

EAGLOTEST

S456 PRO

**AUTOMATIC
TURNS RATIO**



USER MANUAL

CATALOG

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Safety Instructions

- Qualified personnel only. Operate this instrument only if trained in electrical safety and transformer testing.
- De-energized DUT only. The transformer/device under test (DUT) must be isolated and confirmed de-energized using site-approved procedures (e.g., LOTO). Never test on an energized DUT.
- Assume hazardous voltage. Induced voltage, backfeed, or stored energy may exist even after isolation. Treat all terminals as live until verified safe.
- No contact during test. Do not touch bushings, clamps, exposed conductors, or terminals while measurement is running.
- Correct sequence.
- Connect leads to the instrument first, then connect to the DUT.
- For disconnection, remove leads from the DUT first, then from the instrument.
- No HV/LV reversal. Verify HV and LV connections before starting the test.
- Connection sequence (HV/LV). Connect the low-voltage side first (e.g., the secondary winding), then the high-voltage side (e.g., the primary winding). Keep the high-voltage test leads away from the body and other conductive objects, and maintain a safe distance.
- Oil-immersed transformers. Confirm the oil level is normal and there is no leakage. Do not test during oil filling or oil filtering, to avoid oil-level fluctuation that can reduce insulation.
- On-load tap-changer (OLTC) transformers. Before testing, set the tap changer to the rated position and disconnect power to the tap-changing mechanism, to prevent the tap changer from operating during the test.
- Do not use damaged equipment. Do not operate if the instrument, connectors, or test leads are damaged or insulation is compromised.
- Keep dry. The instrument is not waterproof; avoid rain, condensation, and

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excessive humidity.

- Avoid strong EMI. Strong electromagnetic fields may affect measurement stability.
- Specified charger only. Use only the supplied/approved charger.
- Recharge promptly. Recharge when battery is low to maintain performance and battery life.
- Stop immediately if protection trips repeatedly, readings are unstable, or unusual odor/noise occurs. Disconnect following the recommended sequence and investigate before continuing.

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Introduction

The S456 Automatic Transformer Turns Ratio Tester (TTR) is a state-of-the-art diagnostic instrument engineered for precise measurement of turns ratio, vector group, and polarity in transformers.

It is designed to seamlessly test a comprehensive range of transformers, including 3-Phase, Single-Phase, Potential Transformers (PT), Zigzag (Z-type) Transformers, Current Transformers (CT).

After a test, the instrument simultaneously displays the turns ratio, ratio error, vector group, polarity, excitation current and phase angle/angle difference. The excitation current helps observe the magnetization state of the transformer core, the winding condition, the tap-changer contact condition and three-phase consistency; the phase angle/angle difference helps judge the wiring relationship, vector group, polarity and phase deviation, providing a more complete diagnostic reference for on-site testing.

2.1 Key Features & Advantages

- **High-Efficiency 3-Phase Testing:** Utilizes simultaneous three-phase excitation technology to drastically reduce testing time and improve on-site efficiency.
- **Exceptionally Wide Measurement Range:** Capable of measuring turns ratios up to 10,000, accommodating a vast array of transformer sizes and configurations.
- **Intuitive User Interface:** Features a large, high-definition color LCD touch screen for streamlined parameter setup and clear results visualization.
- **On-the-Go Operation:** Equipped with a high-capacity, built-in lithium battery, enabling extended field testing without the need for an external AC power source.

2.1.1 Advanced Diagnostic Functions

- **Automatic Vector Group Detection (Blind Test):** Intelligently identifies the transformer's vector group and turns ratio even without prior nameplate data.

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- Zigzag Transformer Compatibility: Fully supports complex measurements for Zigzag winding configurations.
- Phase Shift Measurement: Delivers highly accurate measurements of the phase angle deviation between the High Voltage and Low Voltage sides.

2.1.2 Safety Protections

- Reverse Polarity Protection: Instantly alarms and halts output if the HV and LV test cables are inadvertently reversed, preventing catastrophic damage to the instrument and transformer.
- Short-Circuit Protection: Automatically interrupts the test voltage in the event of an output short circuit.

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Specifications

3.1 Range and Accuracy

Ratio Test	Accurate	Resolution
0.8000 to 9.9999	$\pm (\text{reading} \times 0.1\% + 3 \text{ dgt})$	0.0001
10.000 to 99.999	$\pm (\text{reading} \times 0.1\% + 3 \text{ dgt})$	0.001
100.00 to 999.99	$\pm (\text{reading} \times 0.2\% + 3 \text{ dgt})$	0.01
1000.0 to 9999.9	$\pm (\text{reading} \times 0.3\% + 3 \text{ dgt})$	0.1

Excitation Current	Accurate	Resolution
0.01 mA to 9.99 mA	$\pm (\text{reading} \times 1\% + 5 \text{ dgt})$	0.01
10.0 mA to 99.9 mA	$\pm (\text{reading} \times 1\% + 5 \text{ dgt})$	0.1
100 mA to 1000 mA	$\pm (\text{reading} \times 1\% + 5 \text{ dgt})$	1

Phase	Accurate	Resolution
0.0° to 360.0°	$\pm 0.5^\circ$	0.1

3.2 General Specifications

Output Signal	Three-phase sinusoidal inverter power output with automatic output voltage regulation, including soft-start and soft-stop functions
Functions	Turns ratio, vector group, and polarity testing for three-phase transformers, single-phase transformers, PT, and Z-type transformers, excitation current testing, phase angle/angle

