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# PCT200 Series CT/PT Testing System User Manual

**VERSION:** PCT200 -AE-1.60
**DATE:** JUL. 2023



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# Notes：

 **In order to prevent static electricity, the PCT and test CT must be connected to ground safely before test.**

 **Avoid electric shock accident when the output voltage is above 36V.**

 **Short circuit is prohibited at output side while testing.**

 **Connect wires in accordance with instructions.**

 **External voltages and currents are prohibited to apply on the tester’s output.**

 **Avoid the equipment being wet by rain.**

 **Contact manufacturer timely and do not repair it when device works abnormally.**

# Special Tips:

1. CT/PT testing system (called PCT) is applied in the electromagnetic and low leakage flux current transformer (CT without gapped core or compensation) and inductive voltage transformer (PT) of power system. It completes the following test items:

- CT load impedance
- CT secondary coil resistance (Rct)
- CT excitation characteristic
- CT ratio
- CT polarity
- PT ratio and polarity
- PT excitation characteristic

……

PCT is used in the above fields and the wiring connection/ operations should be executed in the guide of the user manual. Any other usage is invalid. The users must operate PCT in the proper way. Otherwise, improper operation might cause damage. The manufacturer will not take any responsibility for such damages. The users assume all responsibilities and risks.

2. The power supply must be accordance with the requirements described in user manual.
3. Users can't maintain the PCT without manufacturer's authorization. Otherwise the warranty period statement is invalid.
4. Users can't disassemble the PCT without manufacturer's authorization. Otherwise the warranty period is invalid.

5. It is prohibited to maintain reform, extend or change the system or any other accessories.
6. Only original accessories are accepted in test and detection process.
7. Do not switch-on and operate PCT in the place having explosive gas or water vapor
8. Avoid the equipment to be wet by rain
9. Do not block the ventilation outlets
10. Don’t stand rightly under the joint point in case of clamps hurting.
11. It is not allowed to connect or disconnect the test object in the operation process. The high voltage caused by energy, storing in external inductance, might damage the human, PCT and test object.
12. Make sure that the terminals of the test objects are not charging to exit the program.
13. Please make wiring connection in the guide of user manual while making CT test. If the wiring is wrong, the high voltage might damage the CT or PCT.
14. Please make wiring connection in the guide of user manual while making PT ratio and polarity test. If the users connect the PCT output with the secondary side of PT, thousands of volts high voltage might be generated in the primary side and damage the PT or PCT.
15. Please make wiring connection in the guide of user manual while making PT excitation test. The PCT output must be connected with the secondary side of PT. If it is connected with the primary side of PT, it might damage the PT or PCT.
16. The test of guess nameplate is only for reference.

# Content

# 1. General Description

## 1.1 Functions

| | | PCT200i | PCT200Ai |
|---|---|---|---|
| CT | CT type | P, TP, M | P, TP, M (0.2S) |
| | Ratio | ◆ | ◆ |
| | Polarity | ◆ | ◆ |
| | Coarse ratio | ◆ | ◆ |
| | Guess ratio | ◆ | ◆ |
| | Turn-ratio and error | ◆ | ◆ |
| | Ratio error and phase displacement | ◆ | ◆ |
| | $R_{ct}$ | ◆ | ◆ |
| | Burden | ◆ | ◆ |
| | Excitation characteristic | ◆ | ◆ |
| | CT demagnetization | ◆ | ◆ |
| | Knee point (V-I) | ◆ | ◆ |
| | Remanence flux (Kr) | ◆ | ◆ |
| | Secondary time constant ($T_s$) | ◆ | ◆ |
| | Unsaturated inductance (Lm) | ◆ | ◆ |
| | Saturated inductance (Ls) | ◆ | ◆ |
| | Instrument security factor (FS) | ◆ | ◆ |
| | Accuracy limit factor (ALF) | ◆ | ◆ |
| | Composite error (εc) | ◆ | ◆ |
| | Eal | ◆ | ◆ |

| | | | |
|---|---|---|---|
| | Transient dimensioning factor (Ktd) | ◆ | ◆ |
| | Symmetrical short-circuit current ratio (Kssc) | ◆ | ◆ |
| | Peak instantaneous (total) error εˆ | ◆ | ◆ |
| | Guess nameplate | △ | △ |
| | Report tools | ◆ | ◆ |
| PT | Ratio | △ | △ |
| | Polarity | ◆ | ◆ |
| | Excitation characteristic | △ | △ |
| | Burden | △ | △ |

**Notes:** The symbol "◆" indicates it has the function.
The symbol "△" indicates assessment not to guarantee the accuracy.
The symbol "/" indicates it doesn't have the function.

# 1.2 Technical Specifications

| Items | | PCT200i | PCT200Ai |
|---|---|---|---|
| Output voltage range | | 0-120V | |
| Output current range | | 0-5Arms (15A peak) | |
| Output power | | 0.0001-500VArms (1500VA peak) | |
| 100% Ipn and 100% VA | Ratio test range | 30,000:1-45,000:5 | |
| | Ratio test accuracy * | 1-2,000 0.05% Typ.<br>0.10%Gur<br>2,000-5,000,0.08%Typ.<br>0.15%Gur<br>5,000-30,000, 0.10%Typ.<br>0.20%Gur | 1-2,000 0.02% Typ.<br>0.05%Gur<br>2,000-5,000,0.03%Typ<br>0.10% Gur<br>5,000-30,000, 0.05%Typ.<br>0.20%Gur |
| | Turn ratio range | 1~30,000 | |
| | Max. knee point voltage | 45,000V | |
| | Burden test accuracy | ±0.05% ±1mΩ Typ. ±0.1% ±1mΩ Gur. | |
| | Winding resistance test range | 0~1,000Ω | |
| | Winding resistance test accuracy | ±0.05%±1mΩ Typ. ±0.1%±1mΩ Gur. | |
| | Winding ratio accuracy | 0.1% or 1 turn | |
| | Phase displacement * | 1min Typ. 3min Gur.<br>resolution 0.01min | 1min Typ. 2min Gur.<br>resolution 0.01min |
| | Temperature compensation | -20℃~120℃ | |
| Main supply | | 110~240Vac / 50~60Hz<br>90-260Vac / 45~65Hz<br>Input power: max 2,000VA | |
| Operation temperature | | -10℃~50℃ | |

| | | |
|---|---|---|
| Storage temperature | -25℃~70℃ | |
| Relative humidity | 5%~95% non-condensing | |
| Dimensions | 470x200x245mm (WxHxL) | |
| Weight | 10kg/14kg | 14kg |
| LCD display | 8.4-inch, color display | |
| Operating system | Windows 7/XP | |

**Note:** The corresponding temperature of each parameter is 23℃±5℃. It is suggested the preheat time is longer than 15 minutes.
The symbol “ * ” indicates the knee voltage is more than 3V.

# 1.3 Features

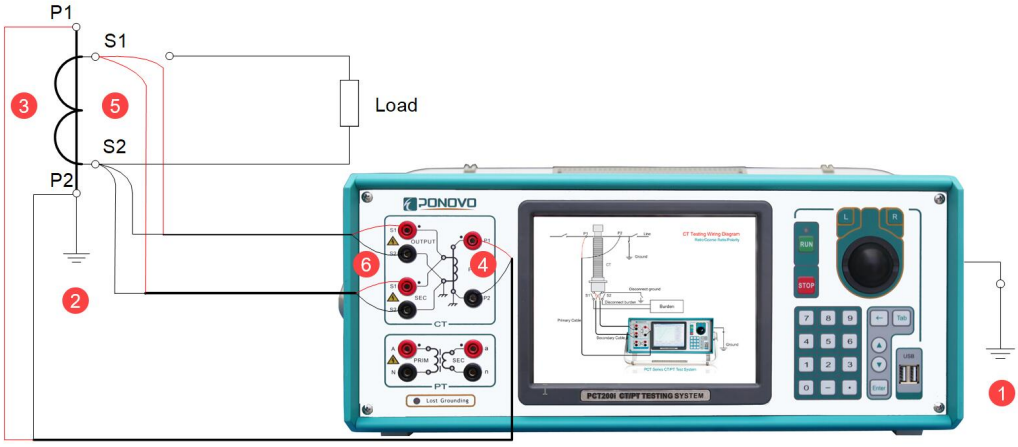
- Apply the newest principle of multi point DC method and meet the standard of IEC 60044-6
- The voltage measurement of ratio and phase displacement complies with standard of IEC 61869-2.
- Calibration certificate approved by National Center for High Voltage Measurement. The report includes: angle differential, ratio differential test and stability test.
- 8.4-inch LCD with colorful graphical interface for HMI.
- The whole integration structure, anti-vibration and anti-electromagnetic interference combination chassis.
- Built-in computer for operation. All test items are completed automatically.
- Light weight and small dimension due to small voltage and power output.
- The voltage measurement is used to test the bushing CT and GIS CT that can’t be measured by traditional way.
- The knee point voltage of CT ranges from 1-45,000V. And the excitation characteristic test speed is fast. These features surpass that of traditional analyzer.
- Apply to various types of CT (including TP type) excitation, ratio, polarity, secondary winding resistance, load, ratio differential and angle differential etc steady-state or transient characteristic test.
- Automatically test knee point voltage/ current, ALF, FS, Ts, and Kr etc CT parameters.
- Users can select ten groups of excitation data to save.
- It lists the ratio error and phase error table and changes the report data in condition the rated current 1%-300% be set.
- The PCT automatically memories test items, report items, and report setting items.
- The report can be converted into EXCEL format. More than thousands of reports are saved in it for checking and printing.
- Users can export the test results by USB disk as well as upgrade.
- The report tool software is convenient for report saving, converting and analyzing which is for data contrast, judgment and assessment.
- User-defined test according to the defined standards.
- PT test items: ratio, polarity and excitation curve.

# 1.4 Operation Preparation

## Preparation:

CT secondary side load loop disconnection and secondary winding off-grounded
CT primary side disconnects with busbar

## Order of connection:

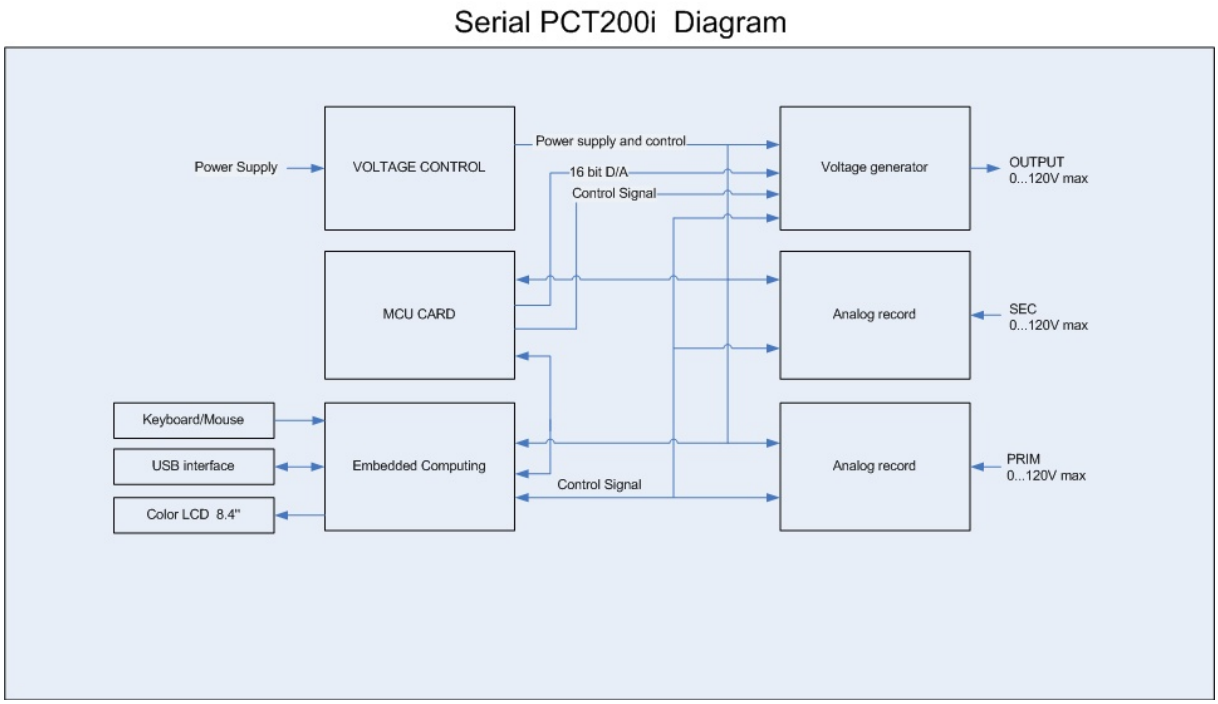



1. The chassis of PCT is grounded.
2. One end of CT primary side grounded (P2)

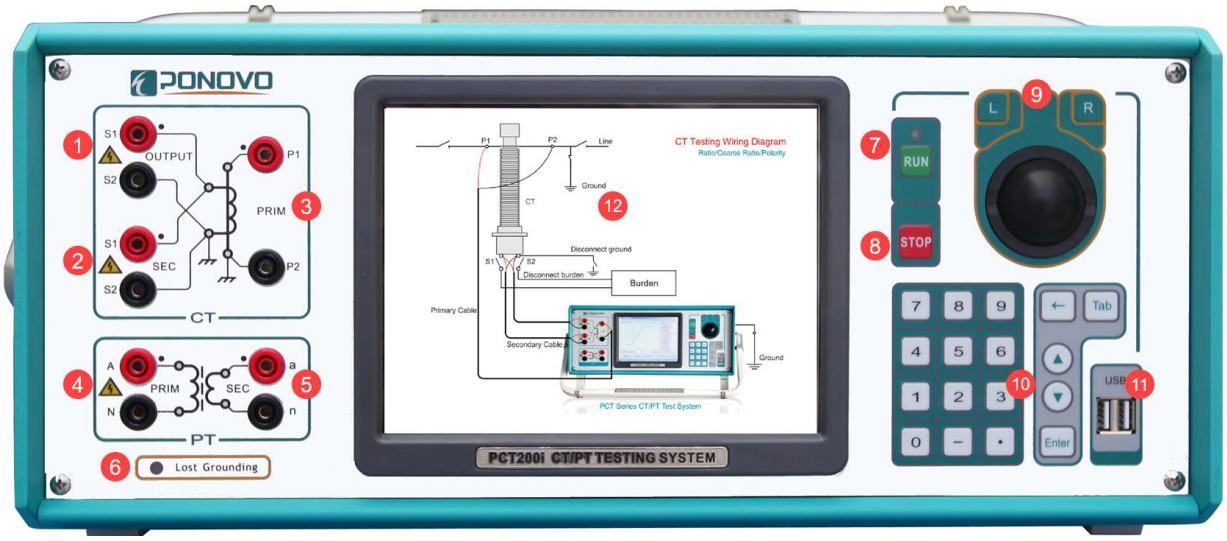
**Note:** There is a grounding switch in one side of primary. No matter the grounding switch is in P1 or P2, only one end is supposed to ground.

3. The test lead connects with P1, P2 of CT.
4. The other end of the lead connects with P1, P2 of PCT.
5. One secondary side connects with one group of CT's S1 and S2
6. The other Secondary side connects with S1, S2 of PCT.
7. Power on

# 1.5 Block Diagram



# 2. Panel Description

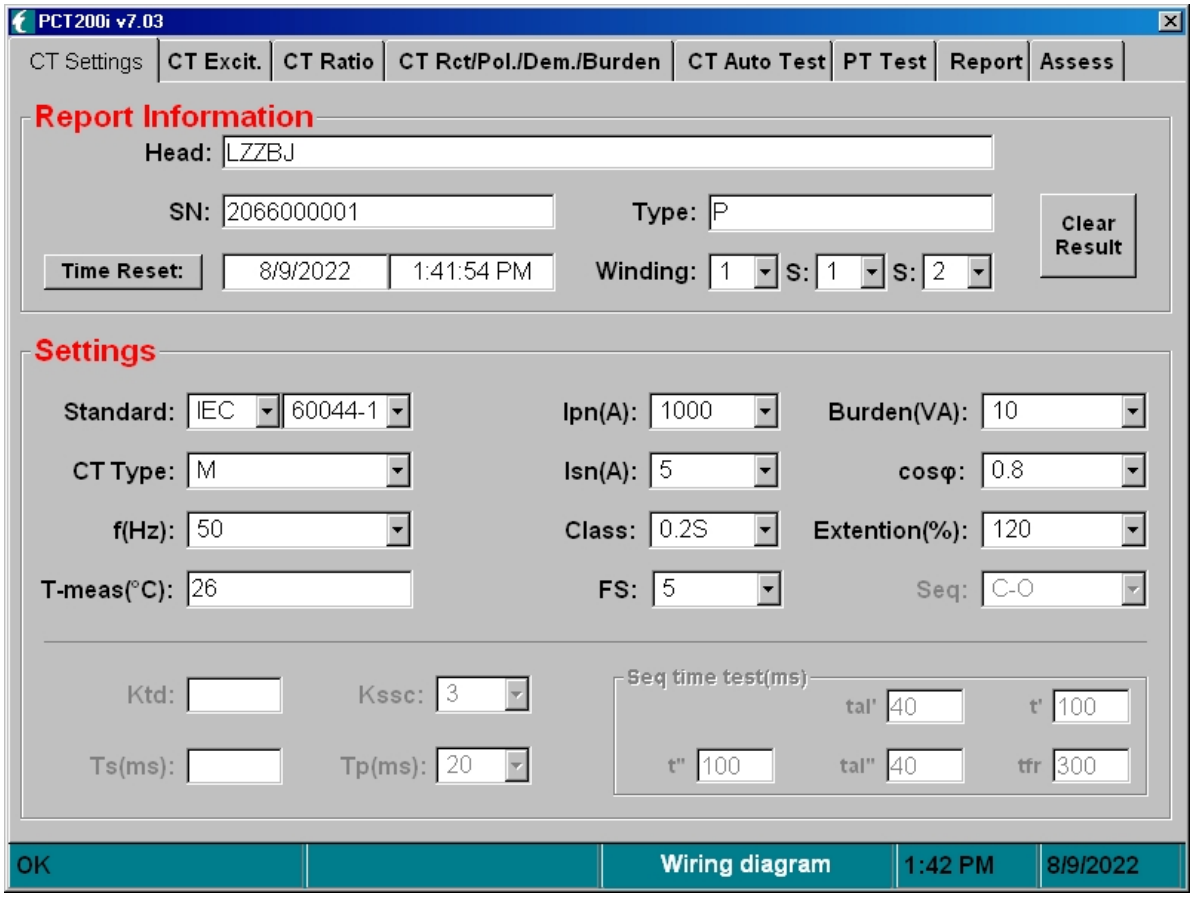



1) Connecting CT secondary side for output (PT secondary for excitation)
2) Connecting CT secondary side for measurement (PT secondary for excitation)
3) Connecting CT primary side for measurement
4) Connecting PT primary side for output
5) Connecting PT Secondary side for measurement
   Please refer to the Wiring Connection in chapter 4.1 and 5.1 for CT and PT.
6) Grounding indicator: When the PCT200 is not connected with grounding cable, the indicator will be on.
7) Run button/ indicator: Press run to start the testing and the indicator will be flashing.
8) Stop button: During the testing, press it to stop the present test.
9) Mouse: it is working as mouse.
10) Keyboard
11) USB interface
12) LCD display

