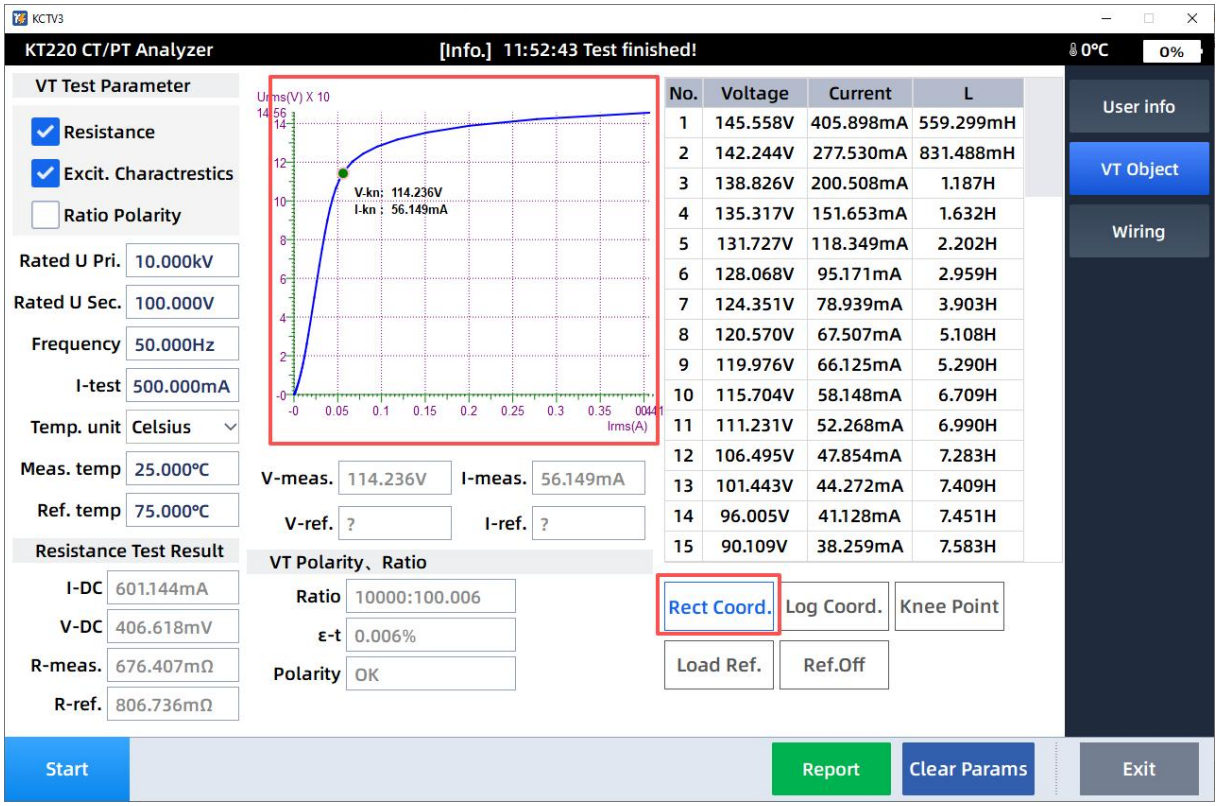


Figure 8-10 VT Excitation Curve - Linear Coordinates

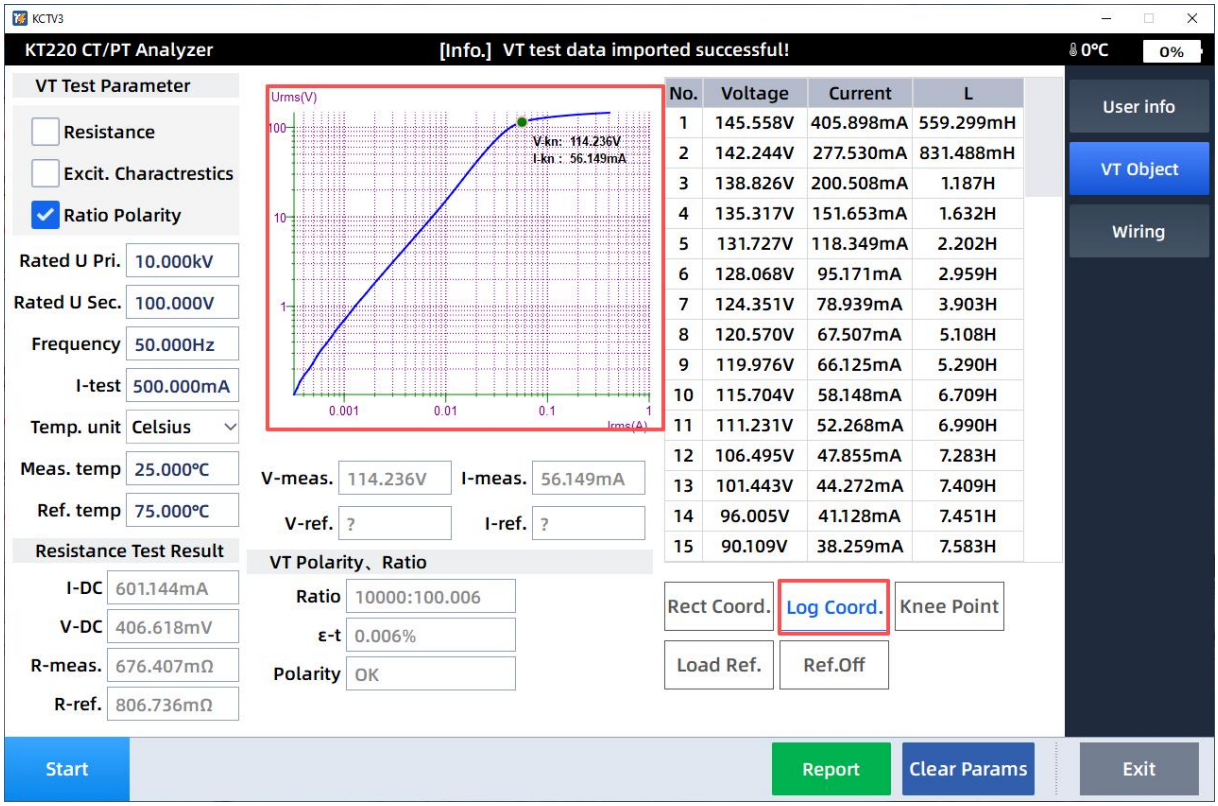


Figure 8-11 VT Excitation Curve - Logarithmic Coordinates

“Knee Point” allows quick location of the knee point on the excitation diagram.

“Load Reference” allows importing other excitation tests to compare excitation curves and knee points.

'Close Reference' cancels the comparison.