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	difference
Range	Ratio: 0.8000~10000 Excitation current: 0.01 mA to 1000 mA Angle difference: 0.0° to 360.0°
Tap Changer	1 to 197 tap positions
Test Voltages	90V AC
Output Protection	HV/LV reverse-connection protection; output short-circuit protection
Display Mode	5.6-inch touchscreen
Data Storage	Up to 500 sets of records
Data Export	The saved data can be exported via USB flash drive or computer software
Data Printing	Connect to a Bluetooth printer to print out the current measurement results or the saved data
Mobile APP	Connects to a smartphone via Bluetooth. The app supports remote control of measurement, reading instrument data, and exporting data in Excel format
PC Software	Connect to a computer via USB for measurement control, data saving, and Excel export
Backlight function	3-level brightness adjustment. After 5 minutes of inactivity, the backlight dims automatically to save power
Power Detection	When battery voltage is low, the battery icon indicates empty and a prompt is displayed; the instrument powers off automatically after 30 seconds with no operation
Automatic Shutdown	Selectable: 15 / 30 / 60 / 120 minutes, or disabled

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Power Consumption	Approx. 380mA for standby, approx. 600mA for output measurement (maximum LCD brightness)
Power	Built-in 12.6V 5200mAh lithium battery
Instrument size	Approx. 320mm× 275mm× 145mm
Instrument Weight	Instrument: about 3.5kg (including battery) Test Lead: Approx. 1.12kg Gross Weight: about 6.7kg (instrument + test cable + printer + charger + tool bag)
Test Lines	Three-core sheathed leads; one red (HV) and one black (LV), length 3 m (End A: 50 A clamp; End B: banana plug)
Working Environment	-10 °C to 60 °C; 0 to 90% RH, non-condensing
Storage Environment	-10 °C to 60 °C; 0 to 75% RH
Safety Regulations	IEC61010-1

3.3 Test Leads Corresponding Interface

Test Color	Yellow	Green	Red
HV Markings	A	B	C
	U	V	W
	H1	H2	H3
LV Markings	a	b	c
	u	v	W
	X1	X2	X3

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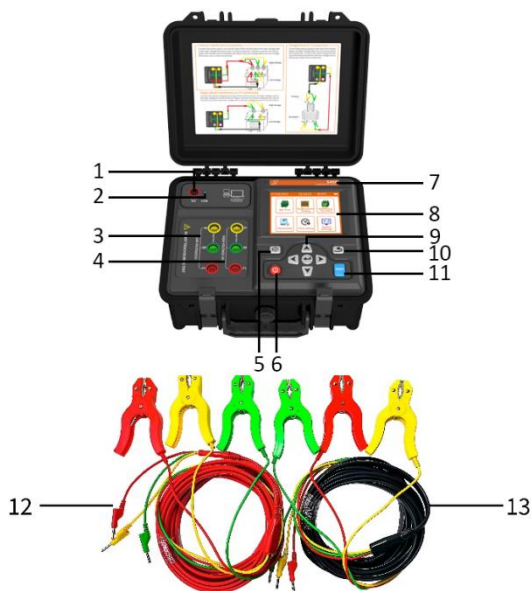
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Structure



- | | | | |
|---|---------------------|----|--------------------|
| 1 | Power charging port | 8 | Color touch screen |
| 2 | USB port | 9 | Operation button |
| 3 | LV terminal | 10 | Operation button |
| 4 | HV terminal | 11 | Operation button |
| 5 | Operation button | 12 | Red HV test lead |
| 6 | Operation button | 13 | Black LV test lead |
| 7 | Model labeling | | |

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Operation

Caution	Do not reverse the connection of the HV and LV test leads during testing.
	Do not short-circuit the connector of the instrument, otherwise the output and measurement of the instrument will be affected.
	Disable the "Data Export Function" when the instrument is connected to the computer to avoid damage to the instrument or computer.
	Please charge the battery in time when the battery is low, otherwise it is easy to damage the battery.
	The instrument is not waterproof, please do not use it in rainy environment.
	Confirm the vector group set on the instrument according to the transformer nameplate. If it cannot be confirmed, select Auto mode; otherwise measurement errors will occur!
	This device has no neutral terminal. For three-phase transformer testing, connect according to the live-terminal (phase) markings.

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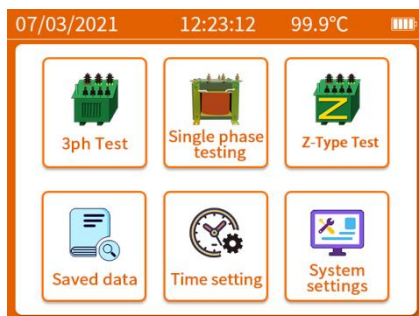
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5.1 Instrument operation

5.1.1 Power ON/OFF

Power ON/OFF: press and hold the  key for 2 seconds, the instrument will turn on and enter into initialization (about 3 seconds), and enter into the function menu interface after the completion of initialization. Short press the  to turn off the instrument.

Auto shutdown: When the low power or auto shutdown time reaches, the instrument buzzer rings and pop-up window reminds, and it will shut down automatically after 30 seconds, press any key to cancel.



5.1.2 System setup

Setting: Select the System Setting in the menu interface and press  to enter the system setting interface to set "Brightness", "Bluetooth", "Sound", "Printer", and "Auto Power Off". Select the required option by pressing the   key, and press the  key or  key to turn on or off.



Screen brightness: After the instrument is turned on for 5 minutes without operation, the instrument automatically reduces the brightness to save power, press any key to restore the set brightness.

Firmware Upgrade: When selecting the "Firmware Upgrade" option and pressing  , a pop-up window "Waiting for Upgrade" will appear waiting for PC to send the upgraded firmware. Exit upgrade by pressing any key before upgrading. When you enter the upgrade state, you can not operate the meter. Please don't power off or disconnect during the upgrade process, the meter will restart automatically after the upgrade is completed.