# 3. Operation Instruction

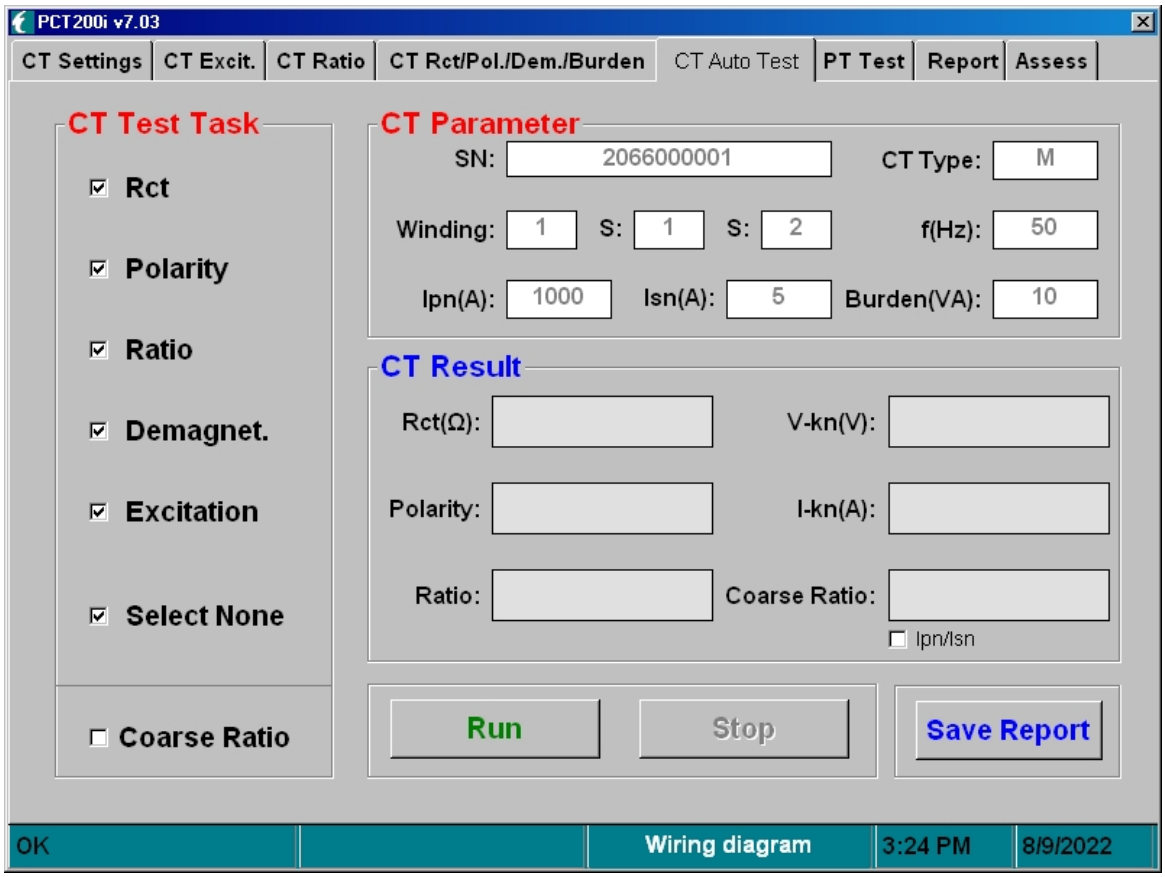
## 3.1 Set Test Parameters

Set variable parameters by pushing keyboard and pressing mouse.



## 3.2 Select Test Functions

After the CT settings are set, then press CT Auto Test to choose the required CT Test Task.



## 3.3 Control Output

After the test task is selected, click Run on the interface or press button Run on the panel to start testing,
During testing, the operation indicator will be flashing.
The test can be stopped by clicking Stop on the interface or press button Stop on the panel.

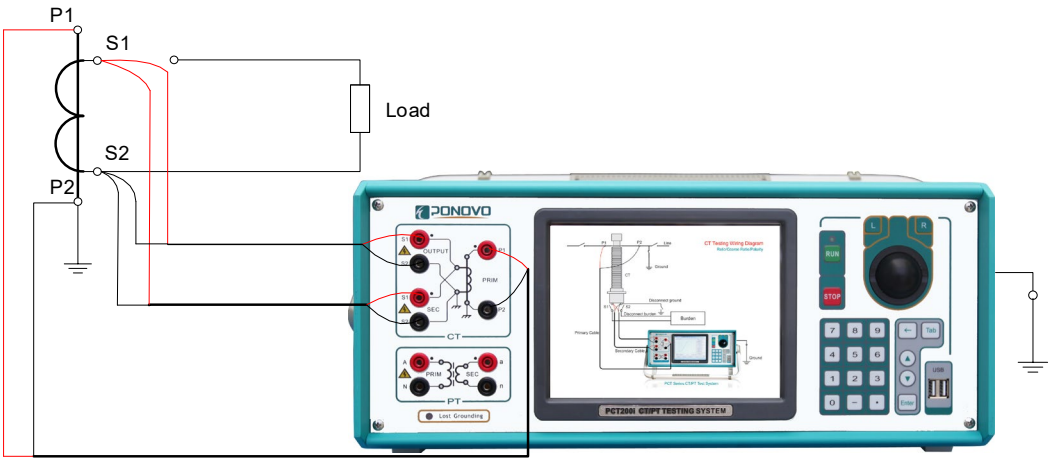
## 3.4 Save Test Report

After testing is finished, click Save Report in the CT Auto Test interface or in the Report interface for report saving.

# 4. CT Test

## 4.1 Wiring Connection

While doing the CT secondary coil resistance, polarity, excitation, demagnetization and ratio test, the instrument transformer tester should be connected according to the below diagram.




**Wiring direction**: The transformer's output S1 and testing side S1 are connected with one side of CT secondary.

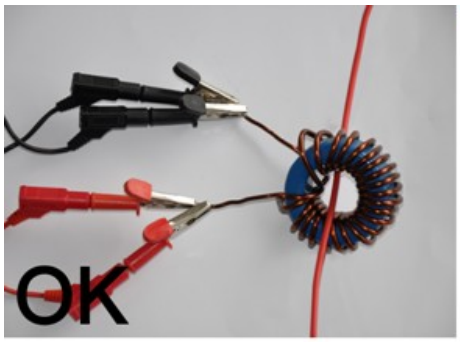
The transformer's output S2 and testing side S2 are connected with the other side of CT secondary.

The transformer's primary test side P1 is connected with one side of CT primary.

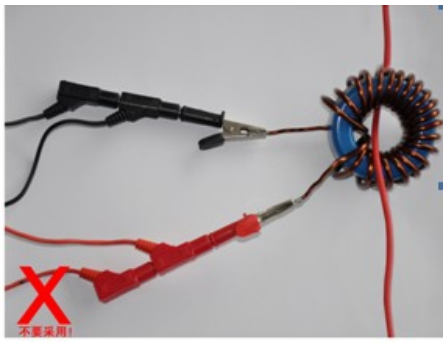
The transformer's primary test side P2 is connected with the other side of the CT primary.

The comparison between four-cable and two-cable testing:

The transformer secondary tap is connected by claps and the following four-cable connection is applied.




Four-cable connection




Two-cable connection

Otherwise, the chuck resistance might affect measuring result and the CT tester might list the incorrect measuring result.

Four-cable connection: CT output terminal and input terminal are connected with tested objects by different claps.

Every testing cable needs a clap.---CORRECT

Two-cable connection: Single testing cable is applied in CT output terminal and input terminal. But the testing cable is connected with the transformer by a public clap.

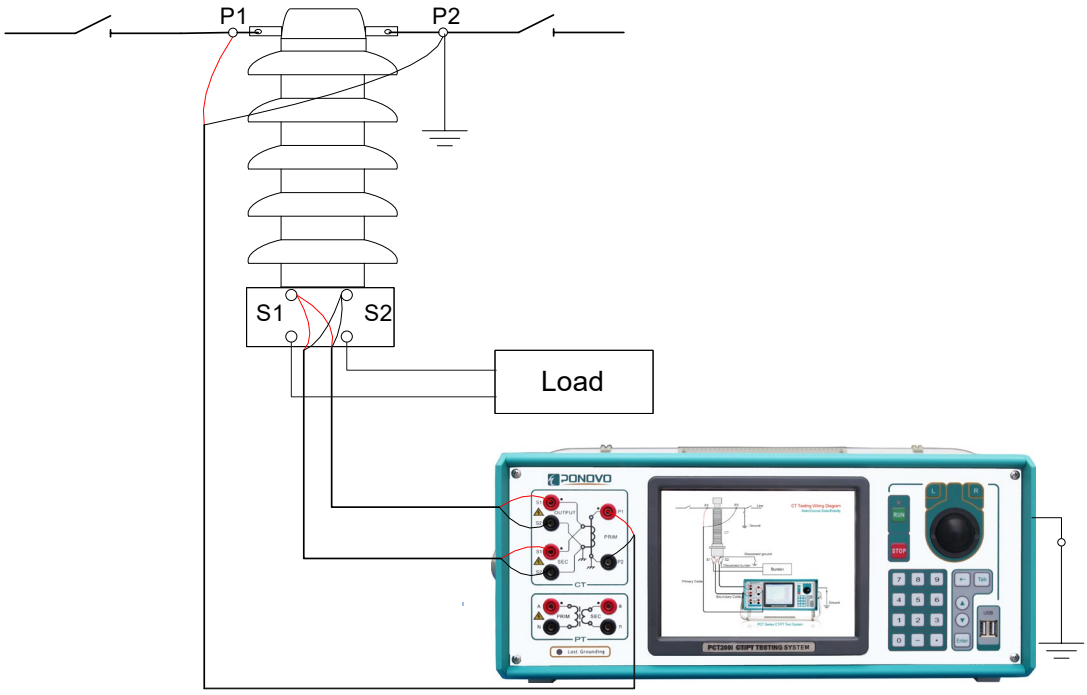
Two testing cables use a public clap.---INCORRECT

Physics background:

While two-cable is applied, if there is contact resistance in the CT clap, there will be big measuring error between the differential error and other parameters. Because the contact resistance might have change when the clap connect or disconnect with CT, the measuring result can’t be repeated.

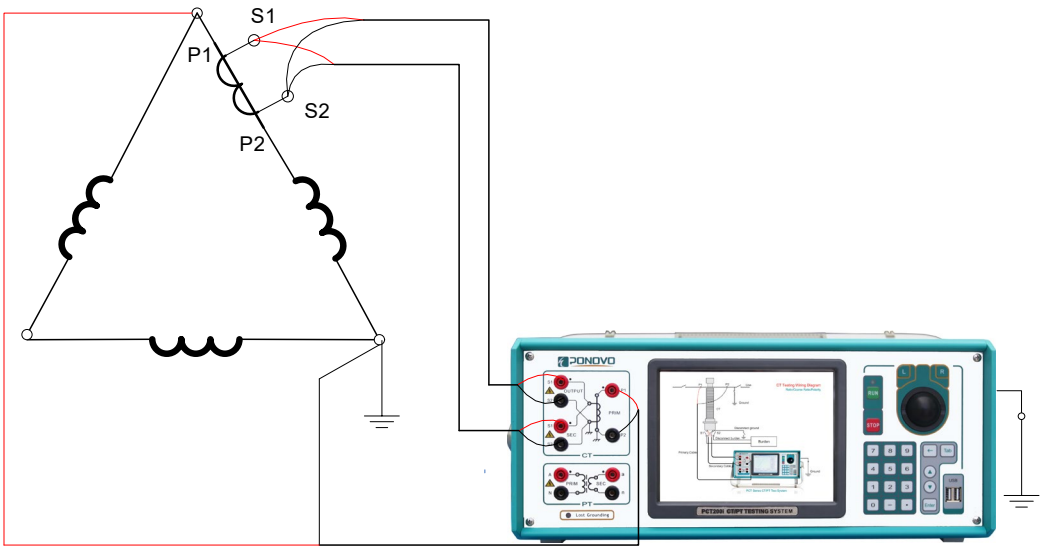
The max. contact resistance of two claps will be 0.5 and the max. overload would be 12.5VA. For this, the lower the CT coil resistance, the bigger the contact resistance’s effect. When testing a 5ACT, such contact resistance might cause a completely wrong result. But if a higher resistance such as 10Ω, the error can be igored. So the four-cable conection is absolutely applied in 5ACT testing.

# 4.1.1 Transmission line CT Test



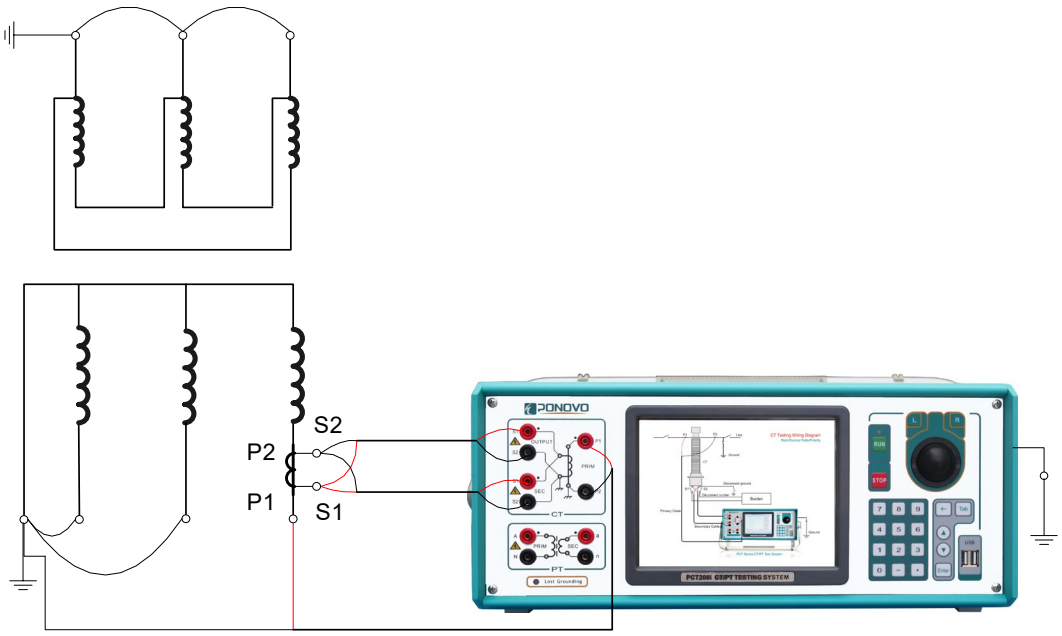
## 4.1.2 CT Test in Delta Connection Transformer

In order to reduce interference, other windings of the CT transformer should be short circuit.



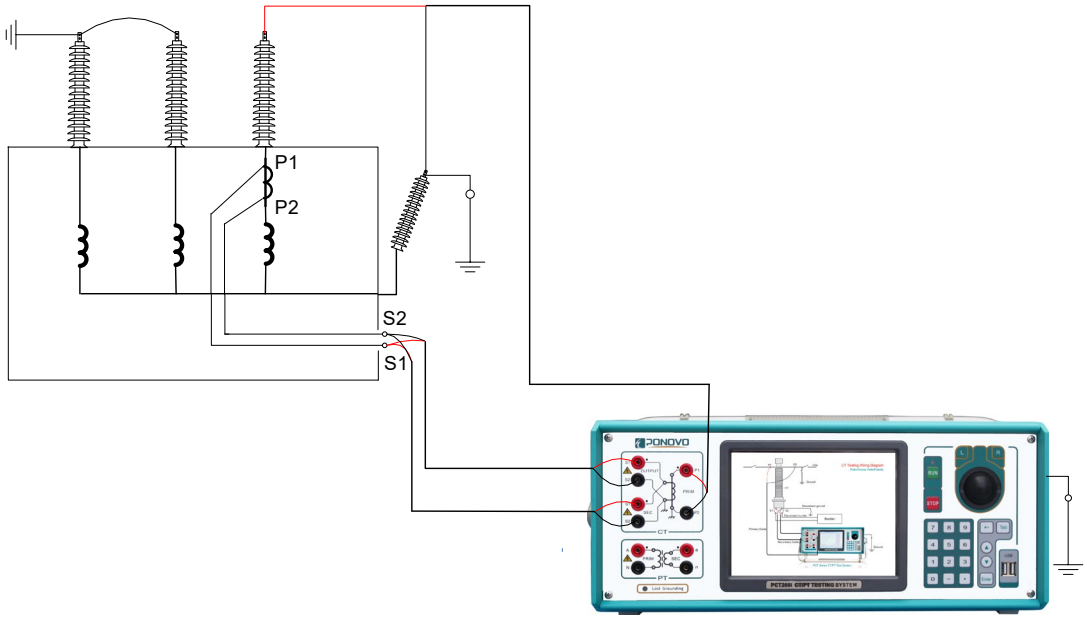
## 4.1.3 CT Test in the Star Connection Transformer

In order to reduce interference, other transformer's windings should be short circuit.



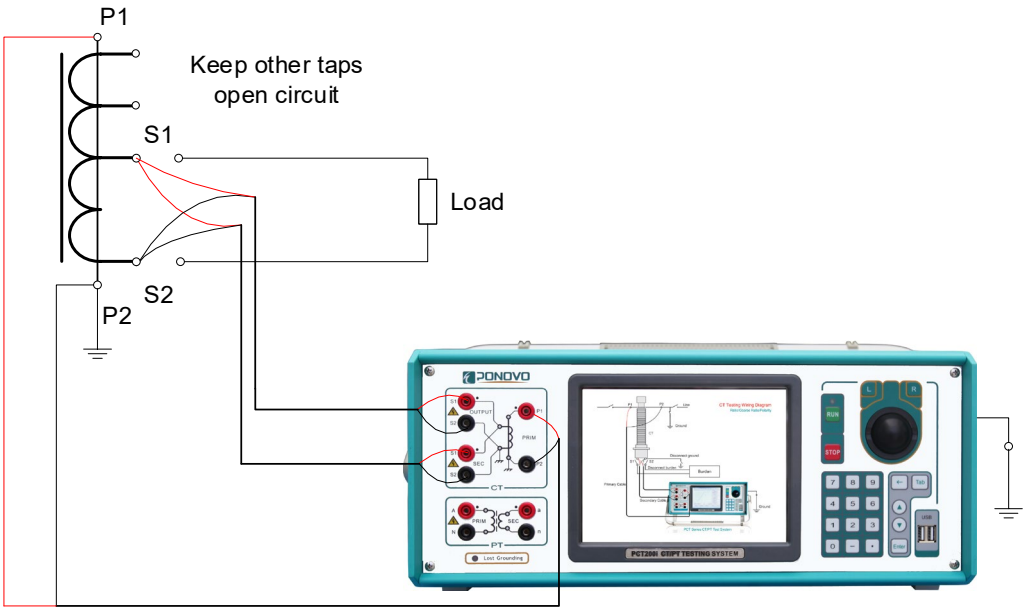
# 4.1.4 Bushing CT Test

In order to reduce interference, other windings of the CT transformer should be short circuit.

