True Three-Phase Transformer Turns Ratio Tester TRT4x

- Specially designed option for testing capacitive voltage transformers
- Test voltages from 1 to 125 V AC
- Up to 5 kV AC with additional CVT40
- Turns ratio range 0,8 – 50 000
- The best turns ratio accuracy of 0,05%
- Single-phase test voltage
- True three-phase test voltage
- Automatic vector group detection
- Detailed analysis of test results using DV-Win software
- Interchangeable test leads with Three-phase Winding Ohmmeters & Tap Changer Analyzers TWA



Description

TRT4x is a true three-phase, fully automatic test set specially designed for turns ratio, phase shift, and excitation current measurements of power, distribution and instrument transformers. TRT4x determines the transformer turns ratio by applying voltages across high voltage windings, accurately measuring voltages across the unloaded transformer windings, and then displaying the ratio of these voltages.

TRT4x is based on a state of the art technology, using the most advanced technique available today. The test set can be used to test single-phase and three-phase transformers, both with and without taps in accordance with the requirements of the IEC 60076-1 standard.

For a three-phase measurement, the test set is connected to all the three phases of a transformer to be tested. If specific vector diagrams are selected for different types of transformers, the TRT4x will run a specific test for each transformer type (i.e., single phase, Delta to wye/star, Wye/Star to delta, Delta to delta, Wye/Star to wye/star, Delta to zig-zag, etc.) without a need to switch the test hookup cables. In addition, it can perform the test with true three-phase test voltage, allowing testing any transformer type. Following the test, it displays a turns ratio, phase shift, and excitation current obtained with single-phase and/or true three-phase tests.

TRT4x lets users enter a transformer's nameplate voltages for the turns ratio deviation calculation. This feature eliminates any error otherwise caused by an operator's manual calculation. The TRT4X also compares the test result with the nameplate ratio and prints out the % of error for each test.

Operating conditions messages or error messages identify incorrect test conditions, abnormal operating condition or transformer problems. TRT4x has a very high ability to cancel electrostatic and electromagnetic interference in HV electric fields. It is achieved by a very efficient filtration. The filtration is made utilizing the proprietary hardware and software design solutions.

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Application

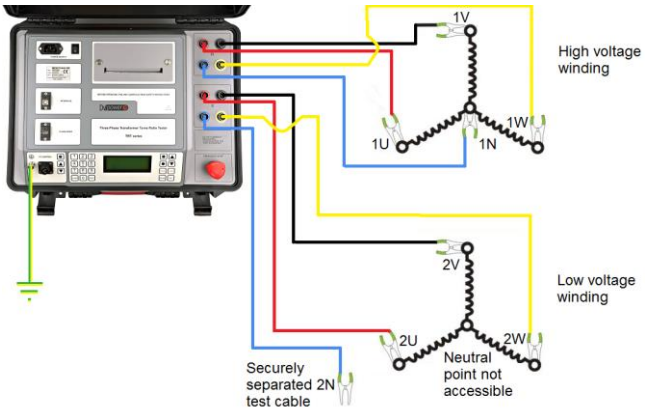
The list of instrument application includes:

- Turns ratio measurement
- Turns ratio deviation calculation
- Excitation current measurement
- Phase angle measurement
- Automatic vector group detection
- Verification of demagnetization process
- Magnetic balance test

Connecting TRT4x to Test Object

Three-Phase Transformer

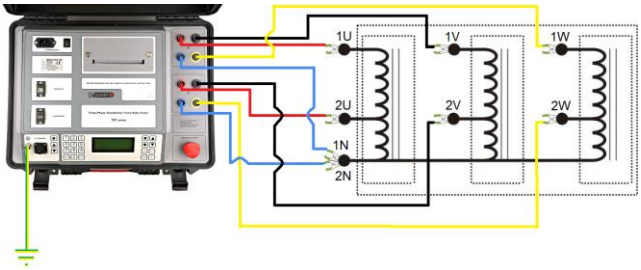
TRT4x is programmed to automatically test turns ratio, phase shift, and excitation current of power and distribution transformer types defined by CEI/IEC, IEEE, and ANSI standards. Using two sets of four cables, all bushings of the primary and the secondary sides are connected only once.