5.1.3 Date and time settings



The time setting interface is used to calibrate the instrument time. After entering the time setting interface, press the "◀" or "▶" key to move the cursor, press "▲" "

or "  " key to modify the time and date parameters. After setting, press "  " key to save the actual setup.

5.1.4 Measurement Parameter Interface

Test function:

Three-phase test: ratio and vector group test for three-phase transformers.

Single-phase test: CT, PT, ratio and polarity test for single-phase transformer.

Z-Type Test: Ratio and vector group test for Z-type transformers.

Normal Test: suitable for the confirmed HV and LV vector group of three-phase transformers, just enter the correct HV and LV vector group to start the test.

Blind Measurement Function: auto vector recognition, suitable for unclear vector group for HV and LV winding, it can accurately measure the ratio and vector group.

Parameter Description:

1. **Sample No.:** Enter an identification code for the device under test (DUT) for this measurement. The name can be user-defined.
2. **Rated HV / Rated LV:** Enter the rated high-voltage and low-voltage values from the transformer nameplate. If required, you may also enter values based on the actual ratio relationship. These two parameters are used as the reference rated ratio when the instrument calculates ratio error. Only after these values are set correctly can the instrument calculate the current tap position and ratio error.
3. **Tap Spacing:** The rated tap step and rated tap position provide the baseline for tap position calculation and should be entered according to the nameplate. For a transformer without tap positions, set the rated tap position to 00 or 01.
Example: If the nameplate shows $220\text{ kV} \pm 8 \times 1.25\% / 35\text{ kV}$, the rated tap step is 1.25%, the total number of taps is 17, and the rated (neutral) tap position is the middle position 9. Therefore, set the rated tap position to 09.
4. **Rated tap changer:** Set the transformer connection and vector group. If the connection and vector group are known, enter the correct values. If unknown, select "?" to allow the instrument to measure/determine the vector group

automatically.

5. **Output Voltage:** Four output-voltage options are available: 4 V, 10 V, 40 V, 90 V. (Note: in single-phase ratio mode, the “single-phase CT” test mode supports 4 V and 10 V only.)
6. **Measurement method:**
 - Three-phase Ratio: Measures three-phase ratio based on the selected HV/LV connection and vector group.
 - Vector Group Only: Measures only the vector group.
 - 3-phase AB / 3-phase BC / 3-phase CA: Measures the ratio for the selected phase pair only.

Note: When Auto is selected, the instrument automatically determines the vector group. In Normal Test mode, the vector group must be set correctly; otherwise, the measurement result may be incorrect. In Blind Test mode, if “?” / “?” / Auto is selected, the instrument may not determine the exact connection type, but it can identify the HV–LV clock phase angle, and this does not affect the ratio measurement result. If testing a Z-type transformer, use the Z-Type Test mode.

Parameter setting:

Press   to switch the parameter that needs to be set, press  or  to enter the setting state of this parameter and select the data bit that needs to be set, then press   to modify the selected data, and then press  to save after the setting is completed.

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2025/05/22 12:23:12

3ph Test > Blind Testing Function > Parameter Settings

Sample No. : 000001 Tap Step : 5.00% +00

Rated HV : 020.00kV Vector Group : ? ? Auto

Rated LV : 00.400kV Test Mode : 3ph Ratio

Test Voltage : 90V

Test

Three-phase test parameter setting interface

2025/04/11 15:42:50

3ph Test > Blind Testing Function > Parameter Settings

Sample number : 000001 Tap spacing : 5.00% +00

Rated high voltage : 010.00kV Rated tap changer : ? ? Auto

Rated low voltage : 00.400kV Meas method : 3ph Ratio

Test

Three-phase blind test parameter setting interface

2025/04/11 15:44:13

Impedance Test (%Z) > Parameter Settings

Sample number : 000001 Tap spacing : 5.00% +00

Rated high voltage : 010.00kV Rated tap changer : ZN Y Auto

Rated low voltage : 00.400kV Meas method : 3ph Ratio

Test

Z-type test parameter setting interface

2025/04/11 15:45:45

Single Phase Testing > Parameter Settings

Sample number : 000001 Tap spacing : 5.00%

Rated high voltage : 010.00kV Rated tap changer : +00

Rated low voltage : 00.400kV Meas method : Single phase transformer

Test

Single-phase test parameter setting interface

5.1.5 Measurement Results Interface

When the completion of measurement, it enters the test result interface, choose the functions of "Continue Test", "Print Data" and "Save Data", press ▲ ▼ ◀ ▶ to switch and select the required function options, and press ↵ key to execute. Press the "Turns Ratio" key to switch the display between the measured turns ratio and the voltage ratio.

