

# True Three-Phase Transformer Turns Ratio Tester **TRT33B**

- Test voltages 1 V, 10 V, 40 V, 100 V AC
- Turns ratio range 0,8 – 15 000
- The best turns ratio accuracy of 0,05%
- Single-phase test voltage
- True three-phase test voltage
- Automatic vector group detection
- Built-in tap changer control unit
- Detailed analysis of test results using DV-Win software
- Interchangeable test leads with Three-phase Winding Ohmmeters & Tap Changer Analyzers TWA



## Description

TRT33B 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. TRT33B 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.

TRT33B 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 TRT33B 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.

TRT33B 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 TRT33B 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. TRT33B 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.

## Application

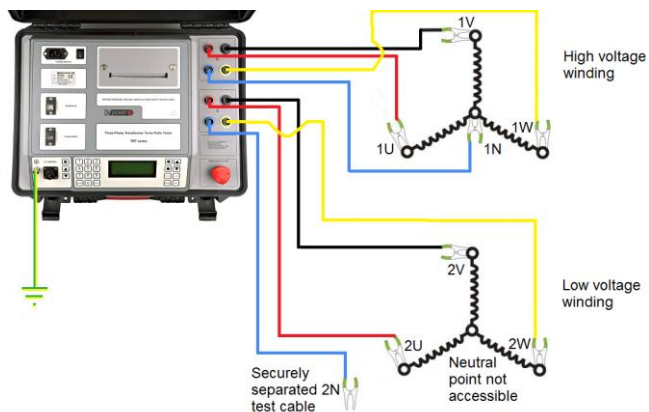
The list of instrument application includes:

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

## Connecting TRT33B to Test Object

### Three-Phase Transformer

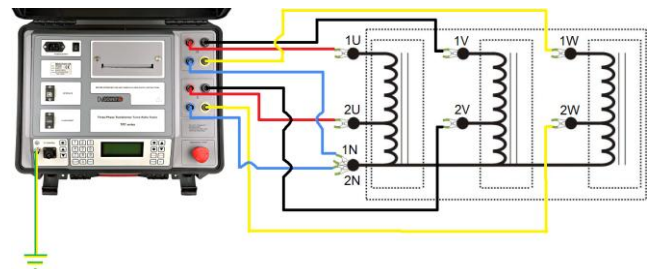
TRT33B is programmed to automatically test turns ratio, phase shift, and excitation current of power and distribution transformer types defined by CEI/IEC standards. Using two sets of four cables, all bushings of the primary and the secondary sides are connected only once.



Connecting TRT33B to a three-phase transformer

### Three-Phase Autotransformer

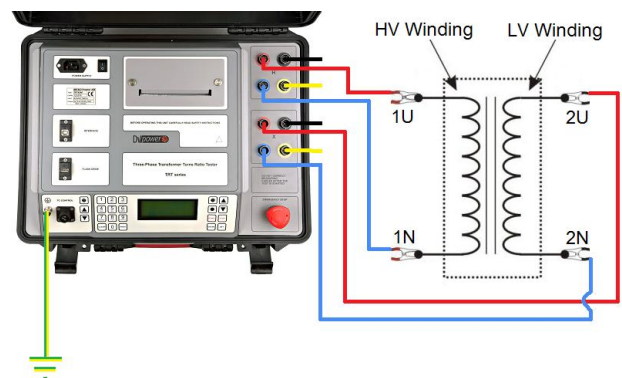
TRT33B is also programmed to automatically test turns ratio, phase shift, and excitation current of autotransformer types defined by CEI/IEC standards. Using two sets of four cables, all bushings of the primary and the secondary sides are connected only once.



Connecting TRT33B to a three-phase autotransformer

### Single-Phase Transformer

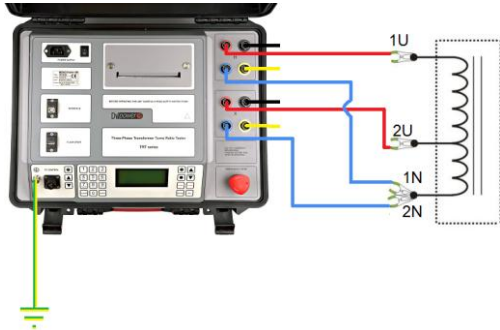
Although a three-phase device, TRT33B is able to test single-phase transformers. Either a special cable set or a three-phase cable set can be used for this purpose.