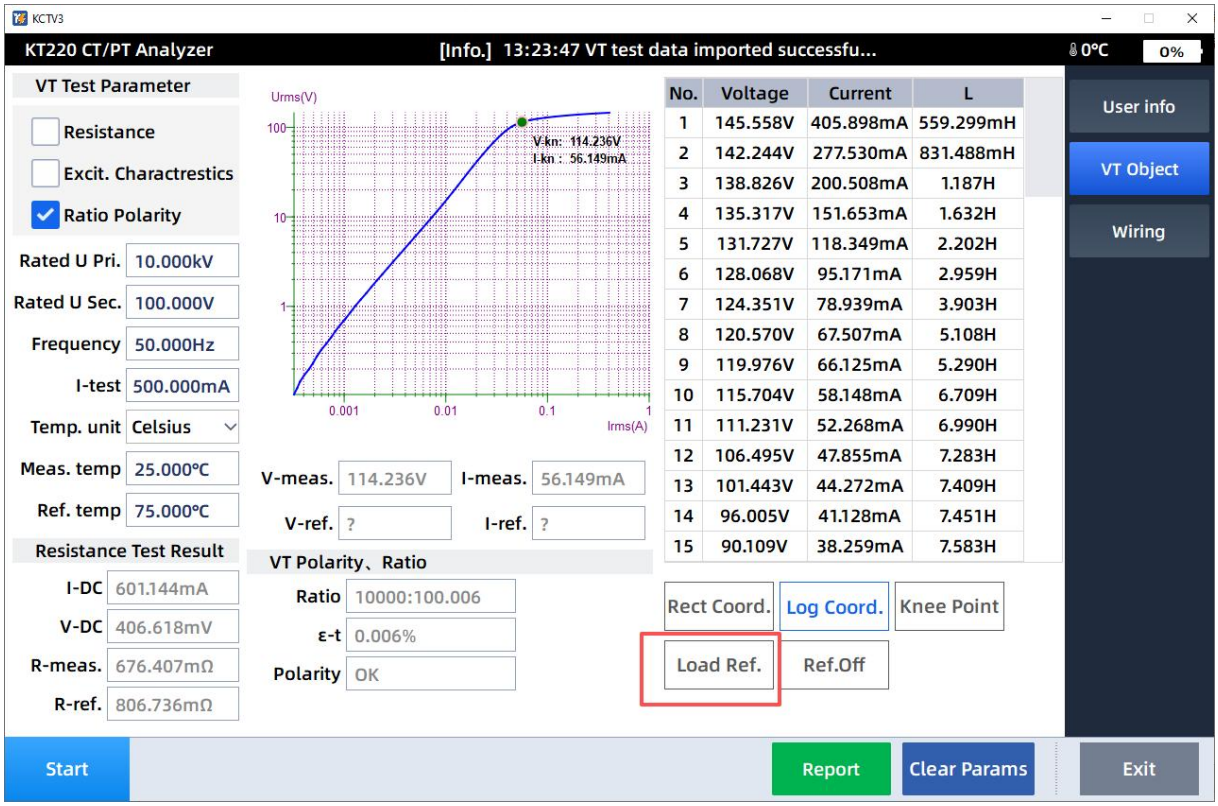


Figure 8-12 Load Reference

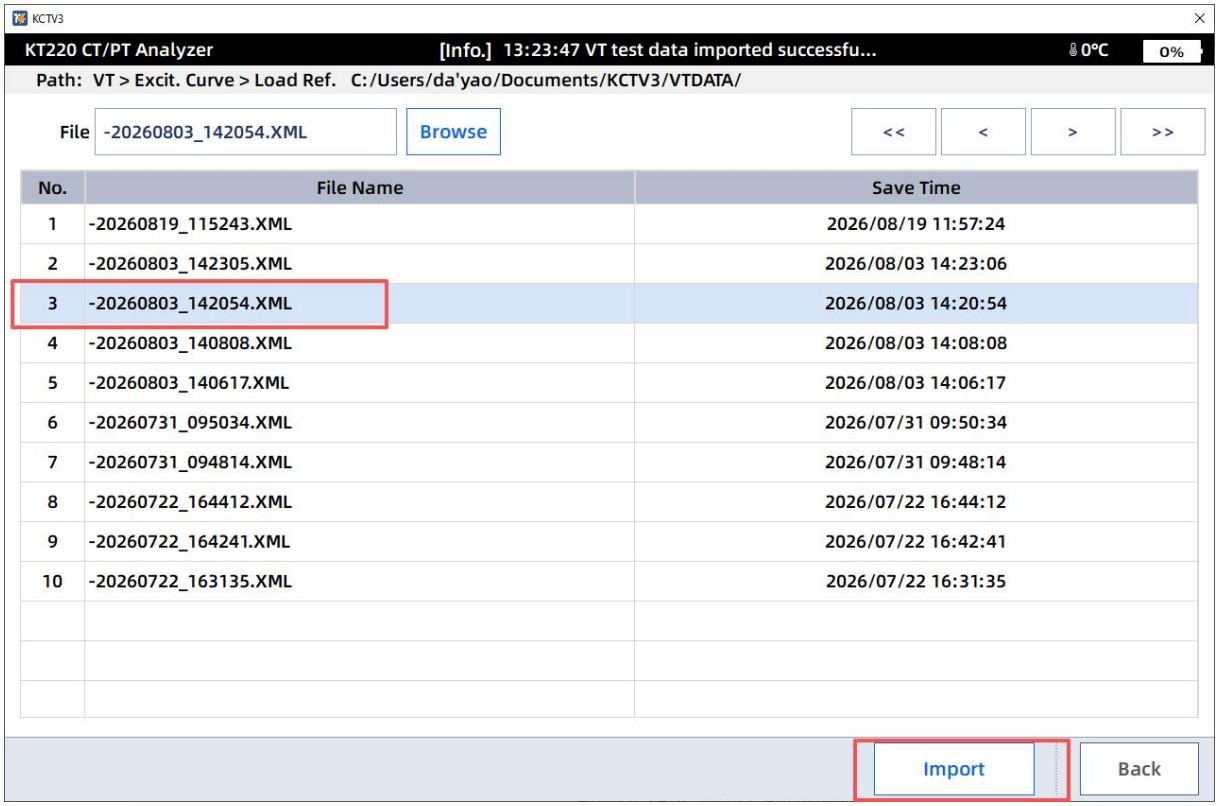


Figure 8-13 Import Reference

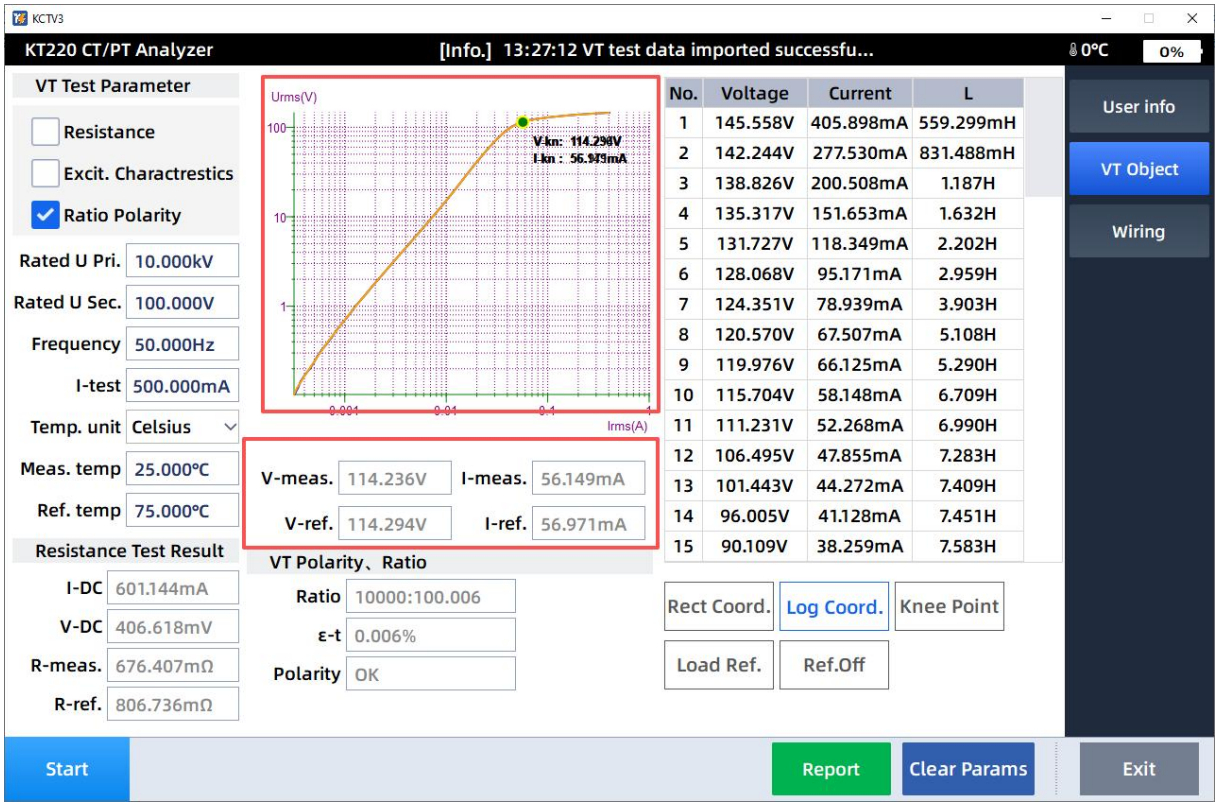


Figure 8-14 Load Reference

Chapter 9 Advanced CT

The Advanced CT function can only be used on the PC application,it supports testing multiple CTs within a same interface ,its main purpose is to facilitate comparison between results from different CTs or multiple test results of a single CT.