The following figure shows the test result screen for the three-phase test:

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2025/05/22		12:23:12			
3ph Test > 3ph Ratio > test results					
Phase	Turns Ratio	Ratio Error	mA	θ°	
AB/ab	25.002	0.01 %	36	34	
BC/bc	25.002	0.01 %	36	34	
CA/ca	25.002	0.01 %	36	34	
Vector Group: Y-d-01		Test Voltage: 90V		Tap Position: 01	
Continue Testing		Print Data		Saved Data	
				Turns Ratio	

Three-phase test result interface

2025/05/22		12:23:12		 	
3ph Test > 3ph Ratio > Test Results					
Phase	Voltage Ratio	Ratio Error	mA	θ°	
AB/ab	14.435	0.01 %	32	34	
BC/bc	14.435	0.01 %	32	34	
CA/ca	14.435	0.01 %	32	34	
Vector Group: Y-d-01		Test Voltage: 90V		Tap Position: 01	
Continue Testing		Print Data		Saved Data	
				Vol. Ratio	

Three-phase test results-Voltage Ratio interface

2025/04/11	15:50:07		
3ph Test > Vector Group Testing > Test Results			
< Vector Group >			
D-yn-11			
Continue testing	Print Data	Save Data	

Group test result interface

Single-phase test result interface:

2025/05/22	12:23:12		
Single Phase Testing > Single Phase PT > Test Results			
Turns Ratio	25.002		
Ratio Error	0.01%		
Polarity	Reverse Polarity		
Excitation Current	0.02 mA		
Phase Deviation	359.9 °		
Tap Position: 01	Test Voltage: 90 V		
Continue Testing	Print Data	Saved Data	Turns Ratio

Single-phase transformer test result interface

2025/05/22	12:23:12		
Single Phase Testing > Single Phase CT > Test Results			
Turns Ratio	25.002		
Ratio Error	0.01%		
Polarity	Reverse Polarity		
Excitation Current	0.02 mA		
Phase Deviation	359.9 °		
Test Voltage	90 V		
Continue Testing	Print Data	Saved Data	Turns Ratio

Single-phase CT test result interface

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5.1.6 Test Result Parameter Descriptions

After the test, the instrument can display the turns ratio, ratio error, polarity, excitation current, phase angle/angle difference, vector group and other parameters. The meaning of each parameter is as follows:

Turns Ratio: The actual ratio calculated by the instrument from the applied voltage and the induced voltage, used for comparison with the rated ratio on the nameplate.

Voltage Ratio: The actual voltage ratio between the HV and LV terminals of the device under test, calculated from the measured applied and induced voltages. It is the raw measured data, not transformed by the vector-group relationship, and is consistent with the voltage ratio measured with an external voltmeter. (Note: the voltage ratio is not the true turns ratio of the transformer; it must be converted using the vector-group formula before it becomes the turns-ratio value.)

Ratio Error: The deviation between the measured ratio and the rated ratio, used to judge whether the tap position, winding turns and accuracy of the device under test are correct.

Vector Group / Polarity: The vector group is used to determine the winding direction of the internal coils of a three-phase transformer and the phase relationship between the HV and LV sides; polarity indicates the polarity relationship of single-phase transformers, PTs and CTs. (Note: for single-phase transformers and PTs, 0° is subtractive polarity and 180° is additive polarity; for CTs, 0° is additive polarity and 180° is subtractive polarity.)

Excitation Current: The current flowing through the winding in the open-circuit state when the instrument applies the test voltage to the measured winding. It is related to the core magnetization state, winding structure, tap position and test voltage. The three-phase excitation currents should follow a certain pattern; if one phase is clearly larger or smaller, evaluate it together with the ratio error, phase angle/angle difference, wiring state and historical data.

Phase Angle / Angle Difference: Reflects the phase relationship between the test voltage and the induced voltage, and can assist in judging the vector group, polarity, wiring state, core loss and three-phase consistency. If the phase angle/angle difference

SECTION 5

is clearly abnormal, first check the wiring, vector-group setting, tap position and condition of the device under test.

5.1.7 Tap Position Auto-Calculation

This function calculates and displays the transformer tap position automatically, provided the rated parameters are entered correctly.

Prerequisites

Before testing, make sure Rated HV, Rated LV, and Tap settings are filled in. Tap position calculation depends on these values.

Procedure

1. **Enter the rated (neutral) tap position**

Input the nameplate rated tap position (usually the middle/neutral position).

Example: for 11 positions, the neutral is typically position 6.

2. **Enter the tap step (tap spacing)**

Input the per-step percentage from the nameplate.

Example: 2.5%

3. **Start the test**

Run the measurement with the above parameters saved. After the test completes, the calculated tap position will be shown on the Result screen together with ratio results.

4. **Change the transformer tap and re-test**

Physically change the tap position on the transformer, then select Continue Testing on the instrument. The S456 will perform the next measurement, and the new tap position will be updated on the next Result screen.

Example (Nameplate-Based Setup)

Transformer has 11 positions with 2.5% per step → set Rated Tap Position = 6, Tap Step = 2.5%. Run the test to display the calculated tap position. After changing taps, use Continue Testing to update results.

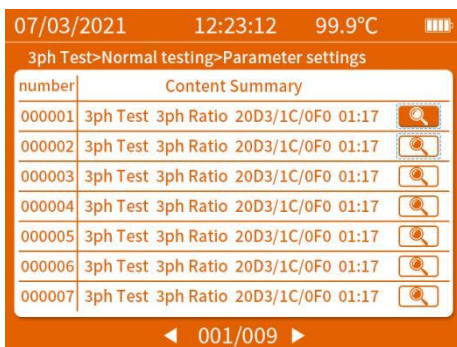
SECTION 5

5.1.8 Record Search Interface

Record Viewing: After entering the record query interface, the instrument displays the record list, which contains the test date, time, type and other information of each record. Press ▲▼◀▶ to select the measurement parameters required, and press ↵ to enter the specific access interface to view the specific contents of the records.

Data Deletion: In the record query interface, press the "TEST" key to bring up a pop-up window prompting the user whether to delete the saved records. Select "Yes" option and press ↵ key to delete all stored data, select "No" and press ↵ key or press other keys to quit deleting data.