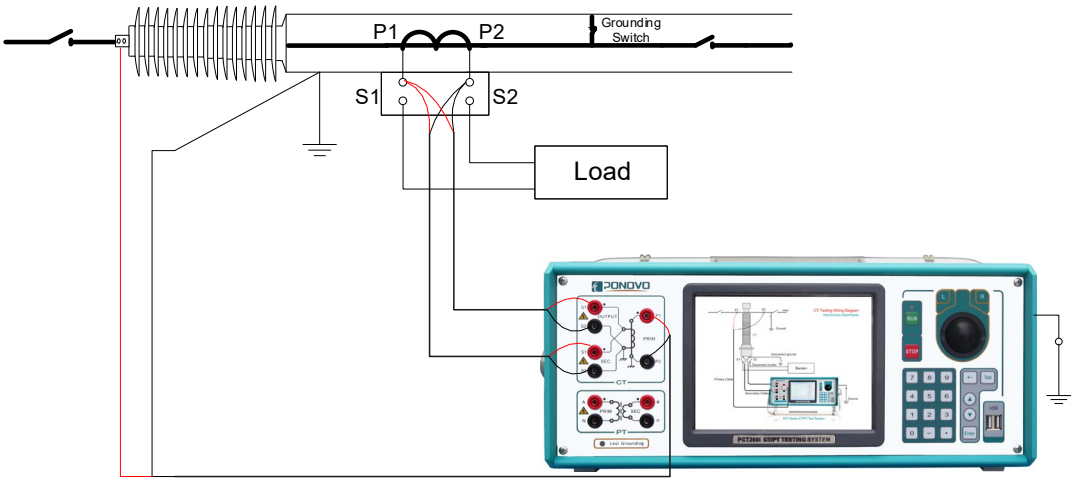


## 4.1.5 Test CT with Tapping

All the windings in the same shank are all switched on while testing CT with tapping.



# 4.1.6 Test CT in GIS



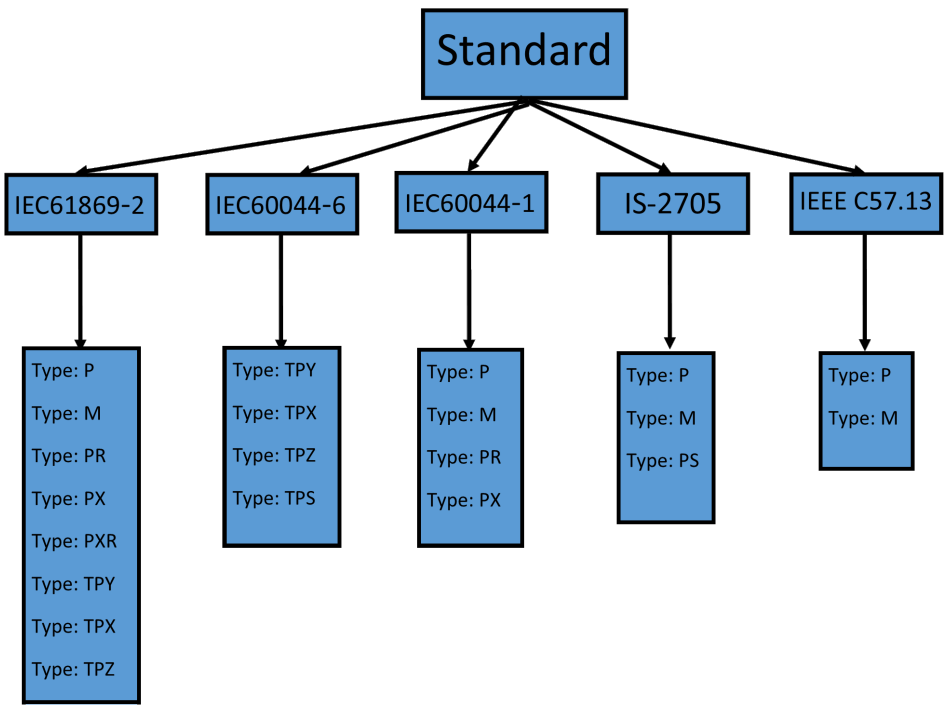
# 4.2 Testing process

## 4.2.1 Settings

Select CT parameter setting menu after entering into main menu. The CT nameplate parameters can be set by mouse or keyboard. The testing result will be correct on condition that the settings are right.

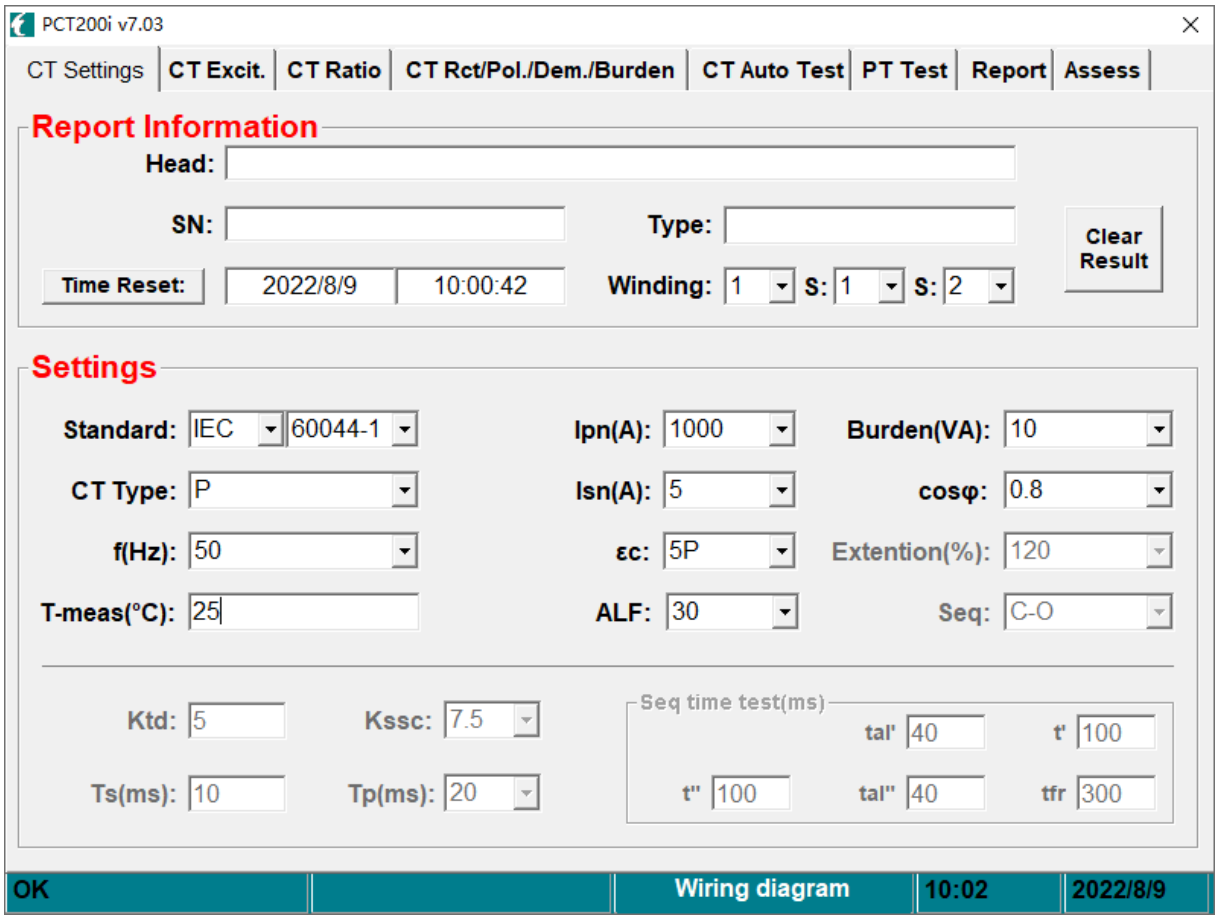
The related parameter settings are based on the selected CT type. All the parameters can be selected in the drop-down menu or by mouse.

The standard and CT type available for PCT200i/PCT200Ai

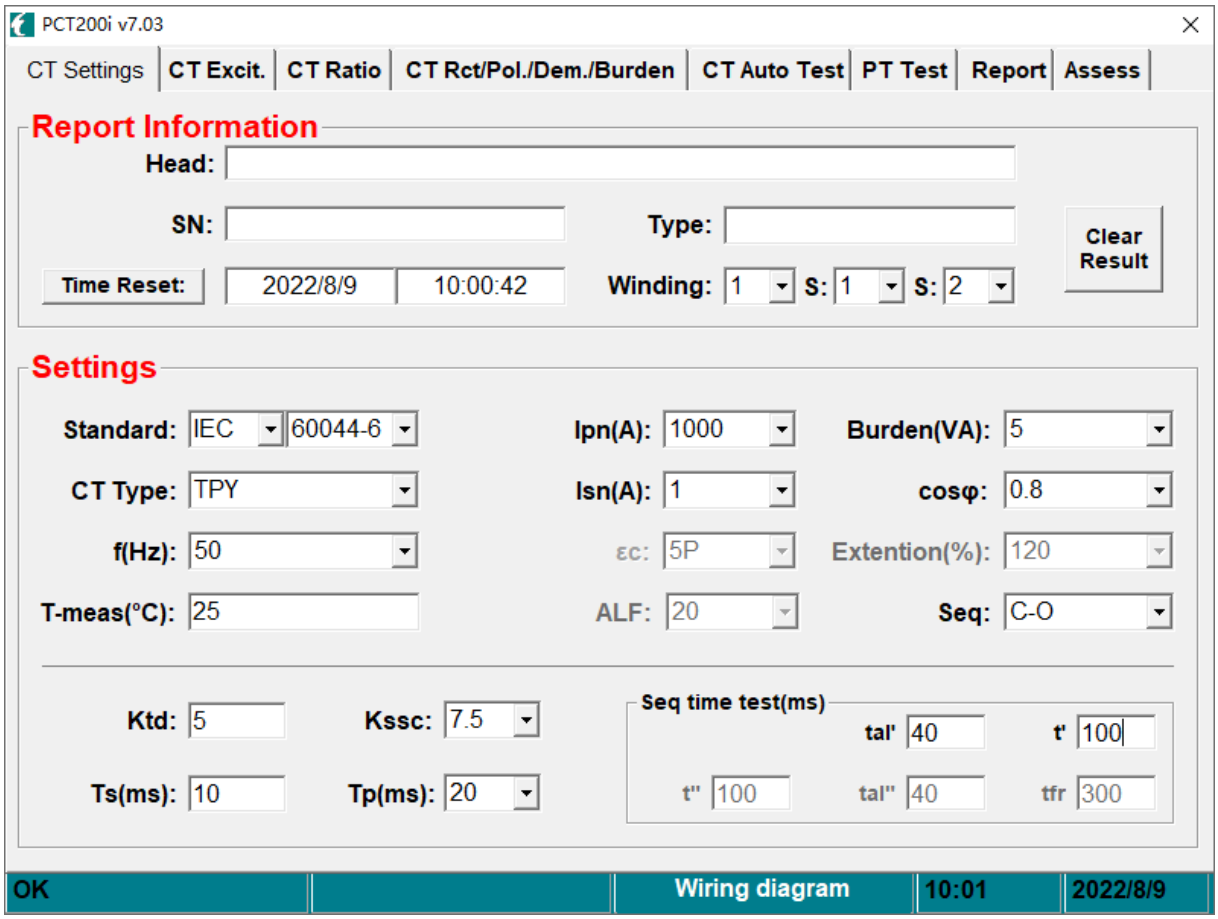


## 4.2.2 Settings for Different CT

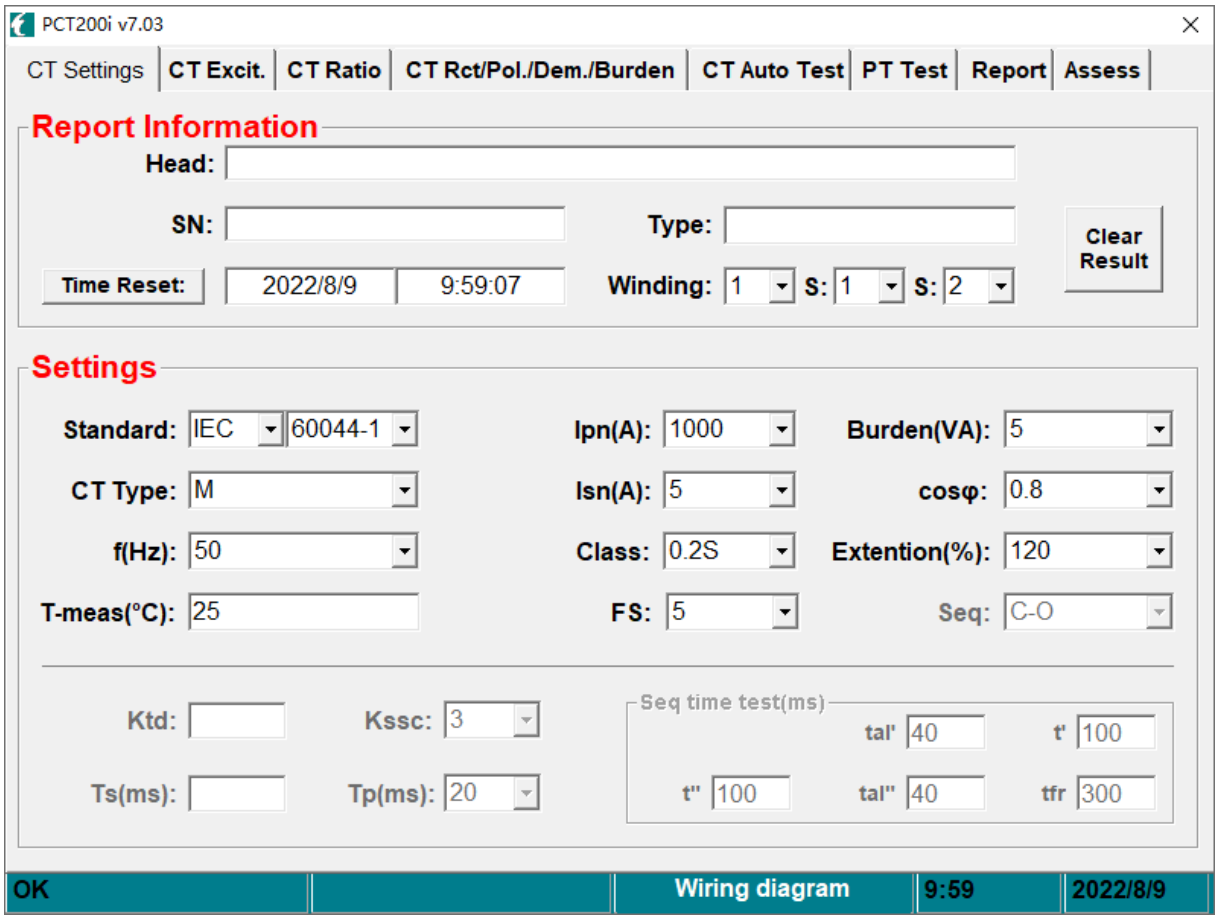
**P type CT** parameter setting:



**TPY type CT** parameter setting:



**M type CT** parameter setting:

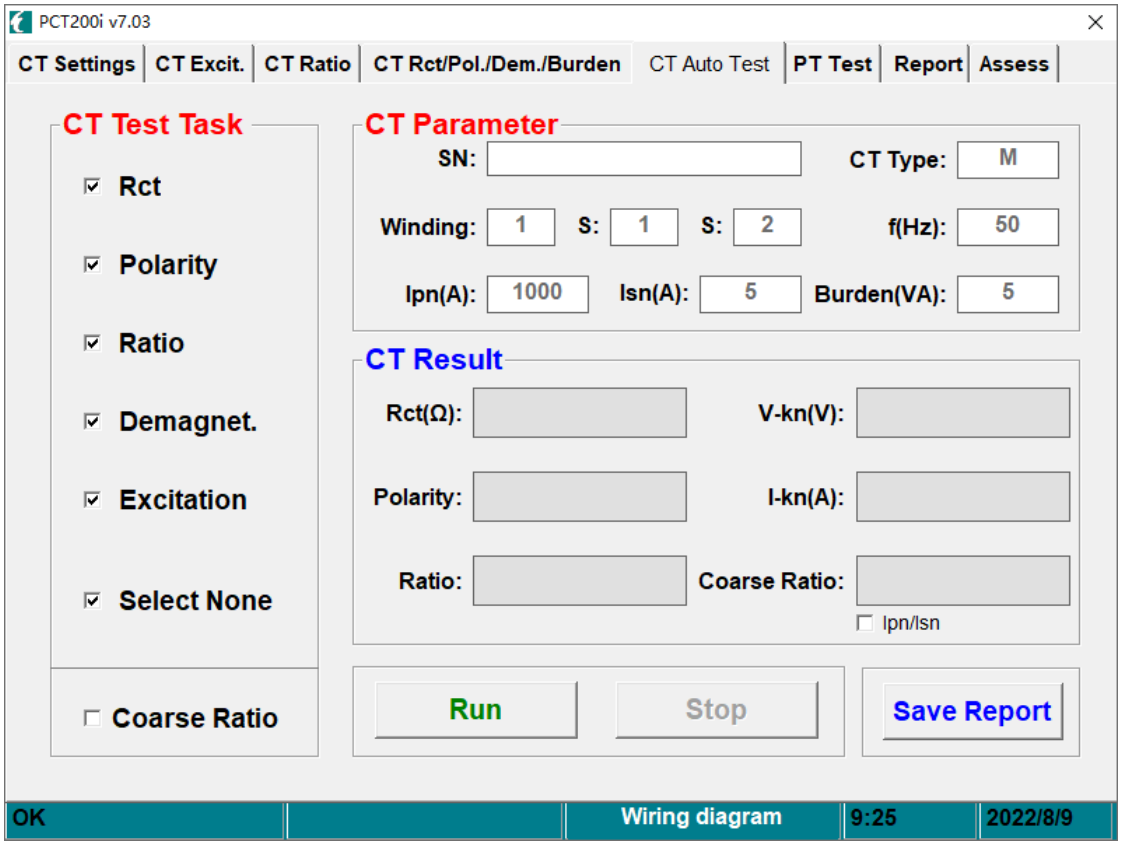


# 4.3 CT Auto Test

## 4.3.1 Test Process

After the CT parameters are set well, all the CT testing items can be finished in CT Auto Test automatically.

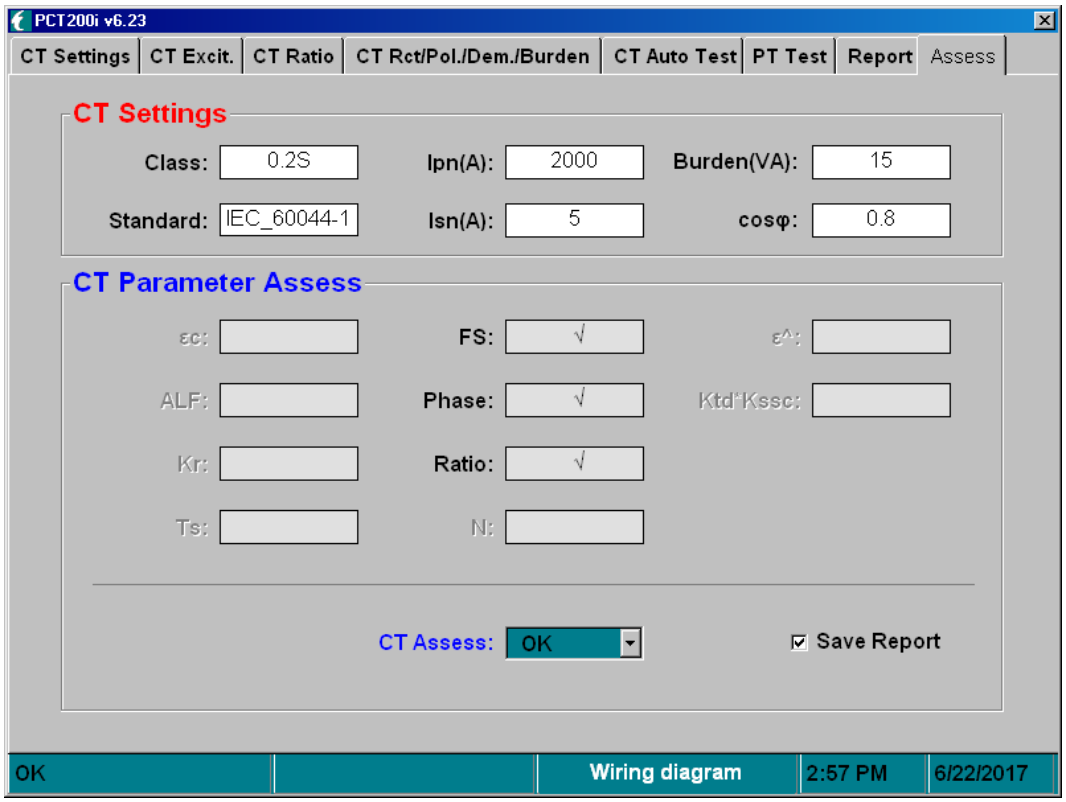
In CT Auto Test, CT excitation, polarity, ratio, secondary winding resistance and demagnetization tests all can be done.