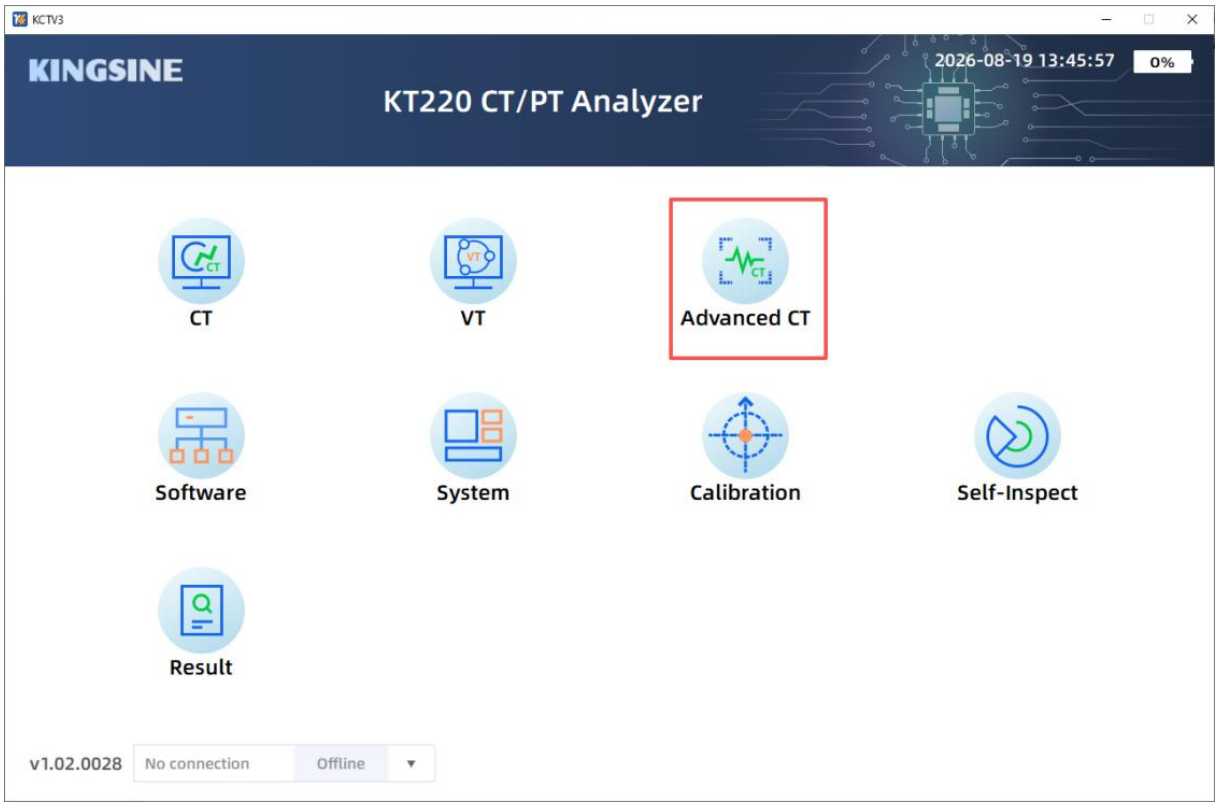


Figure 9-1 advanced CT

1.select the number of CTs

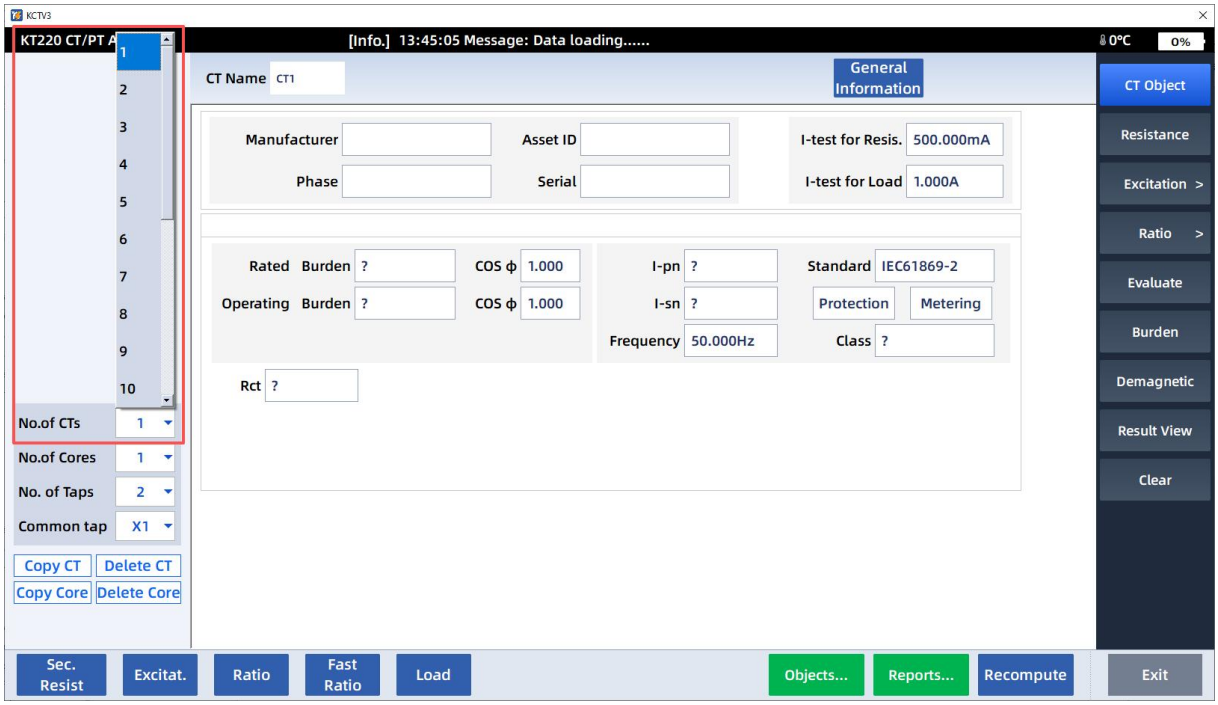


Figure 9-2 advanced CT

2.set parameters of every single CT

Click the CT1. If the CT has multiple windings ,select the number of cores or taps and common tap,and set the parameters from nameplate(refer to 5.2 section)