Note: The data deletion operation will delete all the measurement data, please pay attention to backup the data before deletion, the deletion operation will take about 8 seconds, and there will be a pop-up window prompting when the deletion is completed.



number	Content Summary
000001	3ph Test 3ph Ratio 20D3/1C/0F0 01:17
000002	3ph Test 3ph Ratio 20D3/1C/0F0 01:17
000003	3ph Test 3ph Ratio 20D3/1C/0F0 01:17
000004	3ph Test 3ph Ratio 20D3/1C/0F0 01:17
000005	3ph Test 3ph Ratio 20D3/1C/0F0 01:17
000006	3ph Test 3ph Ratio 20D3/1C/0F0 01:17
000007	3ph Test 3ph Ratio 20D3/1C/0F0 01:17

5.1.9 Instructions for using the printer

The Bluetooth printer needs to be connected to the instrument before use, and then select the desired print data to print.

Printer connection steps:

- Power ON, and the printer's power indicator lights up and blinks;

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- The instrument turns on the printer function. Turn on the "Printer Settings" function in the instrument setup screen;
- Wait for the printer to connect, when the instrument displays the printer icon then the instrument is successfully connected to the printer.

Printer paper: printer "MODE" indicator light on behalf of the printer out of paper, grab the printer compartment cover on both sides up to open the paper compartment cover; insert the print paper into the center, and pull the paper out of a section so that it exceeds the position of the tear paper, paper smooth face up (otherwise it can not be printed on the paper); the printer compartment cover closed, a short press on the "FEED" button, then the whole process for paper change completes.

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5.2 Wiring test

Caution	Electrically charged and dangerous! It must be operated by trained and authorized personnel. The operator must strictly observe the safety rules, otherwise there is a risk of electric shock, causing personal injury or equipment damage.
	Danger! Do not measure the charged transformer, must be disconnected from the test before wiring, please make sure that the test item does not store voltage, otherwise there is a danger of electric shock, resulting in personal injury or equipment damage.
	Before testing, connect the test line to the instrument, and then connect the test line to the transformer under test correctly. The high and low voltage sides of the instrument need to be connected correspondingly with the HV and LV sides of the transformer, and cannot be reversed.
	Test wires must not be short-circuited to each other or connected to ground during testing;
	During the test, the operator should not touch the measuring port of the instrument, the measuring line and the transformer interface to avoid personal injury.
	The test cable must be removed from the object under test before it can be unplugged from the meter after the test is completed.

This instrument can measure the ratio, ratio error, connection group, tap position, polarity, angle difference and other parameters of three-phase transformer, Z-type transformer, single-phase transformer, single-phase voltage transformer, single-phase current transformer. When using the instrument and the test device need to be correctly wired and set the measurement parameters.

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SECTION 5

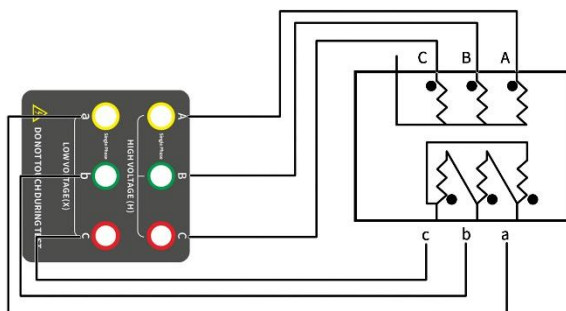
5.2.1 Test Voltage Selection Recommendations

The instrument provides multiple output-voltage levels. The test voltage affects the measured excitation current and phase angle/angle difference. To keep data comparable, use the same test voltage and the same wiring method when comparing historical data for the same transformer. The following recommendations apply:

1. For ordinary distribution transformers, the default test voltage can be used first.
2. For large ratios, large capacities, or when results fluctuate significantly, increase the output voltage appropriately and re-test.
3. For CTs, PTs and small-capacity devices under test, select a lower test voltage first.
4. When results are abnormal, first check the wiring, vector-group setting, tap position and test voltage before judging whether the device under test is faulty.
5. Excitation current and phase angle/angle difference may differ at different test voltages; record the test conditions for later comparison.

5.2.2 Three-phase transformer wiring

The yellow, green and red test clamps of the red test wire on HV side of the instrument need to be clamped on the HV phase A, B and C of the specimen, and the yellow, green and red test clamps of the black test wire on the LV side of the instrument need to be clamped on the LV phase a, b and c of the specimen.



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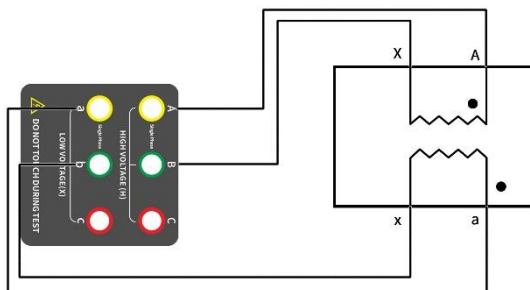
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SECTION 5

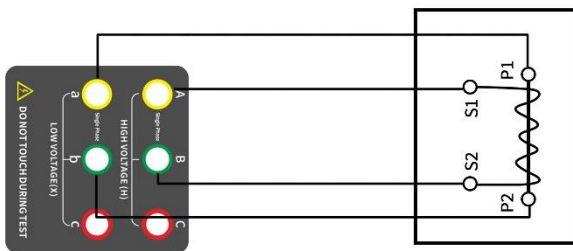
5.2.3 Single-phase transformer or single-phase PT wiring

The yellow and green test clamps of the red test wire on the HV side of the instrument should be clamped on the HV end of the specimen; the yellow and green test clamps of the black test wire on the LV side of the instrument should be clamped on the LV end of the specimen.