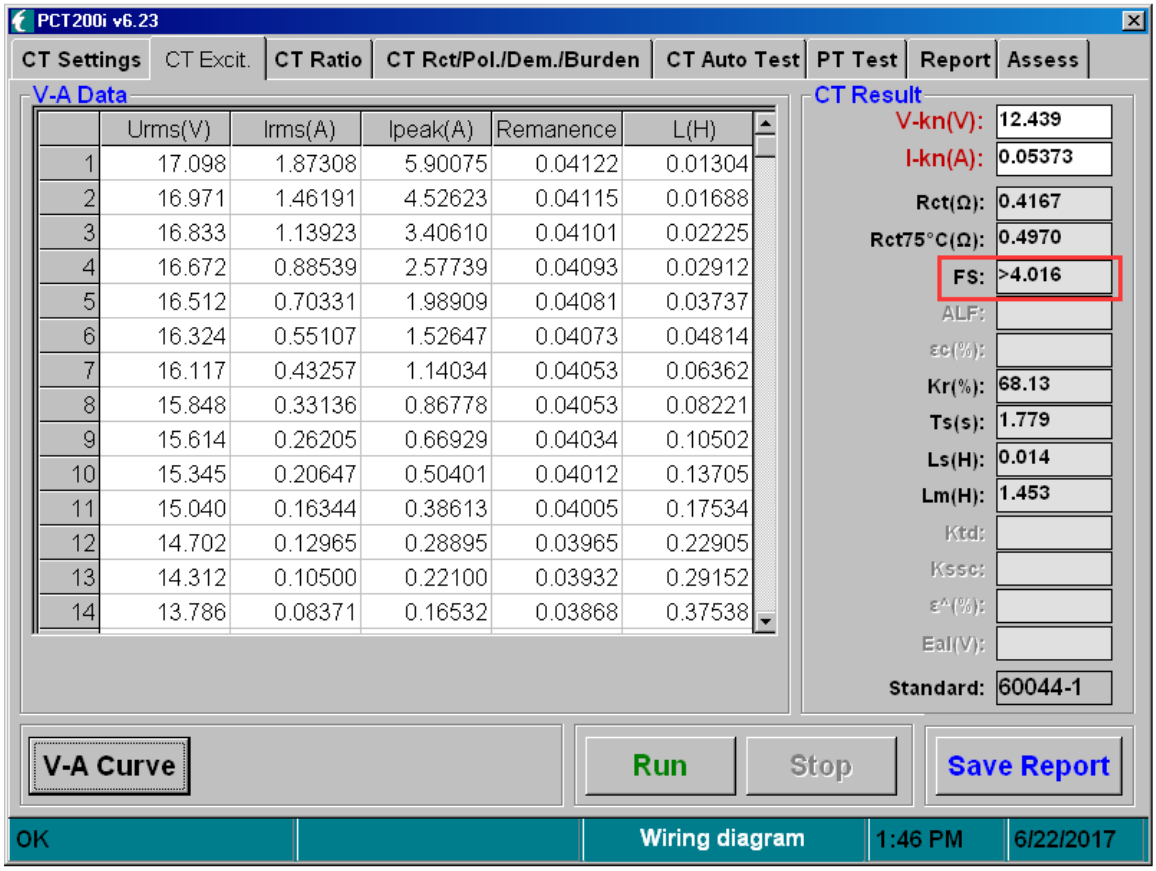

When it is finished, the test automatically stops and the lamp is off. Ratio, excitation knee voltage,

polarity, secondary side resistance test result can be checked in this unit.
The test result for each CT test item can be checked in its interface.
Excitation test result should be checked in **CT Excit.** unit. In Assess unit, the result judgement will be shown.

## 4.3.2 Assessment



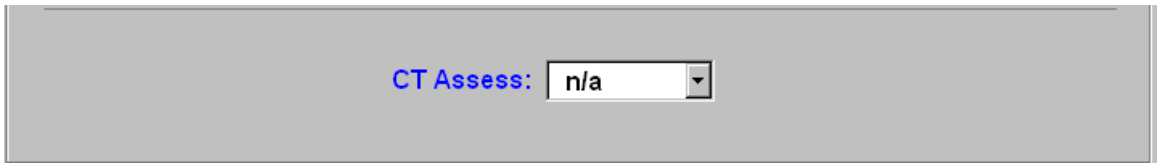

In the CT Parameter Assess areas, the assessment items will be automatically activated according to the test CT type and standards.



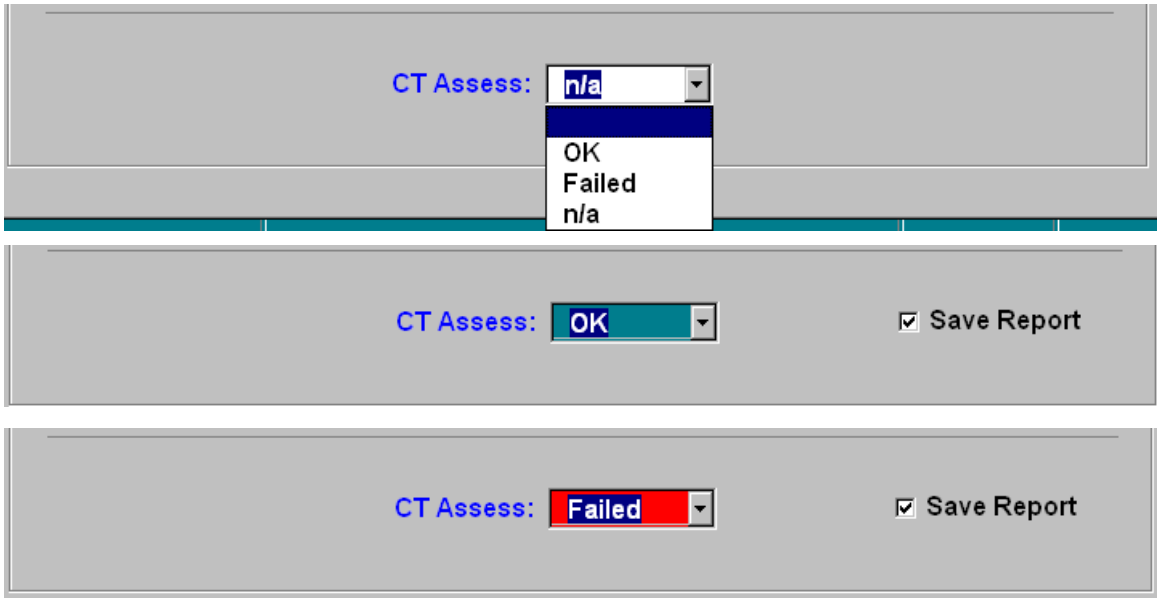

In this case the FS is 5 on the CT nameplate, but the FS>4.016.

It means while making this kind of CT, the PCT can only test FS at 4.016 times, but can't get the exact FS value. It is not confirmed if the real FS value > or < 5.

In this regard, the NA option will be shown there. When NA shows, the assessment result save will not be available showing below picture.



In this case, the test engineer can decide to pass or fail the result separately and save the assessment report.

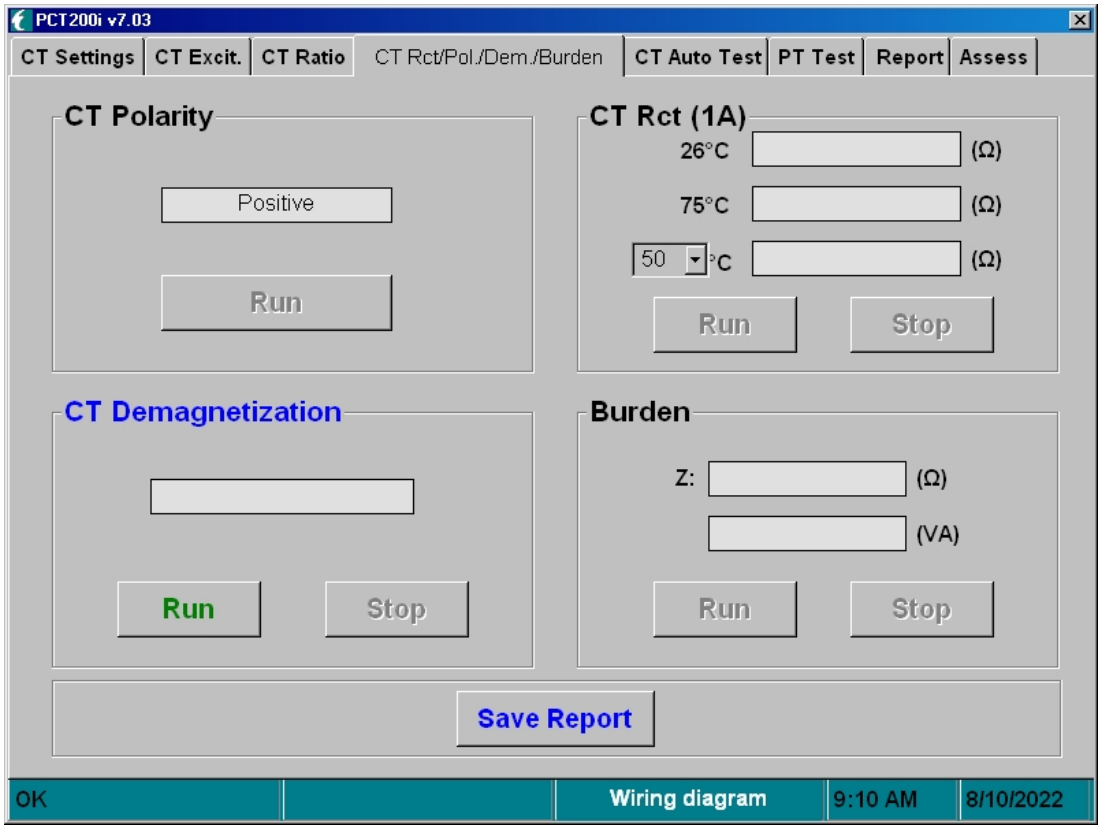


## 4.4 CT Test for Single Item

Sometimes not all the CT test tasks are required to be tested once. In this case, the single CT test item can be selected for testing. More detailed test result can be checked in each unit.

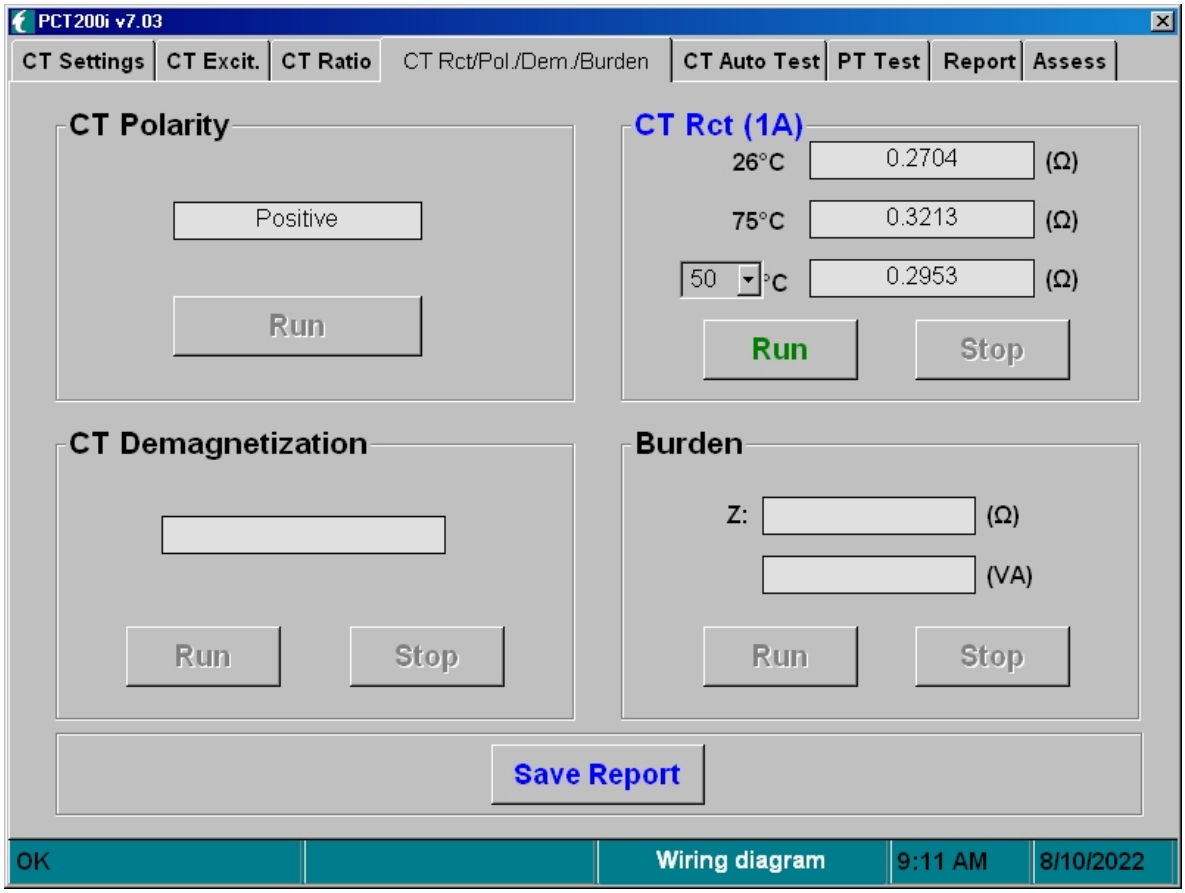
### 4.4.1 Polarity Test

CT polarity check can be done after selecting the **CT Rct/Pol./Demagnet/ Burden** unit. The polarity test is automatically finished while pushing the run button. It stops automatically and the lamp is off. The test method is negative polar.



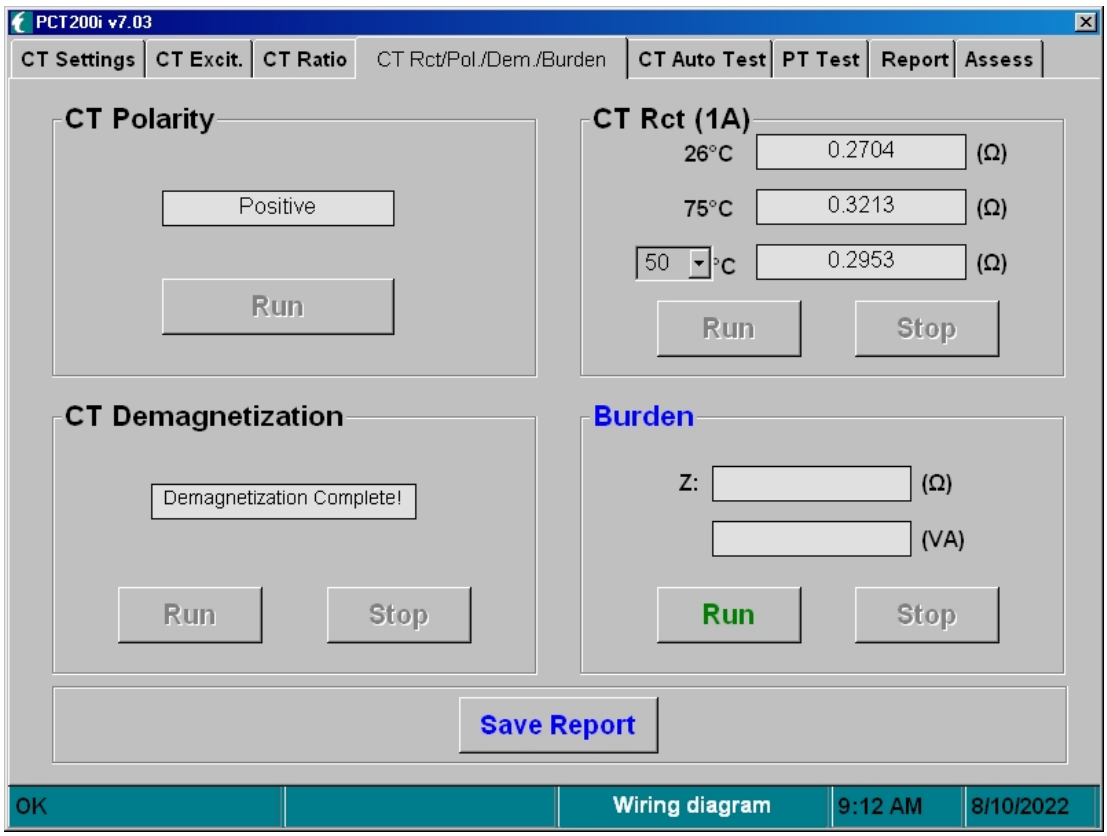
## 4.4.2 Rct Measuring

CT secondary winding resistance test can be done after selecting the **Rct/Polarity/Demagnet/ Burden** measuring unit. Entering the Rct measuring unit, the secondary winding Rct can run automatically after pressing the run button. The measuring result 25 degrees celsius means the resistance at current temperature and the 75 degrees celsius means the resistance at 75 degrees celsius. After testing, it stops automatically and the lamp is off.



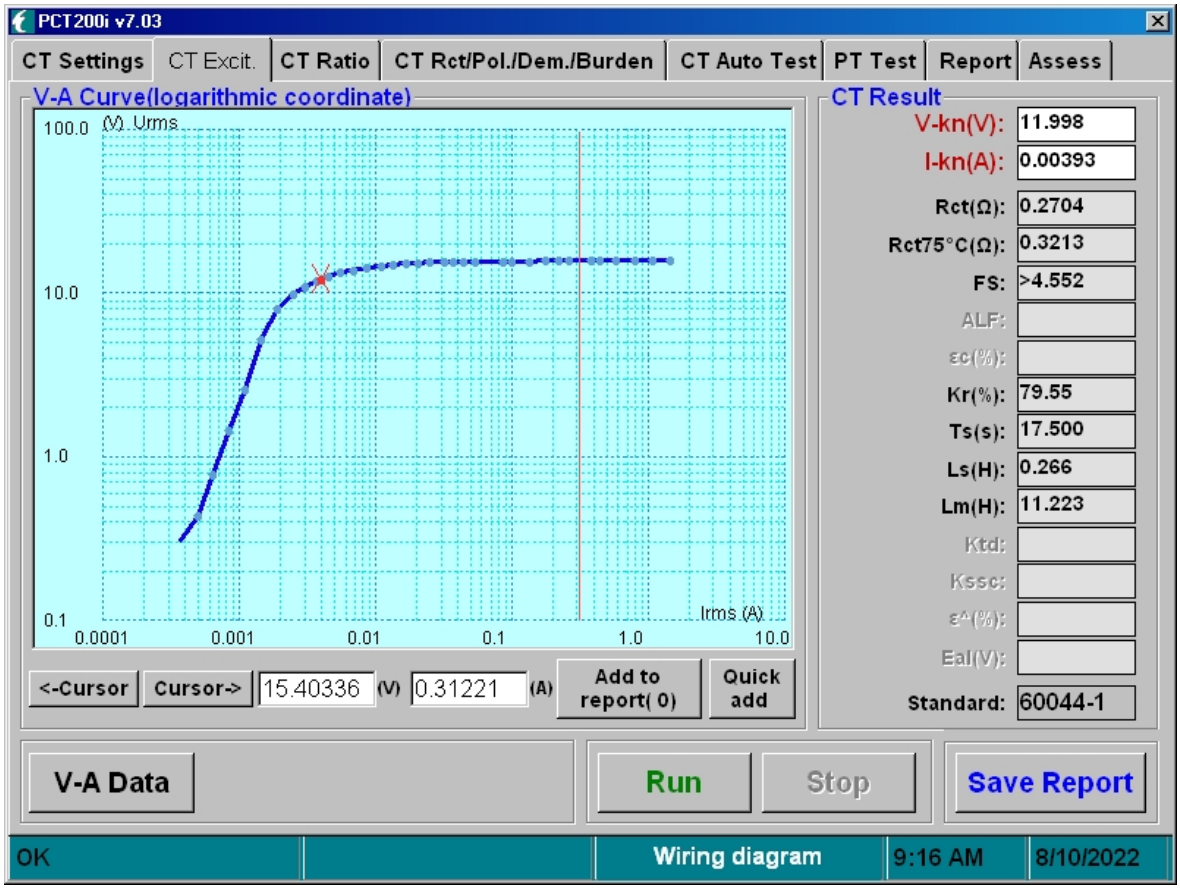
### 4.4.3 Demagnetization

CT demagnetization can be done after selecting the **Rct/Polarity/Demagnet/ Burden** unit. The process will automatically run when entering the unit and pushing the run button. After the test, it will automatically stop and the lamp is off.