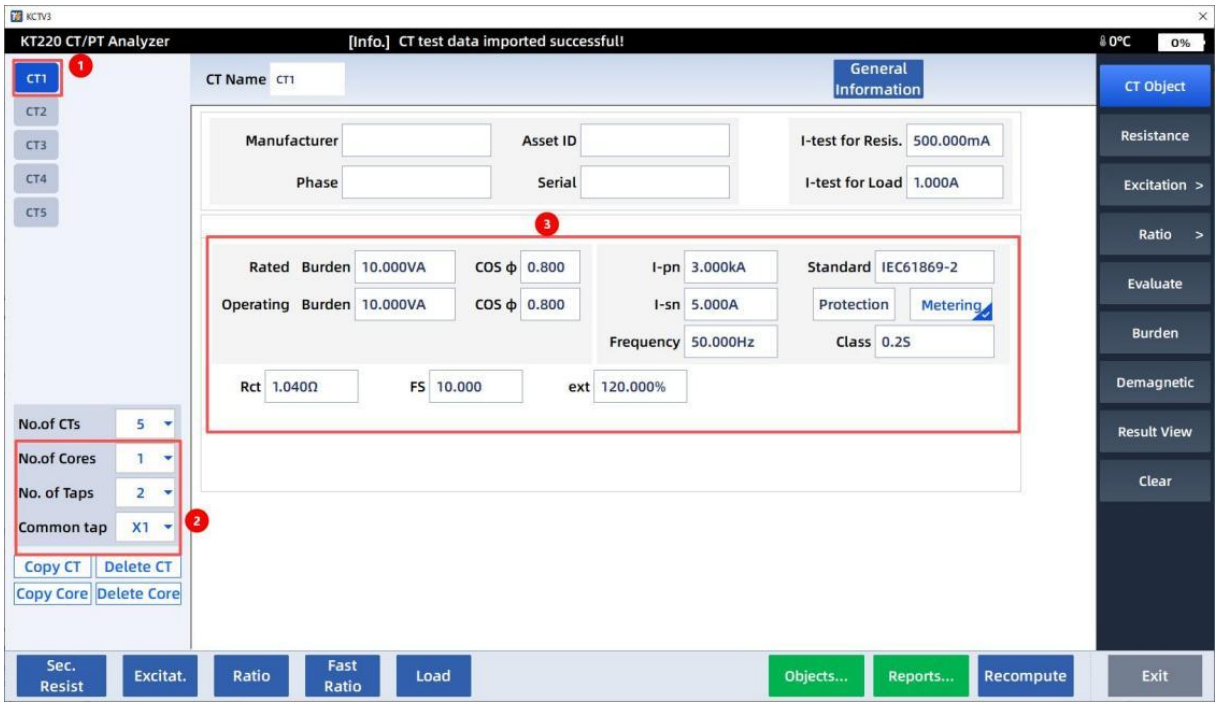


Figure 9-3

3.test

Select the items you want to test

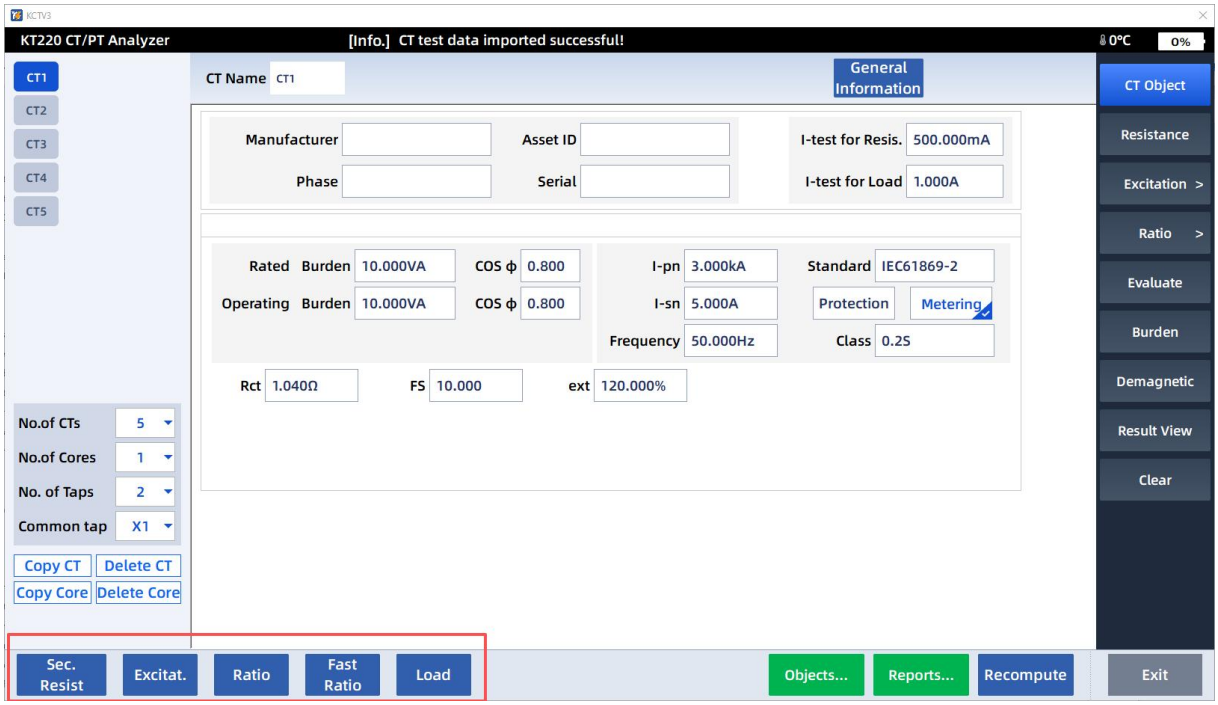


Figure 9-4

4.set other CTs in the same way,and run test,then you will get sets of result

In each test card,you may click different CTs then the interface will display the corresponding results