Connecting TRT4x to a three-phase transformer

Three-Phase Autotransformer

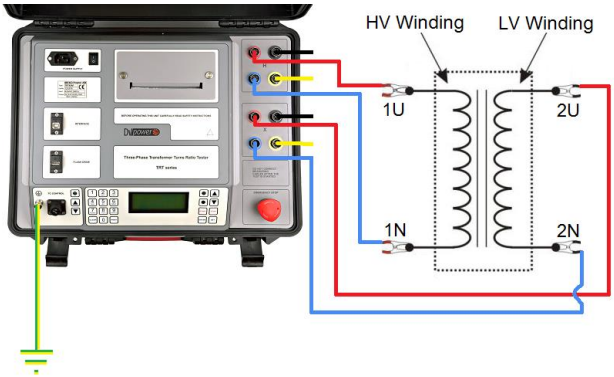
TRT4x is also programmed to automatically test turns ratio, phase shift, and excitation current of autotransformer types defined by CEI/IEC, IEEE, and ANSI standards. Using two sets of four cables, all bushings of the primary and the secondary sides are connected only once.



Connecting TRT4x to a three-phase autotransformer

Single-Phase Transformer

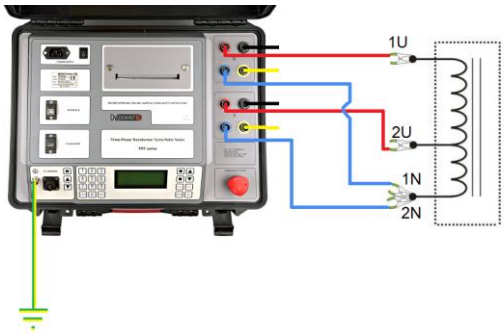
Although a three-phase device, TRT4x is able to test single-phase transformers. Either a special cable set or a three-phase cable set can be used for this purpose.



Connecting TRT4x to a single-phase transformer

Single-Phase Autotransformer

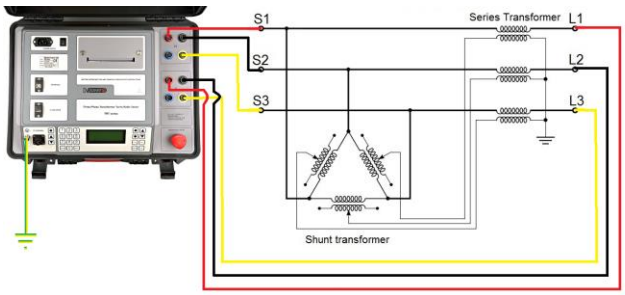
Although a three-phase device, TRT4x is able to test single-phase autotransformers. Either a special cable set or a three-phase cable set can be used for this purpose.



Connecting TRT4x to a single-phase autotransformer

Phase-Shifting Transformer

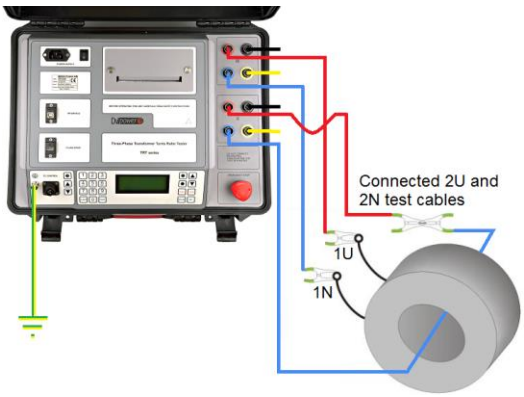
The presence of true three-phase test voltage allows TRT4x to test any type of transformer, even those with irregular vector groups, including phase-shifting transformers.