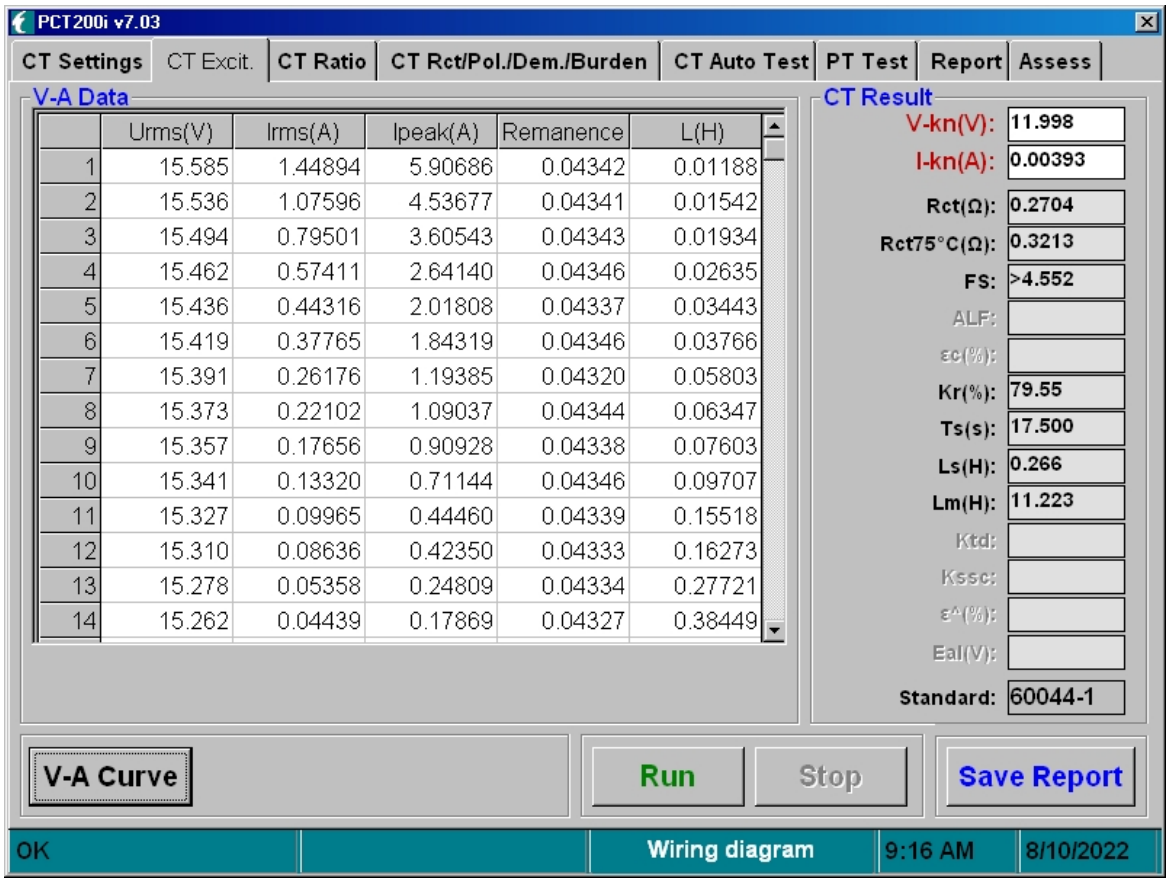
## 4.4.4 Excitation Test

CT excitation test can be done in **CT Excit.** unit.
Press Run to start the test. It stops automatically after test is finished and the lamp is off.
The test result can be display in V-A curve or V-A Data.



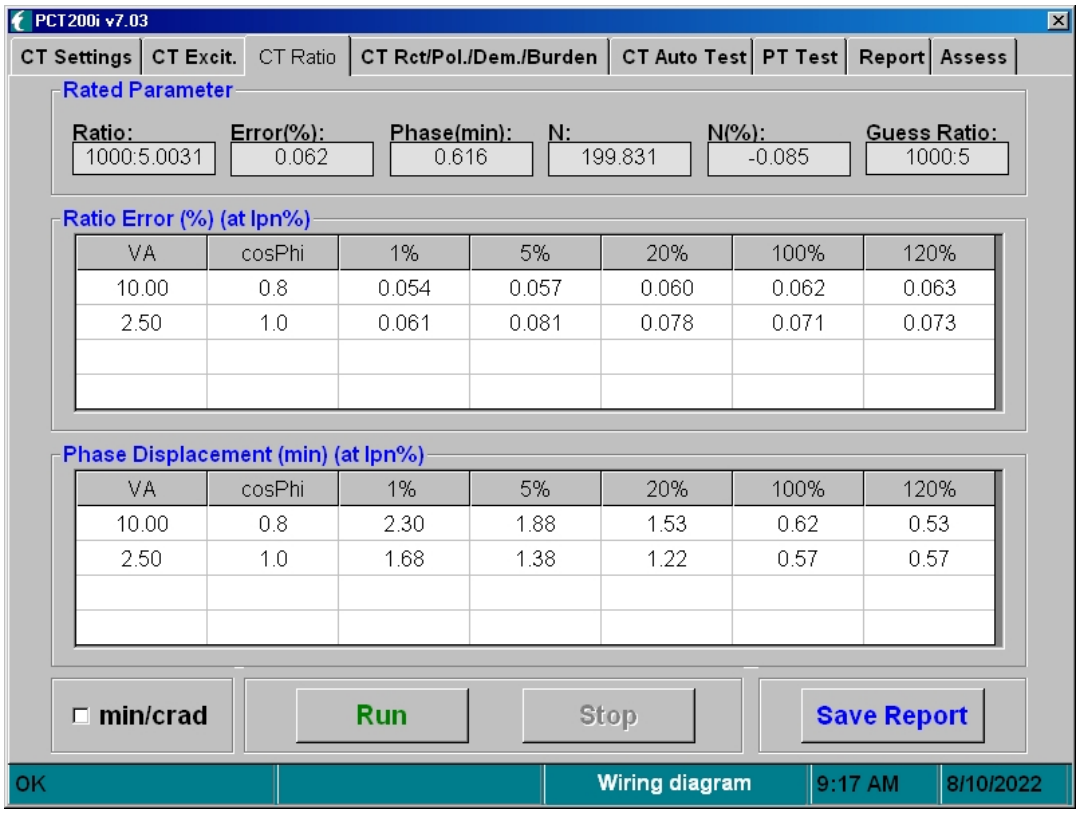

In V-A curve, the voltage and current are shown the figure at knee point.
Red cross will be shown at the knee point.
Press Cursor left, Cursor right or put in figures related to the value to observe.

Press V-A Data, the excitation curve can be changed into data table to check every voltage, current, magnetic flux and inductance figure.



## 4.4.5 Ratio Test

CT ratio test can be made in **CT Ratio** unit. CT ratio, ratio error, phase displacement, composite error and turns ratio error can be automatically tested.
When the test is completed, it stops automatically and the lamp is off.

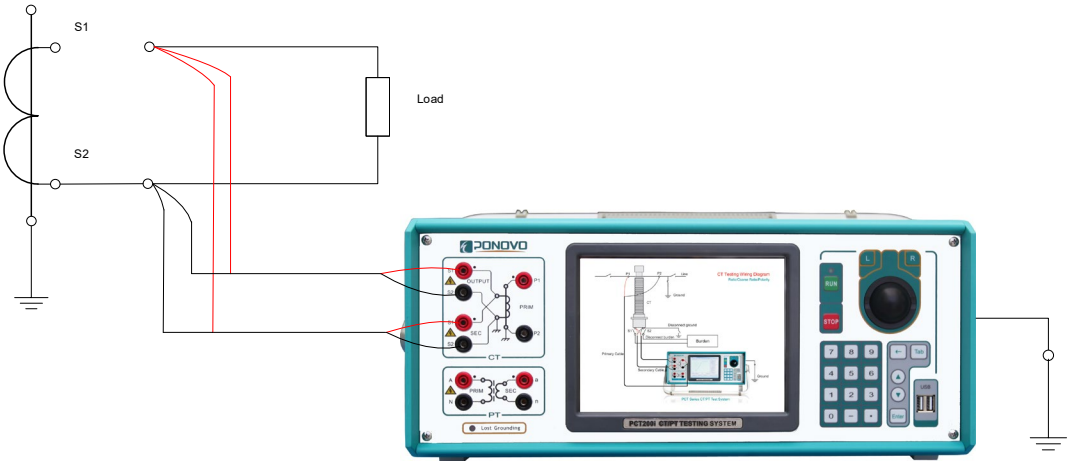



**Note:** N stands for turn-ratio and N% stands for turn-ratio error.

# 5. Burden Test

## 5.1 Wiring Connection

Connecting the instrument transformer according to the below direction, while doing secondary load impedance test.

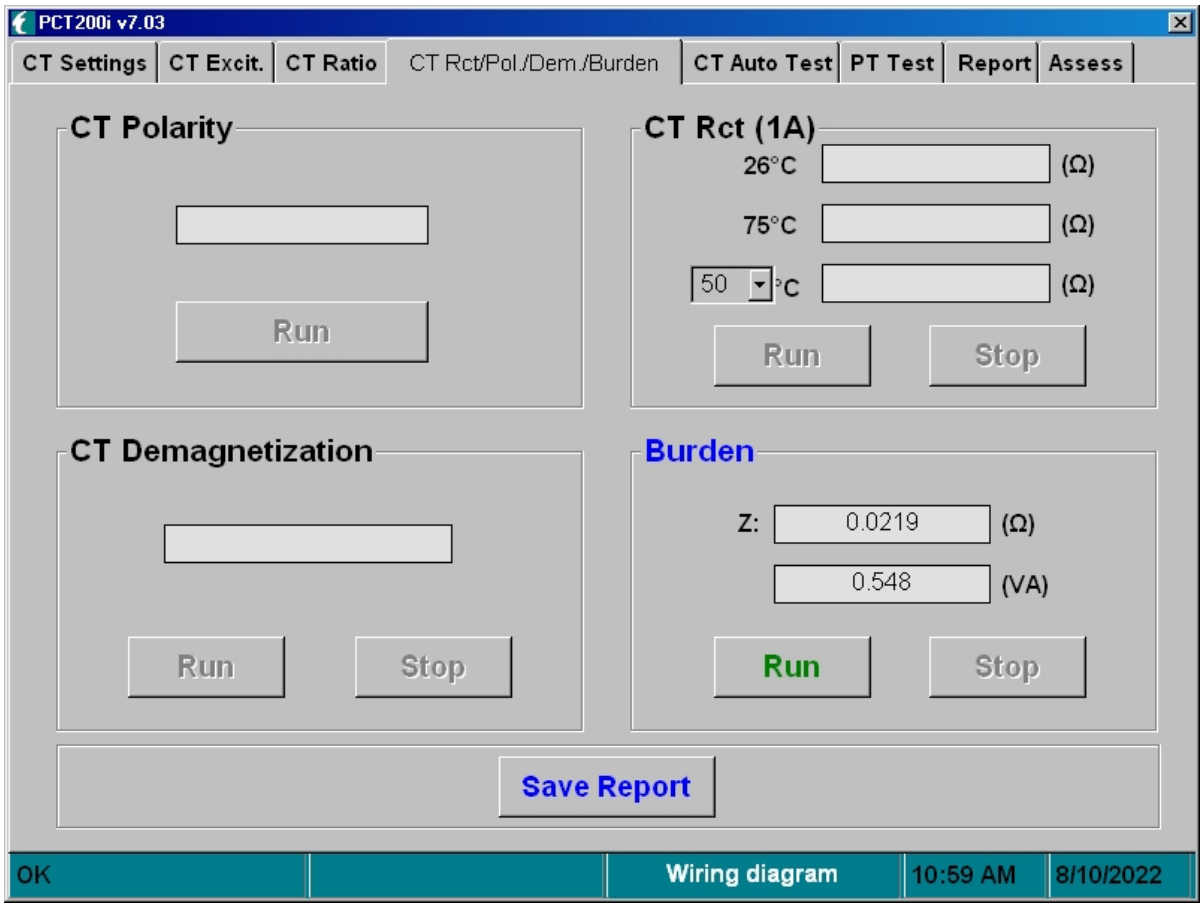



**Wiring direction:** The transformer's output end S1 and testing end S1 are connected with one side of secondary load the CT.

The transformer's output end S2 and testing end S2 are connected with the other side of secondary load of the CT.

## 5.2 Test Operation

Entering the main menu and selecting the **CT Rct/pol./Dem./Burden** test unit, CT secondary burden measuring can be done. After entering this unit and moving the cursor to the Burden box, Press Run to start the test.
The test result will be shown after testing is finished.

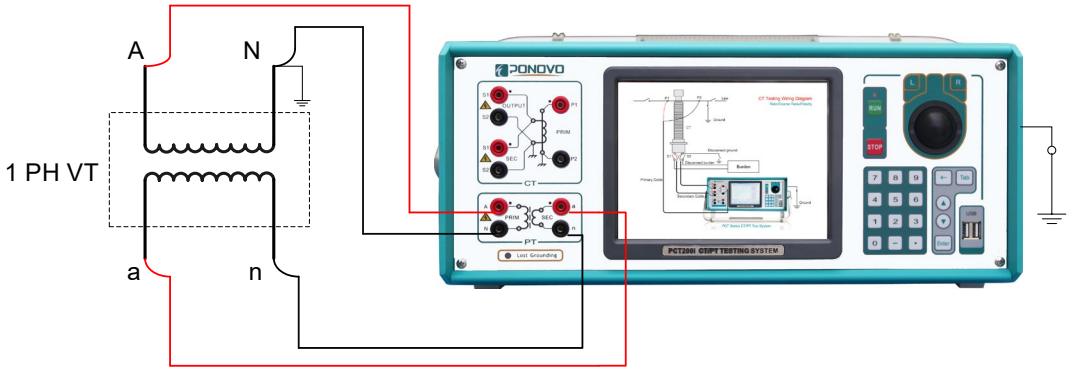


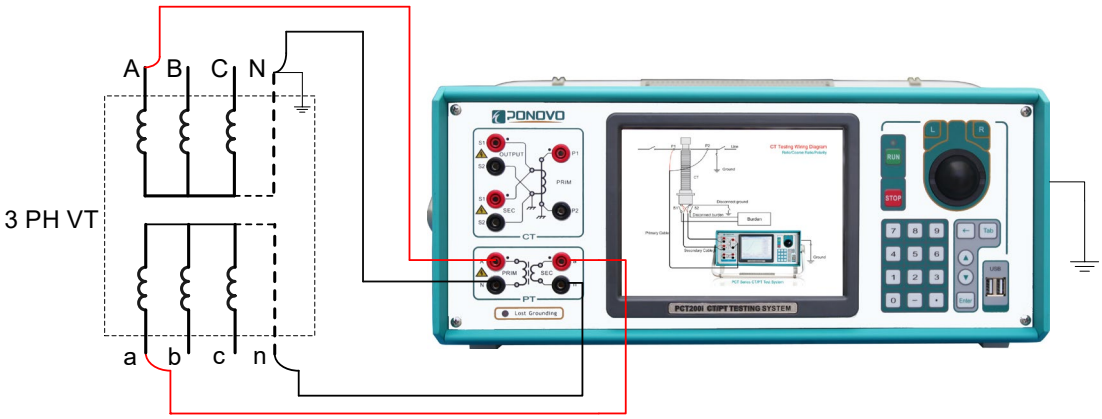
# 6. PT test

## 6.1 Wiring Connection

### 6.1.1 Polarity and Ratio Test

Connect PCT200 with PT as illustrated in below pictures when doing PT polarity and ratio test.



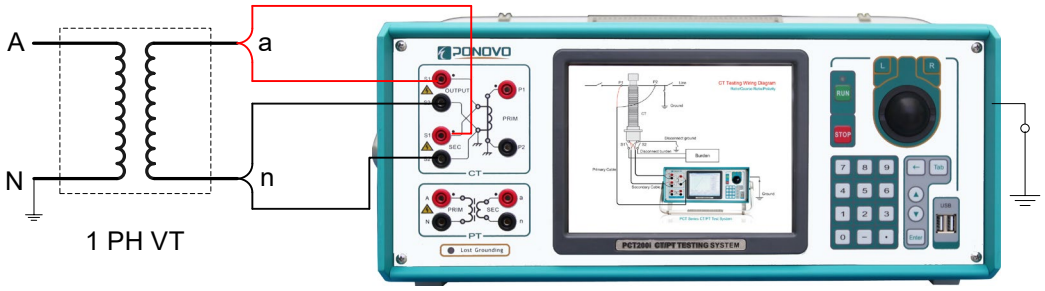



**Wiring directions**： The output “A” of transformer is connected with one side of PT primary.
The output “N” of transformer is connected with one side of PT primary.
The secondary testing end “a” of transformer is connected with one side of PT secondary.
The secondary testing end “n” of transformer is connected with the other end of PT secondary.

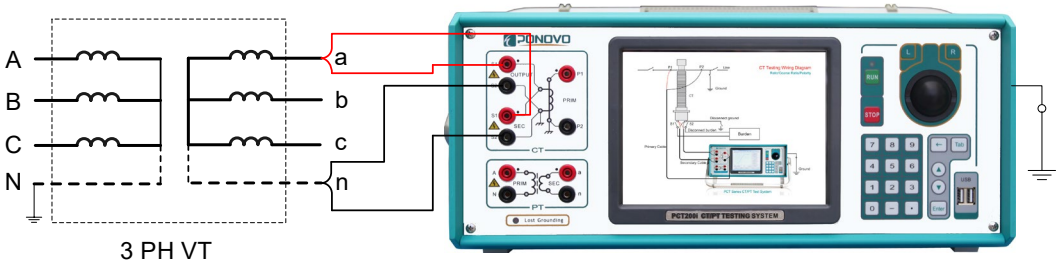
**Note**: The wiring for primary and secondary cannot be wrong, otherwise, it may give thousands of voltage.

## 6.1.2 Excitation Test

Connect PCT200 with PT as illustrated in below when doing PT excitation test.