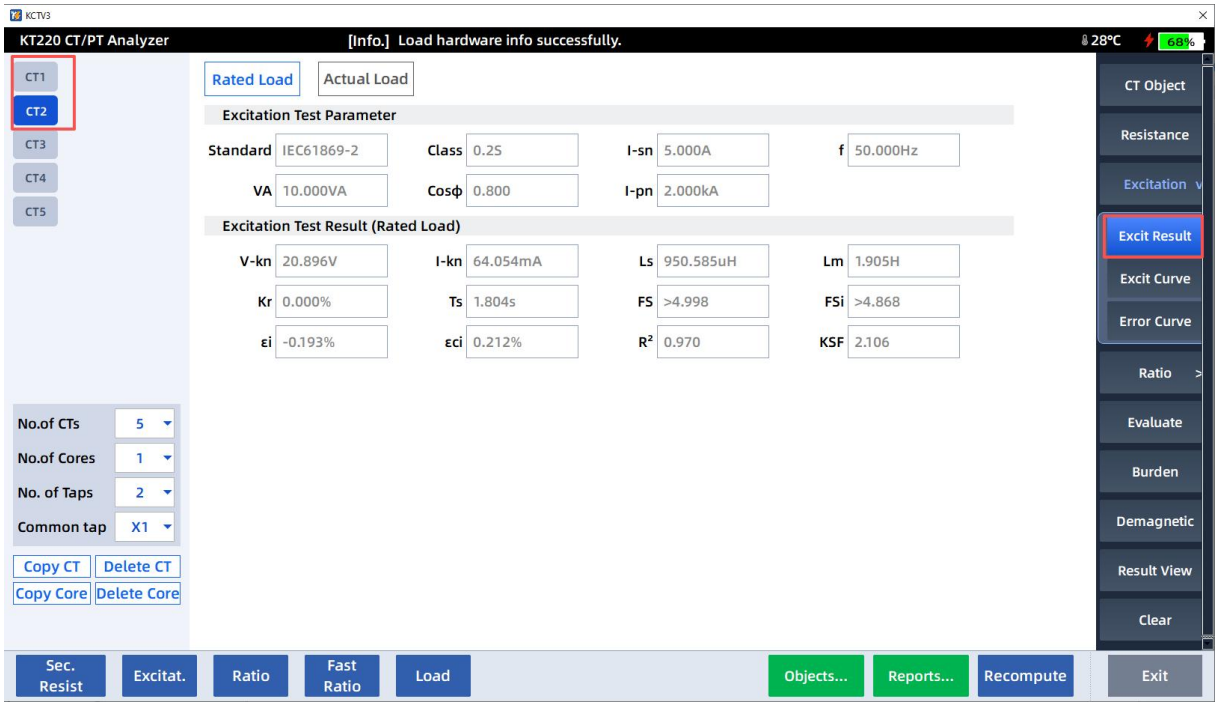


Figure 9-5

Chapter 10 Class Definitions

According to GB 1208-2006 (IEC 60044-1) and GB 16847-1997 (IEC 60044-6), the accuracy and error classes for different classes of current transformers are as follows:

For instrument transformers defined per GB 1208-2006 (IEC 60044-1),

Limits for measuring current transformers from 0.1 to 1:

Accuracy Class	Permissible Current Ratio Error (±%) / at % of Rated Current Ipn			
	5% Ipn	20% Ipn	100% Ipn	120% Ipn
0.1	0.4	0.2	0.1	0.1
0.2	0.75	0.35	0.2	0.2
0.5	1.5	0.75	0.5	0.5
1.0	3.0	1.5	1.0	1.0

Table 10-1

Accuracy Class	Permissible Phase Displacement (±minutes) / at % of Rated Current Ipn			
	5% Ipn	20% Ipn	100% Ipn	120% Ipn
0.1	15	8	5	5
0.2	30	15	10	10
0.5	90	45	30	30
1.0	180	90	60	60

Table 10-2

Limits for special application transformers:

Accuracy Class	Permissible Current Ratio Error (±%) / at % of Rated Current Ipn				
	1% Ipn	5% Ipn	20% Ipn	100% Ipn	120% Ipn
0.2S	0.75	0.35	0.2	0.2	0.2
0.5S	1.5	0.75	0.5	0.5	0.5

Table 10-3

Accuracy Class	Permissible Phase Displacement (±minutes) / at % of Rated Current Ipn				
	1% Ipn	5% Ipn	20% Ipn	100% Ipn	120% Ipn

0.2S	30	15	10	10	10
0.5S	90	45	30	30	30

Table 10-4

Limits for measuring current transformers from 3 to 5:

Accuracy Class	Permissible Current Ratio Error (±%) / at % of Rated Current Ipn	
	50% Ipn	120% Ipn
3	3	3
5	5	5

Table 10-5

Error limits for protective current transformers per GB 1208-2006 (IEC 60044-1):

Accuracy Class	Permissible Current Error at Rated Primary Current (±%)	Permissible Phase Displacement at Rated Primary Current (±)		Composite Error at Rated Accuracy Limit Primary Current (%)
		minutes	centiradians	
5P	1	60	1.8	5
10P	3	-	-	10

Table 10-6

Class definitions per GB 16847-1997 (IEC 60044-6):

Accuracy Class	Permissible Current Error at Rated Primary Current (±%)	Permissible Phase Displacement at Rated Primary Current (±)		Maximum Peak Transient Error at Rated Accuracy Limit Primary Current (%)
		minutes	centiradians	
S	Not specified	-	-	10
TPS	0.25	-	-	10
TPX	0.5	30	0.9	10
TPY	1.0	60	1.8	10
TPZ	1.0	180±18	5.3±0.6	10

Table 10-7

According to GB 1207-2006 (IEC 60044-2), the accuracy and error classes for different classes of

electromagnetic voltage transformers are as follows:

Voltage error and phase displacement limits for measuring voltage transformers:

Accuracy Class	Voltage Error (±%)	Phase Displacement (±)	
		minutes	centiradians
0.1	0.1	5	0.15
0.2	0.2	10	0.3
0.5	0.5	20	0.6
1.0	1.0	40	1.2
3.0	3.0	Not specified	Not specified

Table 10-8

Voltage error and phase displacement limits for protective voltage transformers:

Accuracy Class	Voltage Error (±%)	Phase Displacement (±)	
		minutes	centiradians
3P	3.0	120	3.5
6P	6.0	240	7.0

Table 10-9

Chapter 11 Accessories

Name	Qty	Remarks
KT220 Comprehensive CT Analyzer Main Unit	1	
KT220 Test Lead Set	1	
KT220 Instruction Manual	1	
Direct Network Cable	1	Length: 2m Cat 5e Shielded Cable
USB Drive 8GB	1	Netac/Kioxia USB 2.0, 16GB version
Case + Wave Foam, Black	1	External dimensions: 560×350×227mm
Plastic Outer Case Sticker	1	PC sheet, 3M 9448 double-sided
Outer Packaging Carton	1	Dimensions: 610×315×440mm
EVA Inner Liner	1	
Shoulder Bag	1	
Charger XYY-PD100CL 100W with Plug and Cable PFC Black, Chinese Standard	1	

After-Sales Service Commitment

The main unit carries a free three-year warranty with lifetime repair service; software is upgraded free of charge (at any time); in case of technical issues with the device, free service is provided within 24 hours; according to user needs, our company organizes training in Shenzhen or on-site training for user personnel.

KINGSINE

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Email：international@kingsine.com.cn