Connecting TRT4x to a phase-shifting transformer

Current Transformer

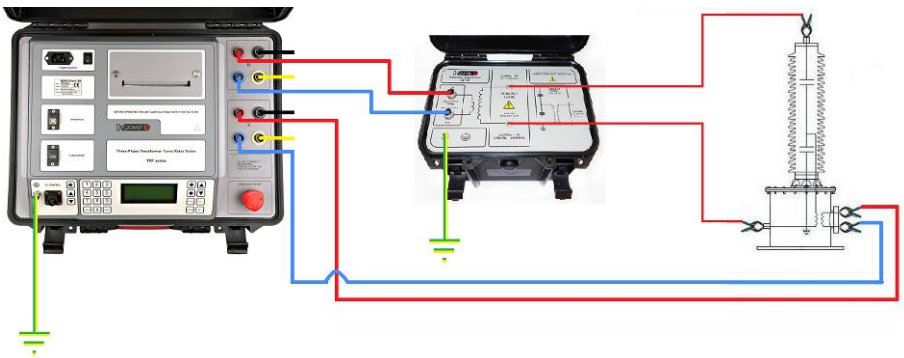
TRT4x can also be used for verifying turns ratio and polarity of current transformers (CTs). CTs are specially constructed transformers – they are instrument transformers with only one, or occasionally two primary turns. Larger number of turns is on the “X” (secondary) side of CTs. For that reason, when verifying CTs, the “X” test cables must be connected to the primary of a CT. If there are no primary terminals, the “X” cables should be slid through the CT core and short-circuited.



Connecting TRT4x to an unmounted current transformer

Capacitive Voltage Transformer

When measuring turns ratio of capacitive voltage transformers (CVTs), test voltage of several kilovolts is required, much higher than available in common turns ratio testers. Together with Extension Transformer CVT40, TRT4x can output up to 5 kV AC, which is suitable for measuring turns ratio of CVTs. Polarity can be checked at the same time.



Connecting TRT4x to a capacitive voltage transformer via CVT40

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Benefits and Features

Test Voltage up to 5 kV AC

TRT4x has specially designed option for testing turns ratio of capacitive voltage transformers (CVTs). Because of their design, these transformers require several kilovolts over capacitive part in order to excite inductive part and obtain correct turns ratio. Together with Extension Transformer CVT40, TRT4x can output up to 5 kV AC.

True Three-Phase Test Voltage

TRT4x is a true three-phase turns ratio tester. Unlike other so-called “three-phase” testers that allow only connecting to three transformer phases at once, TRT4x also has the ability to output true three-phase test voltage, without any additional devices or modules. This allows testing any transformer type, including special designs such as phase shifting, arc furnace, rectifier transformers, etc. Besides measuring a turns ratio, it can also measure a voltage ratio of three-phase transformers, simulating real transformer working condition. By applying true three-phase test voltage, and by measuring induced three-phase voltage, TRT4x is able to determine actual phase shifts between HV and LV side voltages, and not just 0 or 180 degrees shift that is obtained by testing transformers with single-phase test voltage in turns.

Accuracy

The highest accuracy in the market, for all three parameters measured – turns ratio, excitation current, and phase angle – makes potential transformer irregularities and faults more visible.

Resolution

Excitation current measurement is important for determining problems in the transformer magnetic core. High measurement resolution enables better tracking of the current trend through all tap positions.

Interchangeable cables with TWA

TRT4x uses the same cable set as Three-phase Winding Ohmmeter & Tap Changer Analyzer TWA. This enables one-time cable setup for performing six tests: turns ratio, excitation current, phase angle, winding resistance, on-load tap changer DVtest, and demagnetization, thus making TRT4x and TWA one measurement system.

Automatic Vector Group Detection

TRT4x is able to automatically detect vector group of three-phase transformers and auto-transformers. This is possible both with and without PC software.