**Single-phase voltage transformer**




**Three-phase voltage transformer**

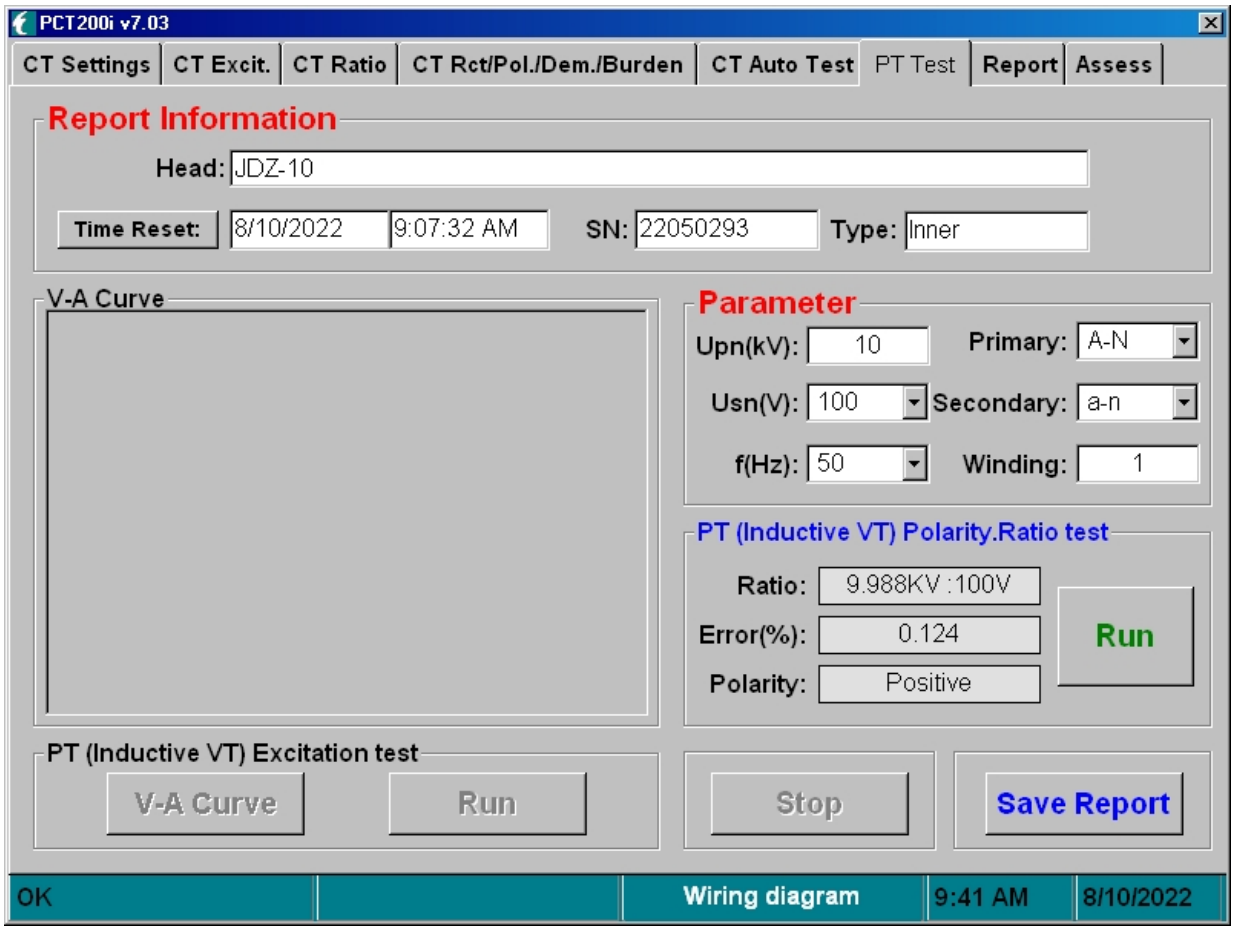
**Wiring directions**: The output S1 of PCT is connected with one side of PT secondary.
The output S2 of PCT is connected with the other side of PT secondary.
The primary end of PT is grounded, and other windings are open-circuit.

**Notes**: Keep off the instrument, in case that thousands of voltage may occur while doing excitation test.

# 6.2 Test Operation

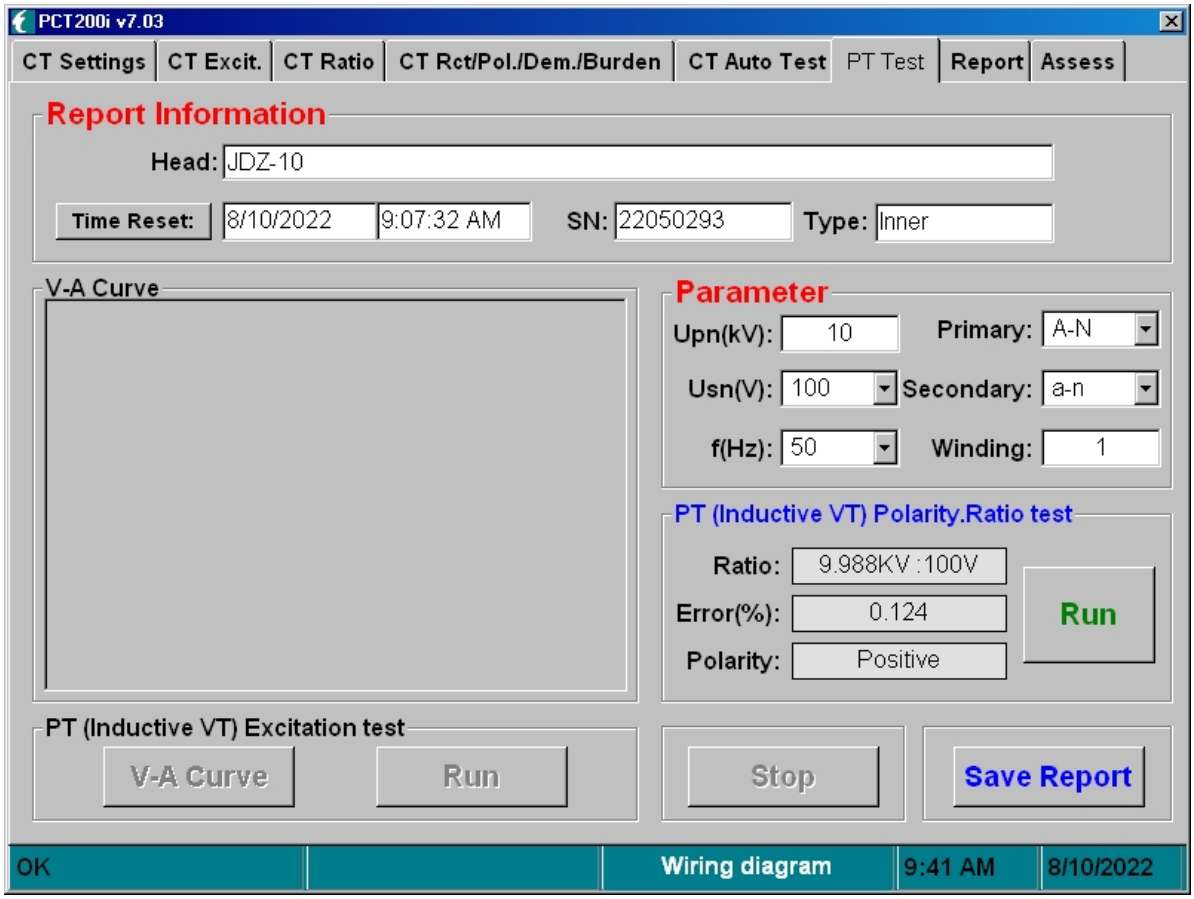
## 6.2.1 Settings

Set parameters according to PT nameplate.



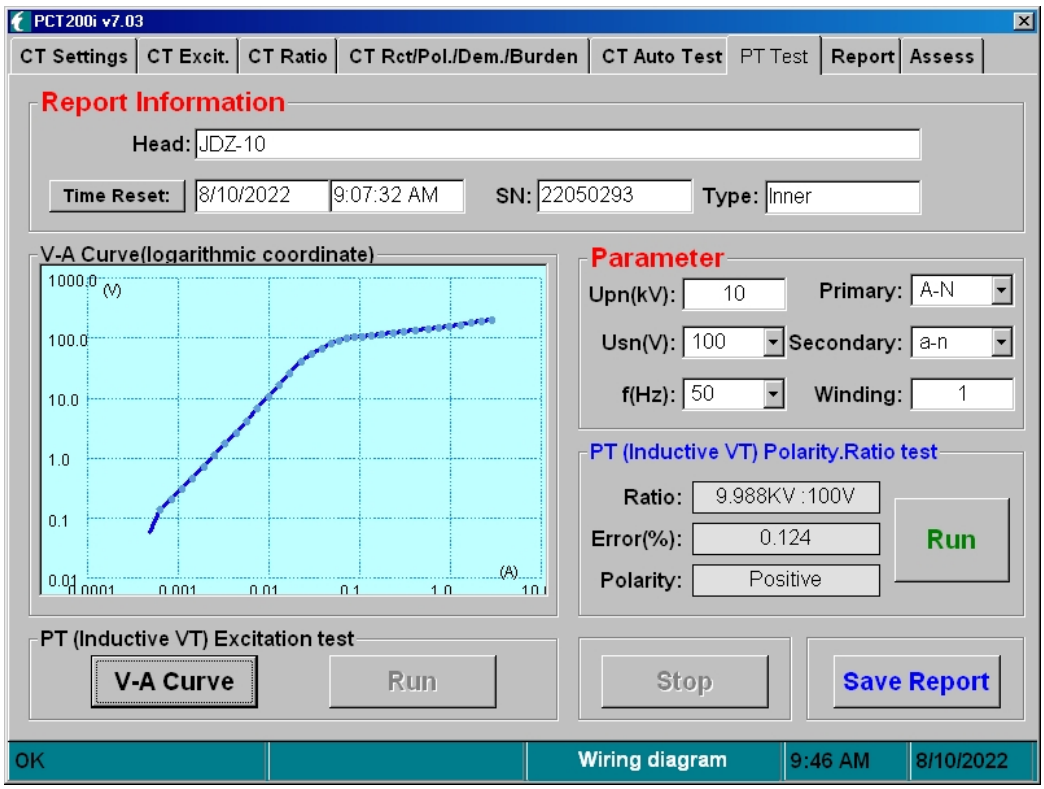
## 6.2.2 Polarity and Ratio Test

After the PT parameters are set well, press Run to start the PT polarity and ratio test.



## 6.2.3 Excitation Test

Move the cursor into the Excitation test box to Run the test.
The voltage and current value can be checked in the V-A curve.




Press Save button to save the testing report after finished the test.

# 7. Report

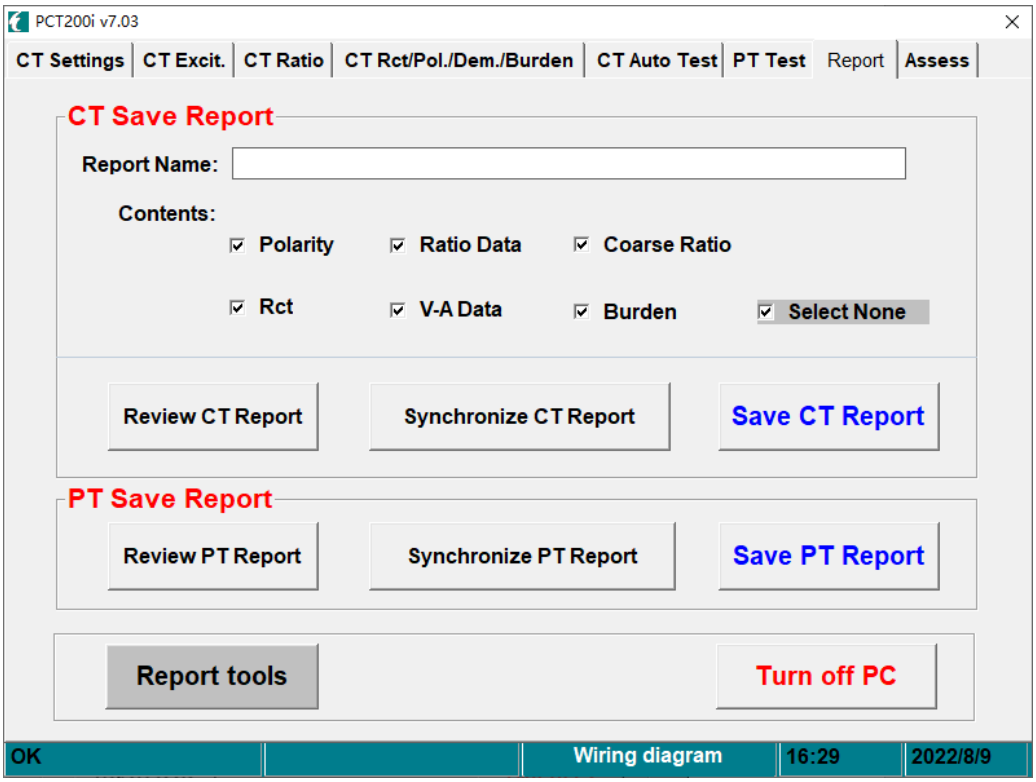
## 7.1 Report Save and Copy

After all the testing is finished, select the **Report** unit and enter into report save interface.

In the **Report page**, the report name can be edited.

The report contents can be selected and saved according to the testing works.

The report is saved automatically in the CT report/PT report file. The report can be copied and converted into EXCEL format in PC by the report convert tool.




**Synchronize CT Report:** Synchronize today's or all the reports into mobile disc showing below.

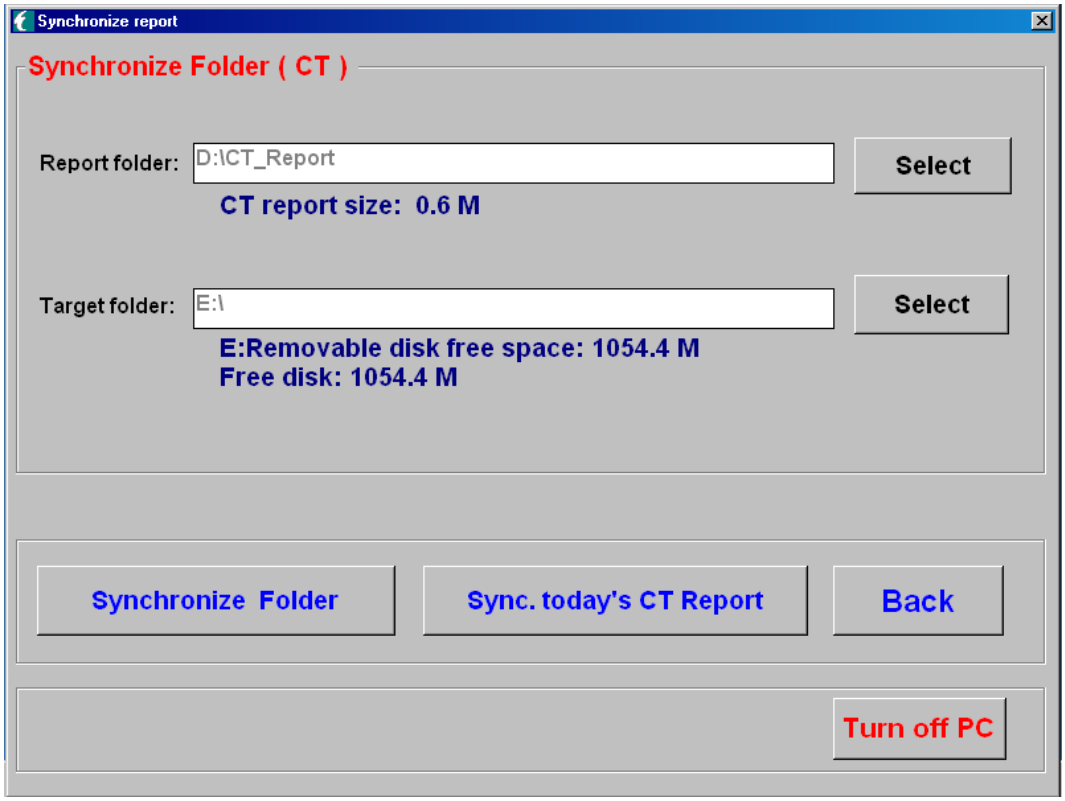
**Save CT Report:** Save the reports to Disc D.

**Synchronize PT Report:** Synchronize today's or all the reports into mobile disc showing below.

**Save PT Report:** Save the reports to Disc D.

**Report tools:** For the operation of the **Report tools**, please refer to next chapter **7.2 PCT Report Tools User Manual**.

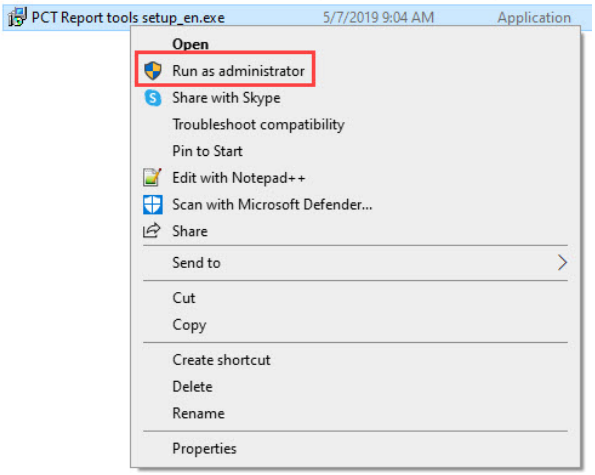
**Turn off PC:** It is suggesting exiting the operation system, then switch off the power supply after reminder.




1. **Report folder:** Select the report folder to be synchronized.
2. **Target folder:** Select the folder to save the synchronized reports.
3. **Synchronize Folder:** Synchronize all the reports in the folder.
4. **Sync today's CT/PT report:** Synchronize the day's CT/PT reports.
5. **Back:** Back to the test interface
6. **Turn off PC:** Exit the system and power off.