5.2.4 Single-phase CT wiring

The yellow and green test clamps of the red test wire on the HV side of the instrument should be clamped on the secondary side of the specimen; the yellow and green test clamps of the black test wire on the LV side of the instrument should be clamped on the primary side of the specimen.



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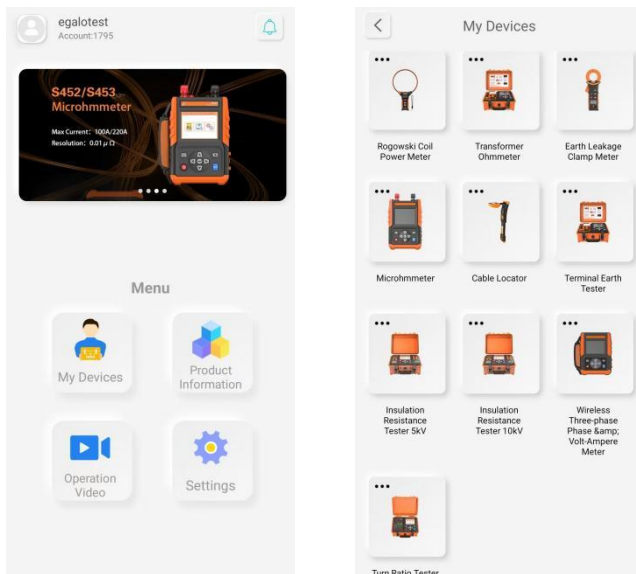
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APP

Download the dedicated E-TEST APP software, log in and click on My Devices, and find the fully automatic ratio tester under the device list.



Click on it to enter the device connection option, when only this instrument is nearby, turn on the Bluetooth option, only need to select the device with the strongest signal to start the connection and automatically synchronize the data.

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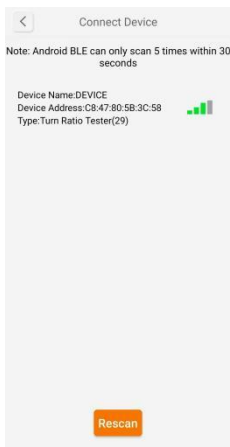
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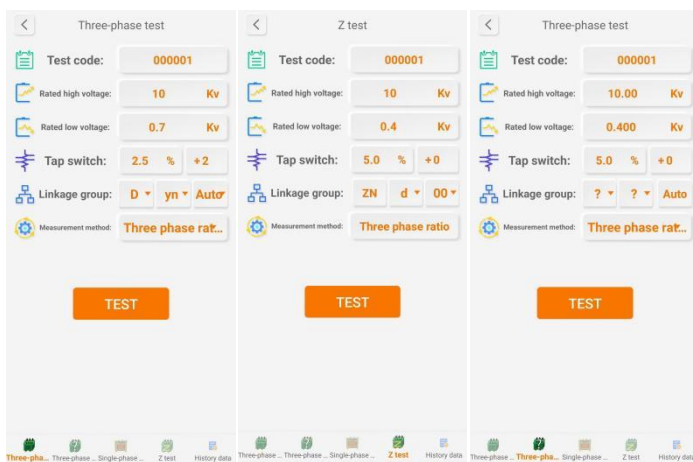
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SECTION 6



After the connection is completed, click on the corresponding test interface to carry out parameter setting and control test, and the test results will be displayed under the parameter setting interface after the test is completed.



Click on Historical Data to read the instrument's saved data.

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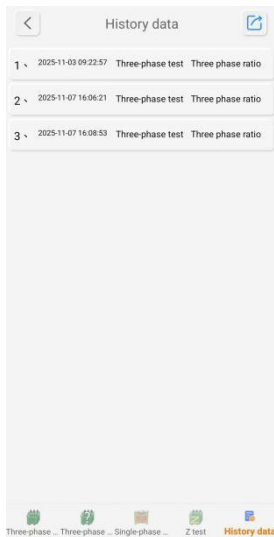
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Click the Share button in the upper right corner to export to Excel or forward.

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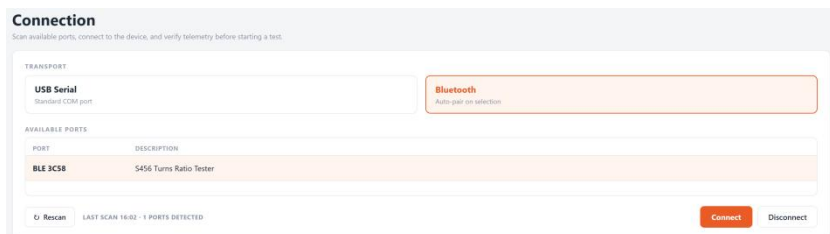
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PC Software

The S456 TTR PC software provides an integrated platform for test execution, data management, and report generation. Through USB or Bluetooth connection, users can operate the S456 instrument from a Windows computer, configure test parameters, monitor live measurements, manage stored sessions, import device records, and export standard reports in Excel and PDF formats.

7.1 Starting the Software and Connecting

The S456 TTR PC software is a single executable file and needs no installation — copy it to a Windows computer and run it. On startup, open the Connection page; the software automatically searches for and connects to the instrument over Bluetooth. To connect by cable instead, select the USB Serial transport, click Rescan, choose the instrument from the port list and click Connect. Once connected, the status changes to Connected and the device information is shown. (When connecting by USB, disable the instrument's "Data Export" function first.)



7.2 Running a Measurement

Open the Live Test page. First fill in Transformer Info (Transformer Name, Object ID and Operator) — these label the saved session and report. Then adjust the test voltage (e.g. 90V), enter the Measurement Parameters from the transformer nameplate: Rated HV and Rated LV, Tap Spacing % with the Rated Tap Position and Tap Total, and the vector group using HV Side, LV Side and Clock (for example D / yn / 11 for a Dyn11 transformer). Frequently used setups can be saved and recalled as a Profile.