DV-Win Software

The DV-Win software is included in the purchase price, and all its updates are free of charge. The software allows full control of TRT4x functions from a PC, creating and storing test plans, and downloading test results from the instrument’s internal memory. All results are presented both numerically and graphically, for an easy and convenient analysis. Test results can be directly exported to excel document. Customized test report can be generated, edited, saved in several file formats including pdf, and printed.

Magnetic Balance Test

This test helps in detecting possible problems in the transformer magnetic core. The test is completely automatic and requires no changes in cable setup comparing to turns ratio test. Results are presented both numerically and graphically.

Memory

There is enough memory in the TRT4x to store 200 test records. Each record consists of 50 test readings.

USB Flash Drive

Results can also be exported to a USB memory through integrated USB flash drive.

Tap Changer Control Unit

TRT4x has a built-in tap changer control unit, which allows remote on-load tap changer operation. A single operator can perform complete testing very quickly.

Built-in Printer

Built-in thermal printer, 112 mm (4.4 in) wide, is an optional accessory.

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Technical Data

Mains Power Supply

- Connection: according to IEC/EN60320-1; UL498, CSA 22.2
- Mains supply: 90 – 264 V AC, 50/60 Hz or 110 – 350 V DC
- Input power: 250 VA
- Fuse: 2 A / 250 V, type F, not user replaceable

Output Data

- Instrument / Test voltages

TRT40A	8, 40, 125 V AC 3 x (8, 40, 125)√3 V AC
TRT43A	1, 8, 40, 125 V AC 3 x (1, 8, 40, 125)√3 V AC

Measurement

- Turns ratio measuring range: 0,8 – 50 000
- Turns ratio resolution: 5 digits
- Typical turns ratio accuracy:

@125 V AC	@40 V AC
0,8 – 999: ±0,05%	0,8 – 999: ±0,05%
1 000 – 3 999: ±0,05%	1 000 – 3 999: ±0,1%
4 000 – 14 999: ±0,1%	4 000 – 14 999: ±0,2%
15 000 – 19 999: ±0,2%	15 000 – 20 000: ±0,3%
20 000 – 50 000:±0,25%	

@8 V AC	@1 V AC
0,8 – 999: ±0,05%	0,8 – 999: ±0,05%
1 000 – 3 999: ±0,1%	1 000 – 4 000: ±0,1%
4 000 – 15 000: ±0,2%	

- Excitation current range: 0 – 2 A
- Excitation current resolution:
  0,0000 – 9,9999 mA 0,1 µA
  10,000 – 99,999 mA 1 µA
  100,00 – 999,99 mA 10 µA
  1,0000 – 2,0000 A 100 µA
- Typical excitation current accuracy: ±(0,25% rdg + 500 µA)
- Phase angle range: 0 – 360º
- Phase angle resolution: 0,01º
- Typical phase angle accuracy: ±0,05º

Display

- LCD screen 20 characters by 4 lines;
- LCD display with backlight, visible in bright sunlight

Interface

- USB (standard)
- RS232 (optional)

Data Storage

- TRT4x can store up to 10 000 test results

Environmental Conditions

- Operating temperature:
  -10 ºC – +55 ºC / 14 ºF – +131 ºF
- Storage & transportation:
  -40 ºC – +70ºC / -40 ºF – +158 ºF
- Humidity: 5% – 95% relative humidity, non condensing

Dimensions and Weight

- Dimensions (W x H x D):
  480 x 190 x 385 mm / 18.9 x 7.48 x 15.16 in
- Weight: 9 kg / 19.8 lbs

Warranty

- 3 years

Printer (optional)

- Built-in thermal printer
- Paper width 112 mm / 4.4 in
- Printer operating temperature:
  0 ºC – +50 ºC / 32 ºF – +122 ºF
- Printer density is guaranteed in this range:
  5 ºC – +40 ºC / 41 ºF – +104 ºF
  20 – 85% relative humidity, non condensing