# 7.2 PCT Report Tools User Manual

**Right click** to **run as administrator** to install the ***PCT Report Tools*** in the PC.




**Right click** to select **run as administrator** to run the Report Tools.

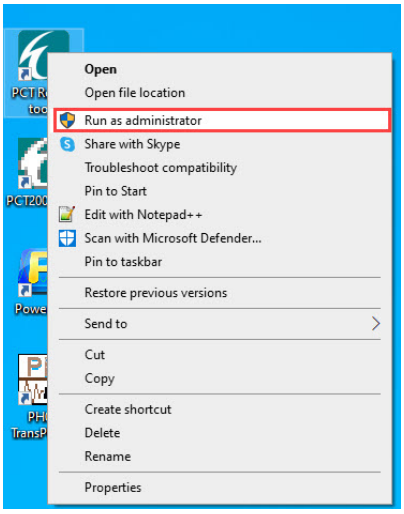


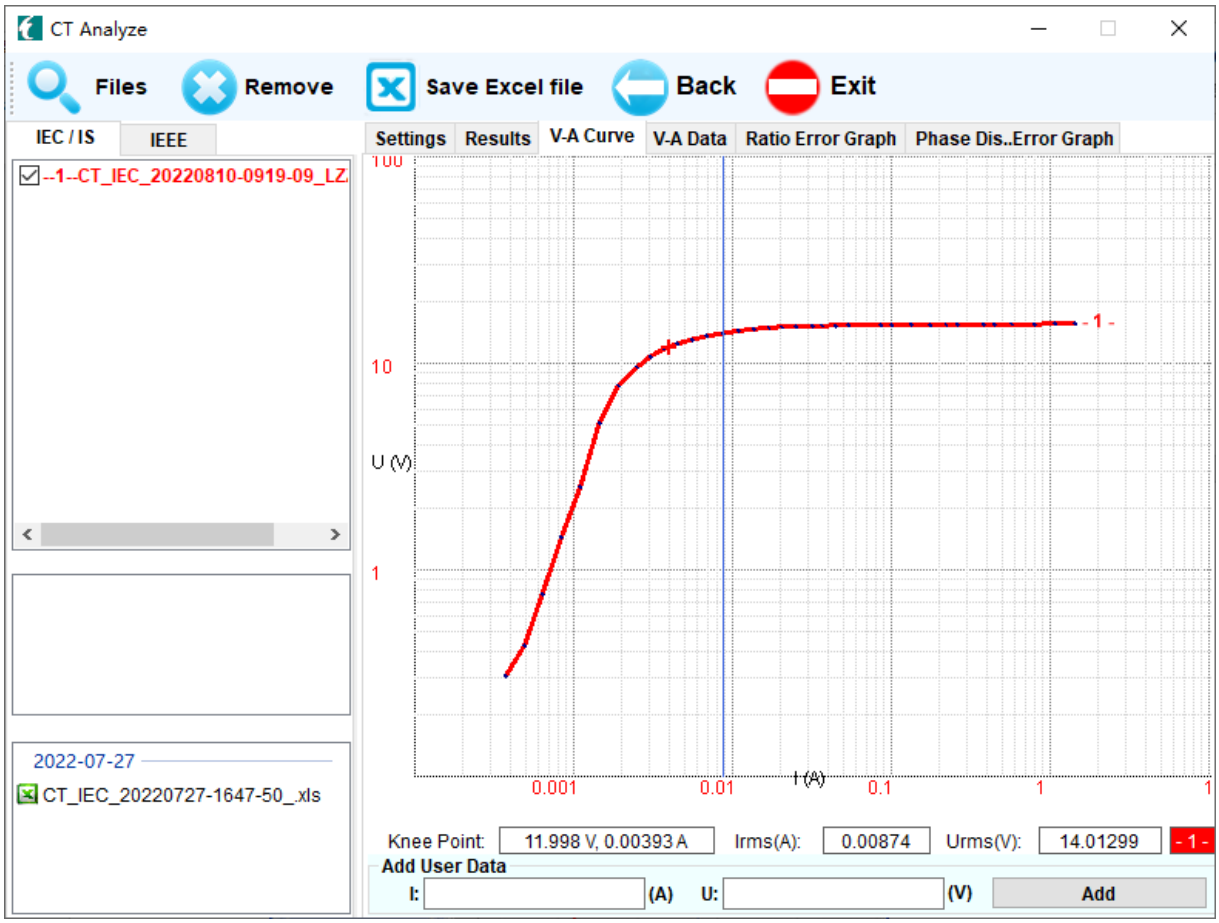

Figure 1


Figure 2

In figure 1, it is the PC software interface installed Excel.

In figure 2, it is in the PCT system or the PC software interface without Excel.

1. **CT multi-report analyze:** to analyze the CT multi-report and curve.
2. **Report folder:** to generate the reports including Excel and JPG formats. In the PCT system, the report is .pct format. All the reports are saved in Disc D.
3. **CT report to excel:** to convert the CT report into Excel format report, support multi-report selection. The conversion process includes the tips (conversion completion and the number of conversion files)
4. **PT report to excel:** to convert the PT report into Excel format report, support multi-report selection. The conversion process includes the tips (conversion completion and the number of conversion files)
5. **create ct excel report shortcut:** to create the desktop file of CT report
6. **create pt excel report shortcut:** to create the desktop file of PT report

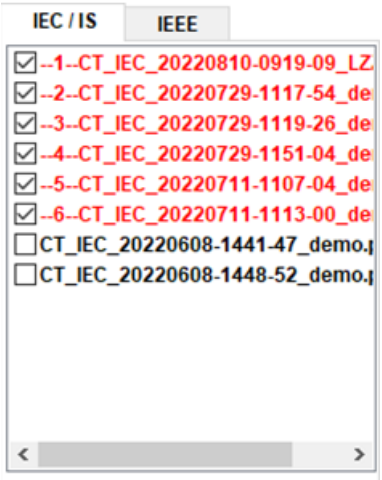



## Files:

1. **Open Files:** open the PCT report (.pct format)

Open the selected PCT report. Max 50 reports can be opened and listed. Among the listed reports, max 6 report data and curve will be shown in the right.

2. **Files Add:** More reports allocated in different report file folders or in the same file folder can be opened by clicking Files add. Max 50 reports can be opened and listed

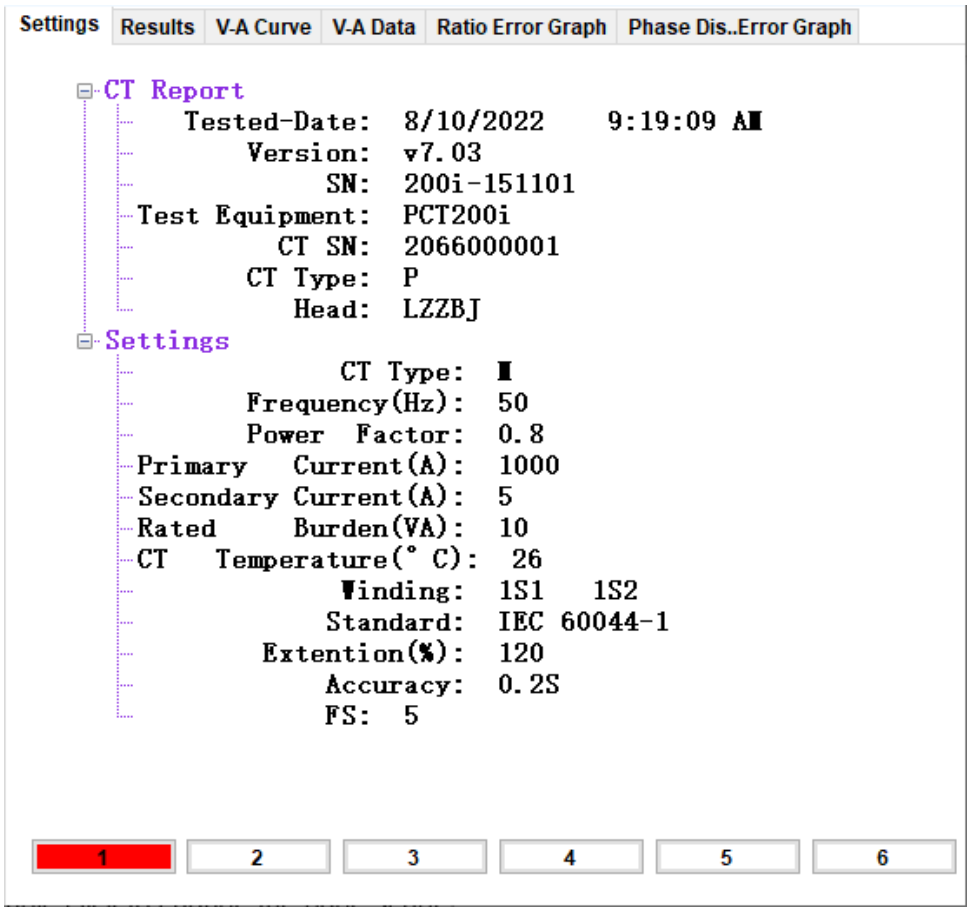



**Open files list:** the selected report will be listed here. The IEC/IS and IEEE standardized reports are categorized separately.

The successfully opened reports are displayed in red with tick in box. The reports waiting for open are displayed in black without tick. If the open report has problem in format, the report ground is grey and cannot be selected.

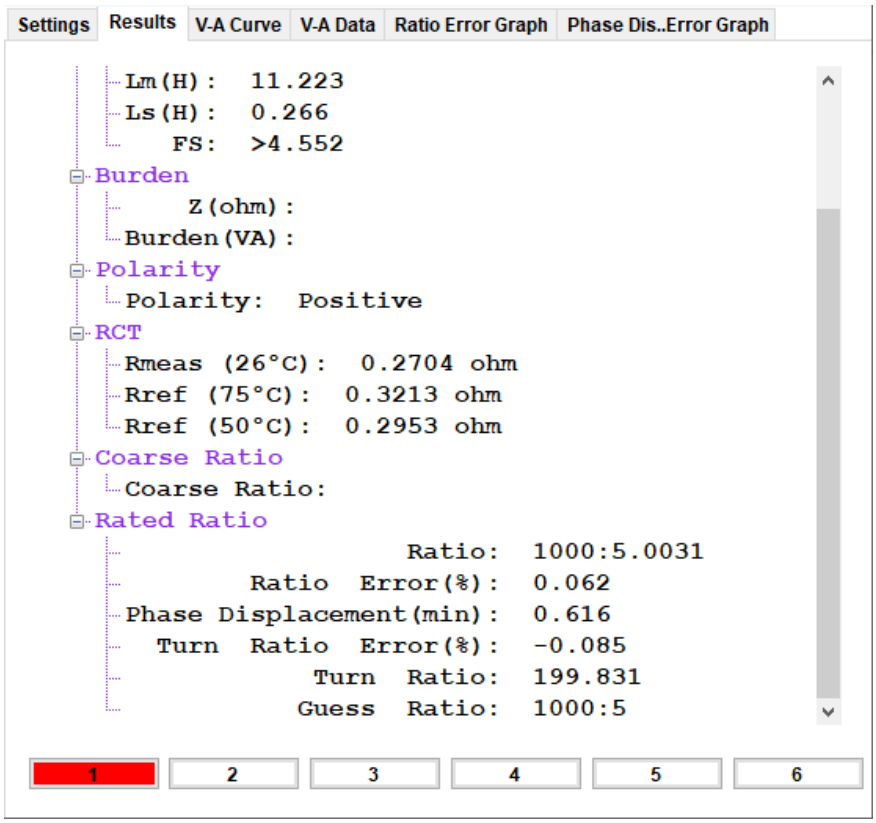
Click the check box or double click the files to open or remove the reports. At least one report should be kept.

The contents of the selected reports will be shown as below.

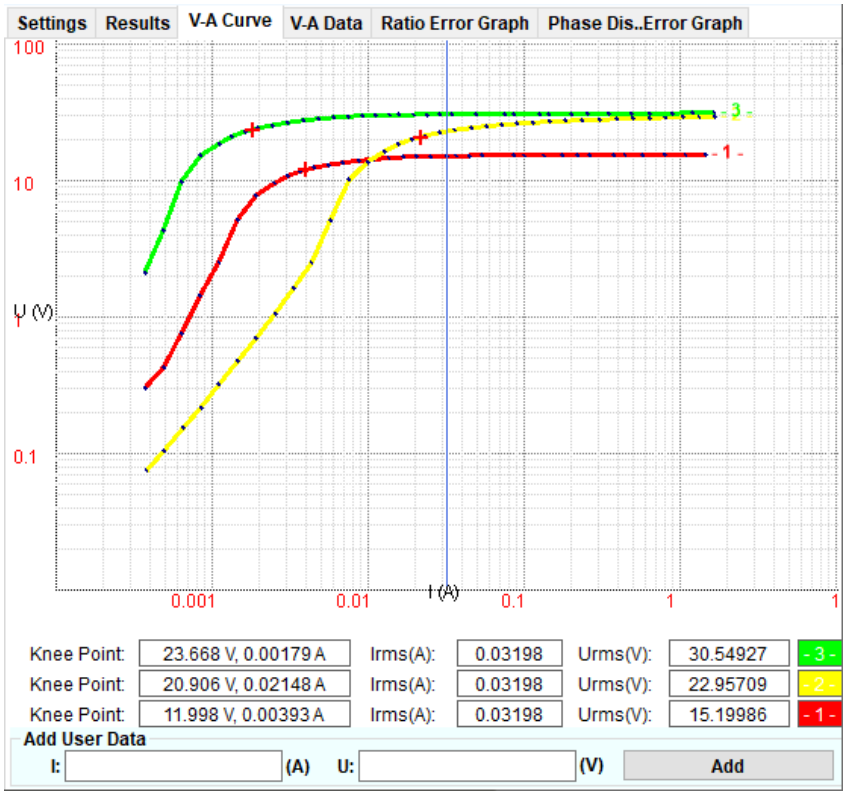



**Settings:** The CT parameters

The number keys are used to switch among the selected reports or click the number to change the setting page.




**Results:** The results for excitation, burden, polarity, RCT, coarse ratio and rated ratio.



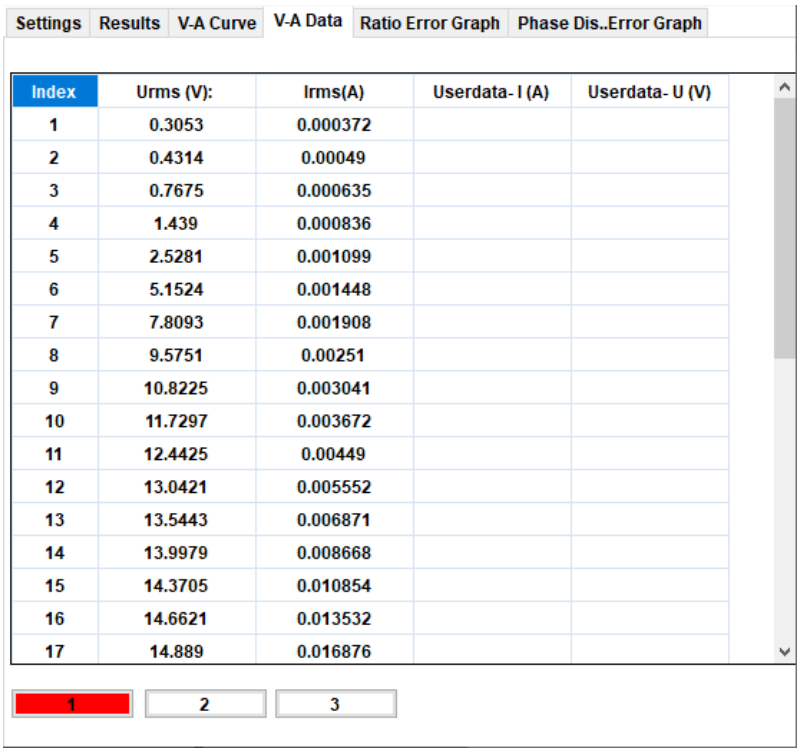

**V-A Curve:** excitation curves

Move the cursor to the curve zone and right-click mouse to set the background color.

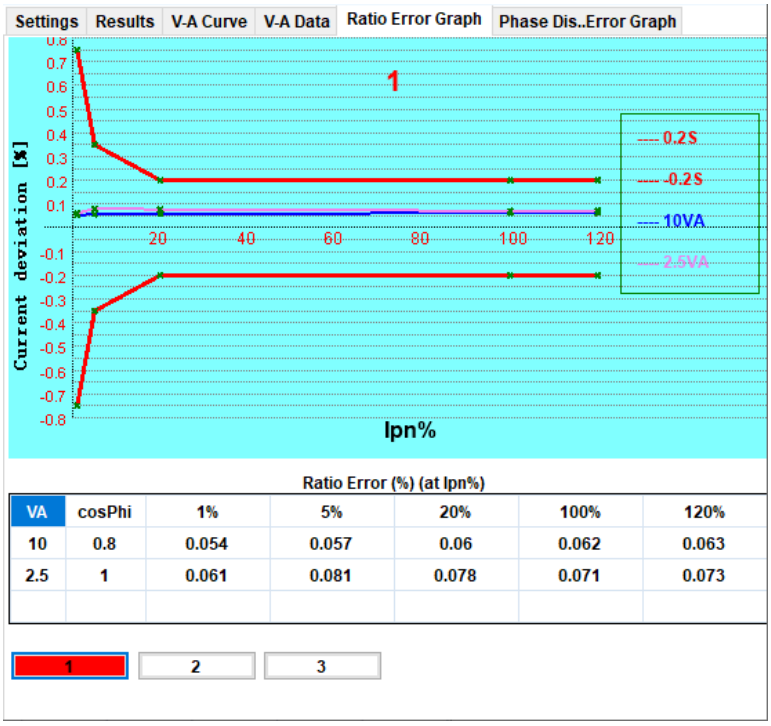
Right-click menu (Add user data): Operation valid during testing process.

Use the number key to choose one curve to display on the top and in bold.

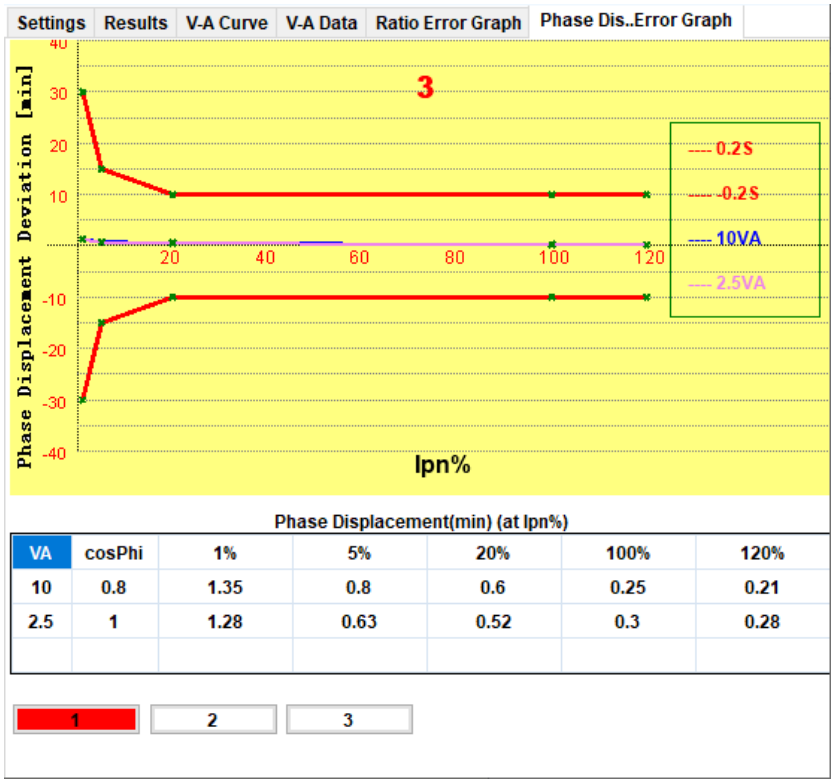
The color for each curve can be changed by clicking the color box in right.



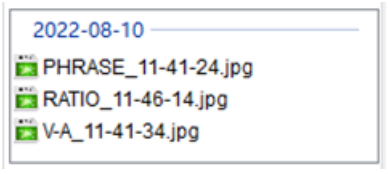

**V-A Data:** The current and voltage data according to the V-A curve.




**Ratio Error Graph:** It shows the ratio error. The ratio error range should be within the red lines and the assessment will be passed ok; Otherwise, it will be failed.




**Phase Displacement Error Graph:** It shows the phase displacement error. The error range should be within the red lines and the assessment will be passed ok; Otherwise, it will be failed.




**JPG file list:** List the screenshot files.

Move the cursor to the report display zone and double click it, the curve picture will be screenshot and saved in the JPG file list.

There are three screenshots: PHASE, RATIO, V-A


**Excel file list:** The Excel reports generated previously will be listed here. Double click the report to open it in Excel when the Excel is installed in the PC.


**Remove:** it works the same as selecting the report file with tick in box in open file list.
**Save Excel file:** to save the PCT format report into Excel reports

The following is sample Excel format report generated by PCT Report Tools in PC, A4.