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SECTION 7

Transformer info

TRANSFORMER NAME (OPTIONAL)

DEMO 8 MVA Power Tx

OBJECT ID

TRX-2026-0042

OPERATOR (OPTIONAL)

Eaglo QC

Measurement Parameters - 3-Phase Ratio

PROFILE Dyn11 33/11 kV Apply Save As...

Saved profile: Dyn11 33/11 kV

TAP SPACING %

1.25

TEST VOLTAGE

90V

RATED HV

33 kV

RATED LV

11 kV

RATED TAP POSITION

10

TAP TOTAL

19

HV SIDE

0

LV SIDE

Y/N

CORRECTION

11

Click Start Test to begin, the live readings for each phase — turns ratio, ratio error, excitation current and phase angle — are shown together with a PASS/FAIL result against the configured tolerance. For tap-changer tests, change the tap on the transformer and click Continue testing to record the next tap; the Session Tap Log lists every tap measured. When finished, click End session to save the session.

Live Test

Configure transformer parameters and monitor live ratio results

Continue testing End session

Tap 1 appended at 16:03:14

Change transformer to Tap 2, then press Continue testing.

Sequence

COMPLETED 1 OF 19 - NEXT TAP 2

Live Readings - 3-Phase Ratio

Tolerance $\pm 0.10\%$

AB / ab 3.3390 0.05% I _{exc} 0.5 mA $\angle -0.12^\circ$	PASS	BC / bc 3.3380 0.03% I _{exc} 0.5 mA $\angle -0.10^\circ$	PASS	CA / ca 3.3390 0.04% I _{exc} 0.5 mA $\angle -0.11^\circ$	PASS
---	-------------	---	-------------	---	-------------

MODE 3-Phase 3-Phase Blind Single-Phase Z-Type METHOD Ratio Group AB BC CA

Session Tap Log

	AB	BC	CA	
Tap 1 16:03:14 PASS Ratio % 3.3390 I _{exc} 0.5 mA Angle -0.12°	3.3380 0.03% 0.5 mA -0.10°	3.3390 0.04% 0.5 mA -0.11°	Max Err 0.05% Attempt 1 View Retest	

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SECTION 7

7.3 Test History and Records

All saved sessions are listed on the Test History page. Filter by date range, mode, voltage or status, or use the search box, then select a row to preview its parameters and results. Double-click a session (or click Inspect) to open the full analysis with tap-by-tap detail and diagnostic charts. Click Import from Device to read records stored on the instrument into the PC database for archiving and later review.

Test History
Review, inspect, and edit all transformer test sessions

Import from Device Fix grouping + Add Record

Filter Today Failed only All sessions 42 OF 42 SHOWN

PRGM: abcmnyyzy TB: abcmnyyzy SEARCH: MODE: All VOLTAGE: All STATUS: All Search Clear

Results

SESSION ID	DATE - TIME	TRANSFORMER	RATING	VOLTAGE	VECTOR	MODE	TAPS	WORST ERROR	STATUS
200601-0042	2026-06-01 14:23	DEMO 8 MVA Power Tx	33 / 13 kV	90 V	Dyn11	3w	19	0.142	PASS
200601-0041	2026-06-01 14:23	TR-014 Feeder A	17 / 0.4 kV	90 V	Dyn11	3w	17	0.118	PASS
200601-0040	2026-06-01 14:23	TR-008 Distribution	10 / 0.4 kV	90 V	Dyn11	3w	5	0.207	PASS
200601-0039	2026-06-01 14:23	PT-020 Bay 3	110 / 0.1 kV	40 V	---	3w	1	0.191	PASS
200601-0038	2026-06-01 11:48	CT 800/S Panel 8	800 / 5 A	10 V	---	3w	1	0.094	PASS
200527-0037	2026-05-27 10:26	TR-002 Substation	33 / 11 kV	90 V	Ynd11	3w	19	0.382	PASS
200527-0036	2026-05-27 11:33	TR-021 Plant 4	35 / 0.4 kV	90 V	Dyn11	3w	9	0.541	FAIL Due >0.5%
200527-0035	2026-05-27 11:21	TR-009 Pole Mount	10 / 0.4 kV	90 V	Dyn11	3w	5	0.166	PASS
200511-0034	2026-05-11 10:26	TR-031 Indoor	22 / 0.4 kV	90 V	Dyn11	3w	17	0.231	PASS

DOUBLE-CLICK ROW OR PRESS ENTER TO INSPECT - 42 OF 42 SESSIONS VISIBLE

Preview

DEMO 8 MVA Power Tx

2026-06-01 14:23

TEST VOLTAGE : 90 V

ALL 19 TAP ROWS WITHIN TOLERANCE

TRANSFORMER DEMO 8 MVA Power Tx

OBJECT ID TRX-2026-0042

MODE ThreePhase

METHOD ThreePhaseRatio

VECTOR Dyn11

RATED HV 33 kV

RATED LV 11 kV

TAP ROWS 19

LATEST TAP 10

WORST ERROR 0.142%

Edit Delete

Inspect

7.4 Reports and Data Export

Select one or more sessions and build a report. Choose the output format — Excel (.xlsx) for further data processing, or PDF for a formatted, ready-to-print report with company header, summary and tap result table. The report covers the transformer identity, test specification, measurement conditions and the complete per-tap ratio/error table. The file is saved to the report output folder set in System Settings.