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Applicable Standards

- Installation/Overvoltage category: II
- Pollution degree: 2
- Safety: LVD 2014/35/EU (CE Conform)
  Standard EN 61010-1:2001
- EMC: Directive 2014/30/EU (CE Conform)
  Standard EN 61326-1:2006

CVT40 Technical Data

Input Data

- Power supply: Only from associated TRT4x device, via provided connection cables
- Maximum input voltage: 125 V AC
- Frequency: 50/60 Hz

Output Data

- Maximum output voltage 5 kV AC

Measurement

- Turns ratio range 40:1
- Turns ratio accuracy ±0,5% of ratio
- Maximum excitation capacity: 0,02 µF

Environmental Conditions

- Operating temperature:
  -10 ºC – +55 ºC / 14 ºF – +131 ºF
- Storage & transportation:
  -40 ºC – +70ºC / -40 ºF – +158 ºF
- Humidity: 5 % – 95 % relative humidity, non condensing

Dimensions and Weight

- Dimensions (W x H x D):
  223 x 260 x 284 mm
  8.78 x 10.24 x 11.18 in
- Weight:10 kg / 22 lbs

Applicable Standards

- Installation/Overvoltage category: II
- Pollution degree: 2
- Safety: LVD 2014/35/EU (CE Conform)
  Standard EN 61010-1:2001
- EMC: Directive 2014/30/EU (CE Conform)
  Standard EN 61326-1:2006

All specifications herein are valid at ambient temperature of + 25 °C and recommended accessories.
Specifications are subject to change without notice.



H winding test cable set



X winding test cable set



Transport case



Cable plastic case – large size



Extension Transformer CVT40



High voltage cable set



H test cable set for connecting to TRT4x



TRTC Verification Calibrator

Order Info

Instrument	Article No
True Three-phase Transformer Turns Ratio Tester TRT40A	TRT40AX-N-00
True Three-phase Transformer Turns Ratio Tester TRT43A	TRT43AX-N-00

Included accessories
Windows-based DV-Win PC software including USB cable
Tap changer control cable 5 m (16.4 ft)
Mains power cable
Ground (PE) cable

Recommended accessories	Article No
H winding test lead set, 4 x 10 m (32.8 ft) with TTA clamps (compatible with TWA and TRT series)	HC-10-4FMCWC
X winding test lead set, 4 x 10 m (32.8 ft) with TTA clamps (compatible with TWA and TRT series)	XC-10-4FFCWC
Cable plastic case – large size	CABLE-CAS-03
Transport case	HARD-CASE-LC

Optional accessories	Article No
H winding test lead set, 4 x 5 m (16.4 ft) with TTA clamps (compatible with TWA and TRT series)	HC-05-4FMCWC
X winding test lead set, 4 x 5 m (16.4 ft) with TTA clamps (compatible with TWA and TRT series)	XC-05-4FFCWC
H winding test lead set, 4 x 15 m (49.2 ft) with TTA clamps (compatible with TWA and TRT series)	HC-15-4FMCWC
X winding test lead set, 4 x 15 m (49.2 ft) with TTA clamps (compatible with TWA and TRT series)	XC-15-4FFCWC
H winding test lead set, 4 x 20 m (65.6 ft) with TTA clamps (compatible with TWA and TRT series)	HC-20-4FMCWC
X winding test lead set, 4 x 20 m (65.6 ft) with TTA clamps (compatible with TWA and TRT series)	XC-20-4FFCWC
H winding cable extension set, 4 x 5 m (16.4 ft) (compatible with TWA and TRT series)	HE-05-4FMCFC
X winding cable extension set, 4 x 5 m (16.4 ft) (compatible with TWA and TRT series)	XE-05-4FFCMC
H winding cable extension set, 4 x 10 m (32.8 ft) (compatible with TWA and TRT series)	HE-10-4FMCFC
X winding cable extension set, 4 x 10 m (32.8 ft) (compatible with TWA and TRT series)	XE-10-4FFCMC
H winding cable extension set, 4 x 15 m (49.2 ft) (compatible with TWA and TRT series)	HE-15-4FMCFC
X winding cable extension set, 4 x 15 m (49.2 ft) (compatible with TWA and TRT series)	XE-15-4FFCMC
H winding test lead set, 4 x 5 m (16.4 ft) with TTA clamps	HC-05-4TRTMW