## CT Report

| | | | |
|---|---|---|---|
| Head: | LZZBJ | | |
| CT Type: | P | CT SN: | 2066000001 |
| Test Equipment: | PCT200i | SN: | 200i-151101 |
| Version: | v7.03 | Tested-Date: | 2022-8-10 9:19 |

## Settings

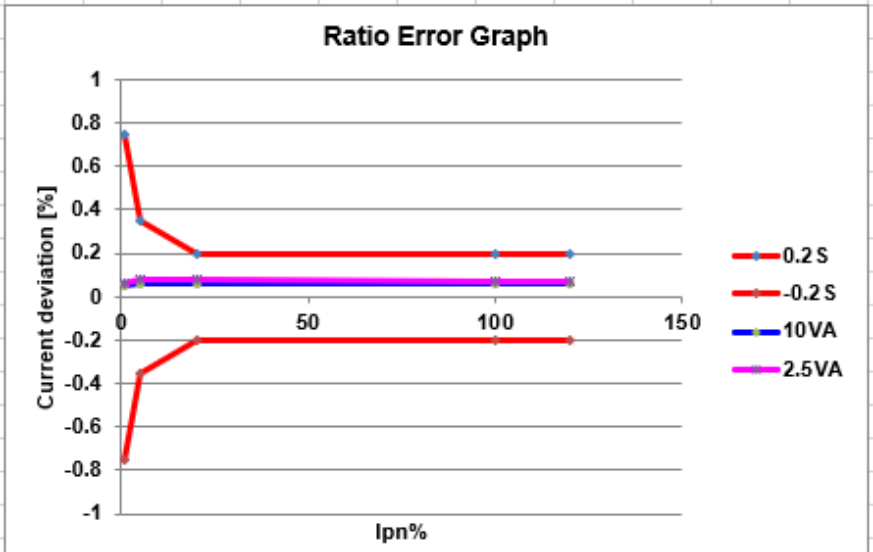
| | | | |
|---|---|---|---|
| CT Type: | M | Frequency (Hz): | 50 |
| Power Factor : | 0.8 | Primary Current (A): | 1000 |
| Secondary Current (A): | 5 | Rated Burden (VA): | 10 |
| CT Temperature (°C): | 26 | Winding: | 1S1 1S2 |
| Standard: | IEC 60044-1 | Extention (%): | 120 |
| Accuracy: | 0.2S | FS: | 5 |

## Results

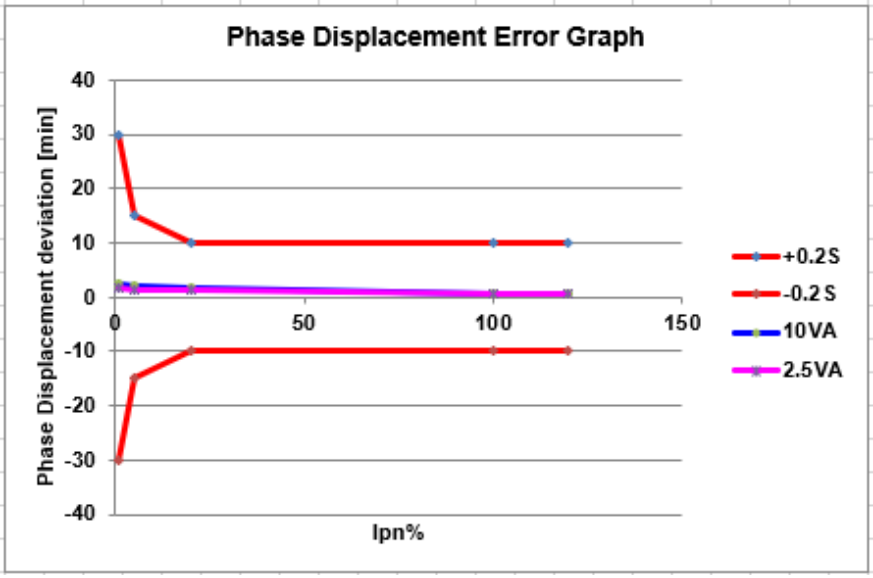
| | | | |
|---|---|---|---|
| Excitation | | | |
| Knee Point: | 11.998 Vrms | | |
| Knee Point: | 0.00393 Arms | | |
| Ts: | 17.5 s | | |
| Kr: | 79.55 % | | |
| Lm: | 11.223 H | | |
| Le-<br>FS: | 0.266 H<br>>4.552 | | |
| Burden | | | |
| Z: | | | |
| Burden: | | | |
| Polarity | | | |
| Polarity : | Positive | | |
| RCT | | | |
| Rmeas(26°C): | 0.2704 ohm | | |
| Rref(75°C): | 0.3213 ohm | | |
| Rref(50°C): | 0.2953 ohm | | |
| Coarse Ratio | | | |
| Coarse Ratio: | | | |
| Rated Ratio | | | |
| Ratio: | 1000:5.0031 | | |
| Ratio Error : | 0.062 % | | |
| Phase Displacement: | 0.616 min | | |
| Turn Ratio Error: | -0.085 % | | |
| Turn Ratio: | 199.831 | | |
| Guess Ratio: | 1000:5 | | |

| | | | |
|---|---|---|---|
| Tested by: | | Approved by: | |

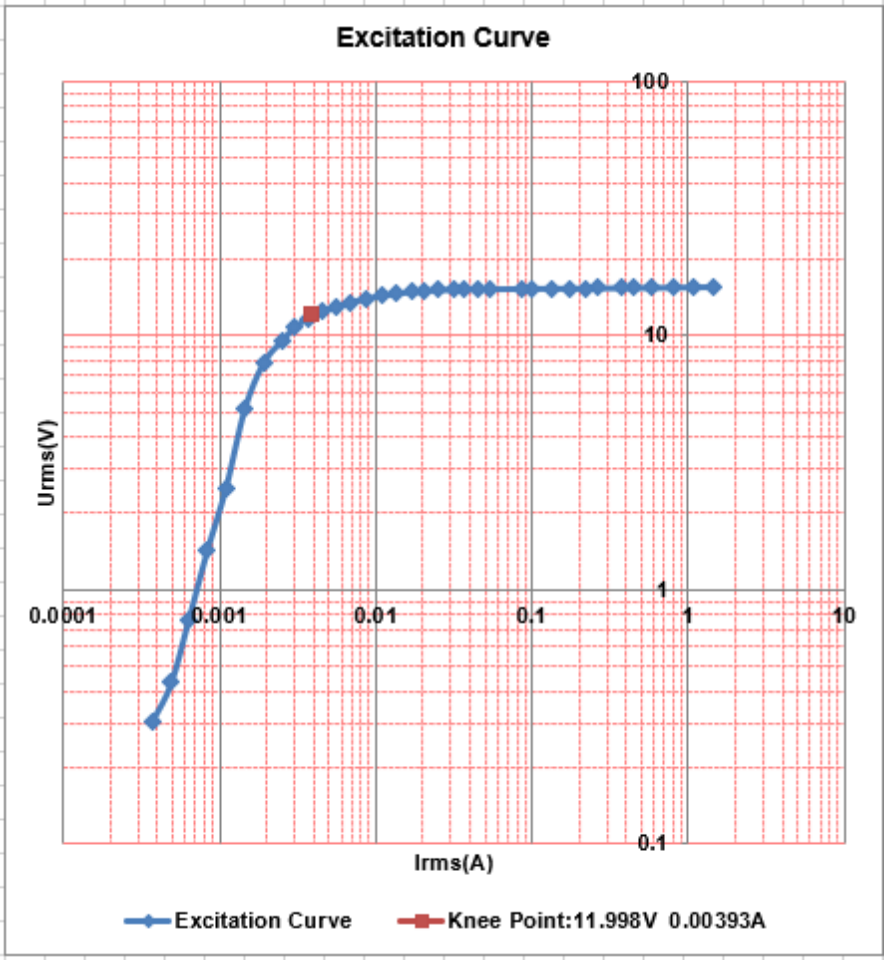
| Ratio Error (%) (at Ipn%) | | | | | | |
|---|---|---|---|---|---|---|
| VA | cosPhi | 1% | 5% | 20% | 100% | 120% |
| 10 | 0.8 | 0.054 | 0.057 | 0.06 | 0.062 | 0.063 |
| 2.5 | 1 | 0.061 | 0.081 | 0.078 | 0.071 | 0.073 |




| Phase Displacement(min) (at Ipn%) | | | | | | |
|---|---|---|---|---|---|---|
| VA | cosPhi | 1% | 5% | 20% | 100% | 120% |
| 10 | 0.8 | 2.3 | 1.88 | 1.53 | 0.62 | 0.53 |
| 2.5 | 1 | 1.68 | 1.38 | 1.22 | 0.57 | 0.57 |



| Excitation Characteristic | | Irms | Urms | Irms | Urms | Irms | Urms |
|---|---|---|---|---|---|---|---|
| | Standard | 1.448937 A | 15.5846 V | 0.053583 A | 15.2776 V | 0.00449 A | 12.4425 V |
| | | 1.075963 A | 15.5357 V | 0.044389 A | 15.2619 V | 0.003672 A | 11.7297 V |
| | IEC 60044-1 | 0.795013 A | 15.494 V | 0.036625 A | 15.2293 V | 0.003041 A | 10.8225 V |
| | | 0.574113 A | 15.4616 V | 0.031544 A | 15.1968 V | 0.00251 A | 9.5751 V |
| | | 0.443161 A | 15.4356 V | 0.025132 A | 15.1319 V | 0.001908 A | 7.8093 V |
| | | 0.377651 A | 15.4185 V | 0.020345 A | 15.0348 V | 0.001448 A | 5.1524 V |
| | | 0.261761 A | 15.3909 V | 0.016876 A | 14.889 V | 0.001099 A | 2.5281 V |
| | | 0.221021 A | 15.3728 V | 0.013532 A | 14.6621 V | 0.000836 A | 1.439 V |
| | | 0.176565 A | 15.3568 V | 0.010854 A | 14.3705 V | 0.000635 A | 0.7675 V |
| | | 0.133202 A | 15.3413 V | 0.008668 A | 13.9979 V | 0.00049 A | 0.4314 V |
| | | 0.099655 A | 15.327 V | 0.006871 A | 13.5443 V | 0.000372 A | 0.3053 V |
| | | 0.086358 A | 15.3096 V | 0.005552 A | 13.0421 V | | |
| User Data | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |




**Back:** back to the main interface

**Exit:** exit the program.

# 8. PCT200 Series-Related Products and Accessories

This chapter describes the optional equipment and accessories for the *PCT200 series* test set. Please visit the PONOVO Web site **www.ponovo.net** for up-to-date information.

## Optional accessories

| No. | Item |
|---|---|
| 1 | PCT Auto-Test Box |

## Standard accessories

| No. | Item |
|---|---|
| 1 | Secondary Cable (Double wired) |
| 2 | Primary Cable (Double wired) |
| 3 | Primary Cable (Single cable) |
| 4 | Spike Test Pen |
| 5 | Cable Connector |
| 6 | Crocodile clamps 1# |
| 7 | Crocodile clamps 2# |
| 8 | Power cord |
| 9 | Earthing lead |
| 10 | BH-0.66 CT |
| 11 | Soft bag for test leads |
| 12 | Shadow shield |
| 13 | Transportation case |

# 8.1 Optional Accessories

1. PCT Auto-Test Box

The PCT Auto-Test Box is an optional accessory for the PCT200i and PCT200Ai and therefore exclusively designated for use with the PCT200i and PCT200Ai.

The operation of PCT Box be referred to the *PCT BOX User Manual.*

# 8.2 Standard Accessories

## 8.2.1 Soft Bag for Test Leads

The PCT200 Wiring Accessory Package contains the following articles:

**Notes: The pictures are for reference only.**

1. Secondary Cable (Double wired)

Amount: 2 pieces

The secondary cables to connect the PCT200 secondary output and secondary measurement.

2. Primary Cable (Double wired)

Amount: 1 piece

The primary cable to connect the PCT200 primary measurement.

3. Primary Cable

Amount: 1 piece

The primary cable to connect the PCT200 primary measurement.

4. Crocodile clamps

Amount: 4 pieces

4 pieces

The Crocodile clamps are connected with the CT/PTs.

5. Spike Test Pen

Amount: 2 pieces

The Spike Test Pens are connected with the CT/PTs.

6. Cable Connector

Amount: 2 pieces

The cable connectors are connected with the secondary or primary cable for extension.

7. Demo CT


Amount: 1 piece

The demo CT is used for inspection and verifying the working status of PCT200.

8. Power Cord

D03 Power code

QP3D Power code

Amount: 1 piece

PONOVO will provide relevant plug socket according to different countries.

---

**NOTE:**

D03： Adapter is mainly used in German, Finland, France, Norway, Sweden, Poland, South Korean, Austria, Spain, Hungary, Czech, Ukraine, Turkey, Brazil and Russia etc.

QP3D: adapter is mainly used in America, Canada and Chinese Taiwan etc.

---

9. Earthing Lead

Amount: 1 piece

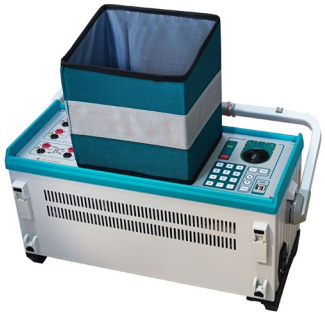
Earthing lead is connected the PCT200 with ground to ensure safety.

---

**NOTE:** In Order to avoid static induction, users should connect the PCT200 with ground reliably before testing.

---

### 8.2.2 Shadow Shield



The shadow shield is used when the light is too strong to watch the display.

### 8.2.3 Transportation Case

The large-size case with wheels is designed for heavy transport stress with folding hand it is made of fireproof materials and smooth rolling rubber tires.

# 9. Troubleshooting

During the testing, there might be some failure messages occurred.
The followings are the measures we suggest for the corresponding failure messages for reference.

1) Message “Output stop! Low Inductive Load!”, it might be caused by:
A. The tested tap is short-circuited in secondary side.
B. The other taps are short-circuited between the same coil.
C. The secondary wiring is connected to the primary side.
D. The incorrect wiring connections, for example S1S2 short-circuited at PCT port.
E. The low inductive in CT itself or CT with gap.

2) Message “Output stop! Please check the secondary wiring!”, it might be caused by
A. The S1 and S2 are not connected with the same coil.
B. The secondary wiring is connected unstably or open-circuited.
C. The RCT is too low to get low voltage (lower than the minimum value)

3) Virus message happened on PCT to do as following steps
A. Save all the reports on PCT into the USB
B. Format the Disc D in the PCT kit.
C. Re-start the PCT to run the software.

4) Error message in running the PCT report tool on PC
The engineers have to run the PCT report as Administrator.

5) The items “CT report to EXCEL” and “PT report to EXCEL” are not listed in below picture.


The reason is the Office Excel is not installed in the present PC.

# Appendix A: Glossary

CT: current transformer
PT: Voltage transformer
P/TP/M: the type of CT.
- P: protection current transformer class P
- M: measurement current transformer
- PR: protection current transformer class PR
- PX: protection current transformer class PX
- PXR: protection current transformer class PXR
- TPY: protection current transformer class TPY
- TPX: protection current transformer class TPX
- TPZ: protection current transformer class TPZ
- TPS: protection current transformer class TPS

Standard: including 60044-1(IEC60044-1), 60044-6(IEC60044-6), IEC61869-2, ANSI/IEEE C57.13, IS2705,
f(Hz): rated frequency of CT
cosφ: Power Factor
$I_{pn}$: rated primary current
$I_{sn}$: rated secondary current
$\varepsilon_c$: composite error
ALF: accuracy limit factor
Class: accuracy class
FS: instrument security factor
Burden (VA): Rated output values
T-meas: temperature of measurement
Seq: sequence
$K_{td}$: transient dimensioning factor
$T_s$: secondary loop time constant
$K_{ssc}$: rated symmetrical short-circuit current factor

$T_p$(ms): specified primary time constant
$T_s$(ms): secondary loop time constant
$t_{al}$: specified time to accuracy limit
t'': duration of the second fault
t': duration of the first fault
$t_{al}$': specified time to accuracy limit in the first fault
$t_{al}$'': specified time to accuracy limit in the second fault
$t_{fr}$: fault repetition time
V-$k_n$: knee point voltage
I-$k_n$: knee point current
$R_{ct}$: secondary winding resistance
$E_{al}$: rated equivalent limiting secondary e.m.f.
$K_r$: remanence factor
$L_m$: magnetizing inductance
$L_s$: the leakage inductances
$K_{td}$: transient dimensioning factor
$\varepsilon^{\wedge}$: peak value of instantaneous error
$U_{pn}$: rated primary voltage
$U_{sn}$: rated secondary voltage

# Appendix B: CT Test Items

The CT test items will be different according to the CT type and its accuracy class.
This is regulated by IEC/IEEE/IS standards.
Here it takes IEC60044-1 as an example.
The CT test items for other CT types can be referred to in the related IEC/IEEE/IS standards.

**Limits of current error and phase displacement for measuring current transformers**

**Table 11 – Limits of current error and phase displacement for measuring current transformers (classes from 0.1 to 1)**

| Accuracy class | ± Percentage current (ratio) error at percentage of rated current shown below | | | | ± Phase displacement at percentage of rated current shown below | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Minutes | | | | Centiradians | | | |
| | 5 | 20 | 100 | 120 | 5 | 20 | 100 | 120 | 5 | 20 | 100 | 120 |
| 0.1 | 0,4 | 0,2 | 0,1 | 0,1 | 15 | 8 | 5 | 5 | 0,45 | 0,24 | 0,15 | 0,15 |
| 0.2 | 0,75 | 0,35 | 0,2 | 0,2 | 30 | 15 | 10 | 10 | 0,9 | 0,45 | 0,3 | 0,3 |
| 0.5 | 1,5 | 0,75 | 0,5 | 0,5 | 90 | 45 | 30 | 30 | 2,7 | 1,35 | 0,9 | 0,9 |
| 1.0 | 3,0 | 1,5 | 1,0 | 1,0 | 180 | 90 | 60 | 60 | 5,4 | 2,7 | 1,8 | 1,8 |

**Table 12 – Limits of current error and phase displacement for measuring current transformers for special application**

| Accuracy class | ± Percentage current (ratio) error at percentage of rated current shown below | | | | | ± Phase displacement at percentage of rated current shown below | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Minutes | | | | | Centiradians | | | | |
| | 1 | 5 | 20 | 100 | 120 | 1 | 5 | 20 | 100 | 120 | 1 | 5 | 20 | 100 | 120 |
| 0.2 S | 0,75 | 0,35 | 0,2 | 0,2 | 0,2 | 30 | 15 | 10 | 10 | 10 | 0,9 | 0,45 | 0,3 | 0,3 | 0,3 |
| 0.5 S | 1,5 | 0,75 | 0,5 | 0,5 | 0,5 | 90 | 45 | 30 | 30 | 30 | 2,7 | 1,35 | 0,9 | 0,9 | 0,9 |

### Table 13 – Limits of current error for measuring current transformers (classes 3 and 5)

| Class | ± Percentage current (ratio) error at percentage of rated current shown below | |
|---|---|---|
| | 50 | 120 |
| 3 | 3 | 3 |
| 5 | 5 | 5 |

## Limits of error for protective current transformers

### Table 14 – Limits of error for protective current transformers

| Accuracy class | Current error at rated primary current % | 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 |

## Limits of error for class PR protective current transformers

### Table 15 – Limits of error for class PR protective current transformers

| Accuracy class | Current error at rated primary current % | Phase displacement at rated primary current | | Composite error at rated accuracy limit primary current % |
|---|---|---|---|---|
| | | Minutes | Centiradians | |
| 5 PR | ±1 | ±60 | ±1,8 | 5 |
| 10 PR | ±3 | – | – | 10 |