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Transformer Turn Ratio Test Report

Eaglotest
2026-05-27 15:58

IDENTITY		SPECIFICATION		CONTEXT	
Object ID	TRX-2026-0042	Test Mode	3-Phase	Instrument	S456 / 8125110350
Transformer	DEMO 8 MVA Dyn11 Power Transformer	Vector Group	Dyn11	Ambient	23.5 °C
Operator	Eaglo QC	HV / LV	33.0 kV / 11.0 kV		
Sessions	1	Rated Tap	10		
Test Date	2026-05-27	Tap Step %	1.250		
		Threshold (ref)	±0.50%		

Total Taps	Worst (Δ%)	Mean (Δ%)	Phase coverage
19	0.580%	0.072%	AB · BC · CA

Tap Result Summary

Tap	Time	AB	BC	CA	Expected Ratio	Deviation %	Error %	Δ%	Notes
1	14:45:15	3.339	3.338	3.339	3.337	0.048	0.049	0.049	-
2	14:45:40	3.301	3.299	3.301	3.300	0.033	0.032	0.032	-
3	14:46:05	3.263	3.260	3.262	3.263	0.028	0.063	0.063	-
4	14:46:30	3.226	3.223	3.224	3.225	0.028	0.060	0.060	-
5	14:46:55	3.188	3.187	3.187	3.188	0.006	0.021	0.021	-
6	14:47:20	3.149	3.151	3.150	3.150	0.025	0.029	0.029	-
7	14:47:45	3.111	3.114	3.113	3.112	0.048	0.047	0.047	-
8	14:48:10	3.074	3.076	3.075	3.075	0.029	0.030	0.030	-
9	14:48:35	3.038	3.037	3.037	3.038	0.030	0.029	0.029	-
10	14:49:00	3.002	2.999	3.000	3.000	0.057	0.055	0.055	-
11	14:49:25	2.964	2.961	2.964	2.962	0.044	0.043	0.043	-
12	14:49:50	2.925	2.925	2.926	2.925	0.048	0.050	0.050	-
13	14:50:15	2.888	2.888	2.888	2.888	0.031	0.033	0.033	-
14	14:50:40	2.850	2.851	2.866	2.850	0.579	0.580	0.580	Phase CA exceeds ±0.5% tolerance — recommend recheck of tap 14 winding connection
15	14:51:05	2.812	2.813	2.812	2.812	0.007	0.033	0.033	-
16	14:51:30	2.774	2.774	2.775	2.775	-0.007	0.037	0.037	-

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Troubleshooting

8.1 Excitation current abnormality reference

Phenomenon	Possible Cause	Recommended Check
One phase of excitation current is clearly high	<ol style="list-style-type: none">1. Local core anomaly2. Inter-turn winding anomaly3. Wiring error4. Abnormal tap-changer contact	<ol style="list-style-type: none">1. Check the test-lead connections and tap position2. Evaluate further together with DC resistance and insulation tests
Clear difference among the three-phase excitation currents	<ol style="list-style-type: none">1. Unbalanced three-phase magnetic circuit2. Winding anomaly, wrong wiring sequence	<ol style="list-style-type: none">1. Check the A/B/C phase wiring sequence, HV/LV side connections2. Nameplate parameters of the device under test
Overall excitation current is high	<ol style="list-style-type: none">1. Higher test voltage2. Different core magnetization state3. Differences in capacity or structure of the device under test	<ol style="list-style-type: none">1. Compare with the same model or historical data2. re-test with a different test voltage if necessary
Unstable excitation current	<ol style="list-style-type: none">1. Poor test-lead contact2. Oxidized terminals3. On-site interference4. Device under test not fully de-energized	<ol style="list-style-type: none">1. Check clamp contact2. Clean the terminals3. move away from strong interference sources and re-test

SECTION 8

8.2 Phase angle/angle difference abnormality reference

Phenomenon	Possible Cause	Recommended Check
Phase angle/angle difference does not match expectation	1.Wrong vector-group setting 2.Wiring error, reversed polarity	1. Check the nameplate vector group, HV/LV side wiring and polarity connections
One phase clearly deviates	1.Anomaly in that phase's winding, core or test connection	1.Re-test that phase 2.Evaluate together with excitation current and ratio error
Inconsistent three-phase phase differences	1.Unbalanced three-phase magnetic circuit 2.wrong phase sequence, abnormal tap position	1.Check the phase sequence, tap position and terminal connections
Ratio normal but phase abnormal	1.Possible anomaly in wiring, vector group, polarity or core loss	1.Do not judge by ratio alone 2.Analyze together with excitation current, phase angle/angle difference and historical data

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Battery Management

- Charge the battery in time, and charge the battery every 3 months if the meter is not used for a long time.
- When replacing the batteries, note the battery polarity or the meter may be damaged.
- When the battery voltage is lower than 10.8V, please charge it in time, the charging time is about 4 hours.
- If can't turn on the instrument after long time storage, please use the charger to charge continuously for 8 hours and then try to turn on the instrument, if you still can't turn on the instrument and the instrument doesn't respond please contact Eaglotest.
- Please use 12.6V charger for charging, otherwise it is easy to damage the battery.

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SECTION 10

Packing List

Instrument	1
Tool Bag	1
Three core sheathed test lead (10m)	1 set (Red and Black)
Bluetooth printer	1
12.6V 1A Charger	1
Dual A-port USB communication cable	1
Instruction manual, warranty card, certificate of conformity	1

Note:

- We are not responsible for other damages caused by the use of this product.
- The contents of this user manual do not justify the use of the product for special purposes.
- The Company reserves the right to modify the contents of the user manual. In case of modification, no further notice will be given.

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