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(compatible with TRT series only)	
X winding test lead set, 4 x 5 m (16.4 ft) with TTA clamps (compatible with TRT series only)	XC-05-4TRTFW
H winding test lead set, 4 x 10 m (32.8 ft) with TTA clamps (compatible with TRT series only)	HC-10-4TRTMW
X winding test lead set, 4 x 10 m (32.8 ft) with TTA clamps (compatible with TRT series only)	XC-10-4TRTFW
H winding test lead set, 4 x 15 m (49.2 ft) with TTA clamps (compatible with TRT series only)	HC-15-4TRTMW
X winding test lead set, 4 x 15 m (49.2 ft) with TTA clamps (compatible with TRT series only)	XC-15-4TRTFW
H winding test lead set, 4 x 20 m (65.6 ft) with TTA clamps (compatible with TRT series only)	HC-20-4TRTMW
X winding test lead set, 4 x 20 m (65.6 ft) with TTA clamps (compatible with TRT series only)	XC-20-4TRTMW
H winding cable extension set, 4 x 5 m (16.4 ft) (compatible with TRT series only)	HE-05-4TRTMF
X winding cable extension set, 4 x 5 m (16.4 ft) (compatible with TRT series only)	XE-05-4TRTFM
H winding cable extension set, 4 x 10 m (32.8 ft) (compatible with TRT series only)	HE-10-4TRTMF
X winding cable extension set, 4 x 10 m (32.8 ft) (compatible with TRT series only)	XE-10-4TRTFM
H winding cable extension set, 4 x 15 m (49.2 ft) (compatible with TRT series only)	HE-15-4TRTMF
X winding cable extension set, 4 x 15 m (49.2 ft) (compatible with TRT series only)	XE-15-4TRTFM
Cable plastic case – small size	CABLE-CAS-01
Cable plastic case – medium size	CABLE-CAS-02
Cable plastic case with wheels – medium size	CABLE-CAS-W2
Cable plastic case with wheels – large size	CABLE-CAS-W3
Plastic transport case	HARD-CASE-PC
Plastic transport case with wheels	HARD-CASE-PW
Built-in thermal printer 112 mm (4.4 in)	PRINT-112-00
Thermal paper roll 112 mm (4.4 in)	PRINT-112-RO
Bluetooth communication module	BLUET-MOD-01
Inverter 12 V DC to 230 V AC, 50 Hz	IN650-12-230
Verification Calibrator TRTC	TRTC-05-4800
H winding test lead set, 4 x 1 m (3.28 ft) with banana plugs	HC-01-4LMCBP
X winding test lead set, 4 x 1 m (3.28 ft) with banana plugs	XC-01-4LFCBP
Extension Transformer CVT40	CVT40XX-N-00
High voltage cable set 2 x 10 m (32.8 ft)	CET-10-03EWC
High voltage cable set 2 x 15 m (49.2 ft)	CET-15-03EWC
High voltage cable set 2 x 20 m (65.6 ft)	CET-20-03EWC
H test cable set for connecting to TRT4x, 2 x 5 m (16.4 ft)	HET-05-2MCFC
Cable bag	CABLE-BAG-00
TWA-TRT safety switchbox with ground cable	SWTCH-BOX-00
H connection between instrument and switchbox, 4 x 0,8 m (2.62 ft)	HE-08-4LMCMC
X connection between instrument and switchbox, 4 x 0,8 m (2.62 ft)	XE-08-4LFCFC