Connecting TRT33B to a single-phase transformer

### Single-Phase Autotransformer

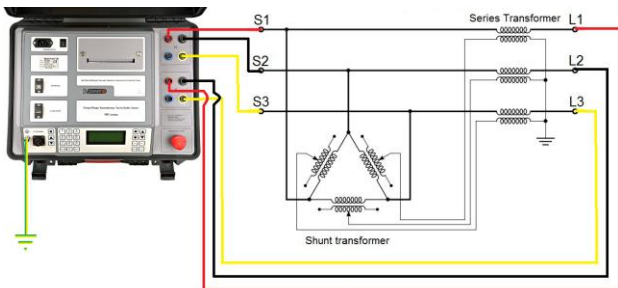
Although a three-phase device, TRT33B is able to test single-phase autotransformers. Either a special cable set or a three-phase cable set can be used for this purpose.



Connecting TRT33B to a single-phase autotransformer

### Phase-Shifting Transformer

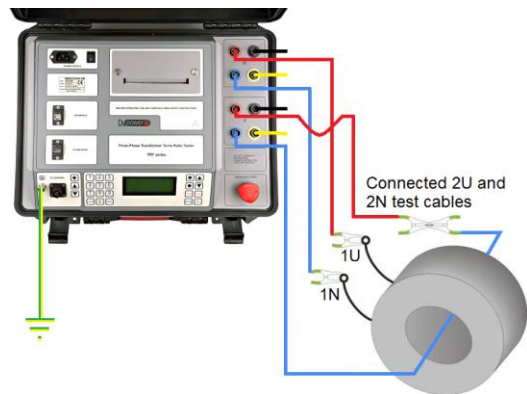
The presence of true three-phase test voltage allows TRT33B to test any type of transformer, even those with irregular vector groups, including phase-shifting transformers.



Connecting TRT33B to a phase-shifting transformer

### Current Transformer

TRT33B 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 TRT33B to an unmounted current transformer

## Benefits and Features

### True Three-Phase Test Voltage

TRT33B 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, TRT33B 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, TRT33B 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

TRT33B 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 TRT33B and TWA one measurement system.

### Automatic Vector Group Detection

TRT33B 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 TRT33B 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.

### Memory

There is enough memory in the TRT33B 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

TRT33B 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. A single measurement, measurement range, or entire memory can be printed on a thermal paper.

## 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: 200 VA
- Fuse: 2 A / 250 V, type F, not user replaceable

### Output Data

- Test voltages  
1 V, 10 V, 40 V, 100 V AC  
3 x (1, 10, 40, 100) $\sqrt{3}$  V AC

### Measurement

- Turns ratio measuring range 0,8 – 15 000
- Turns ratio resolution 5 digits
- Typical turns ratio accuracy:
 

@100 V AC	@40 V AC
0,8 – 999: $\pm 0,05\%$	0,8 – 999: $\pm 0,05\%$
1 000 – 3 999: $\pm 0,05\%$	1 000 – 3 999: $\pm 0,1\%$
4 000 – 15 000: $\pm 0,1\%$	4 000 – 15 000: $\pm 0,2\%$
@10 V AC	@1 V AC
0,8 – 999: $\pm 0,05\%$	0,8 – 999: $\pm 0,05\%$
1 000 – 3 999: $\pm 0,1\%$	1 000 – 3 999: $\pm 0,1\%$
4 000 – 15 000: $\pm 0,2\%$	
- Excitation current range 0 – 2 A
- Excitation current resolution:
 

0,0000 – 9,9999 mA	0,1 $\mu$ A
10,000 – 99,999 mA	1 $\mu$ A
100,00 – 999,99 mA	10 $\mu$ A
1,0000 – 2,0000 A	100 $\mu$ A
- Typical excitation current accuracy  $\pm (0,25\% + 500 \mu\text{A})$
- Phase angle range 0 – 360°
- Phase angle resolution 0,01°

- Typical phase angle accuracy  $\pm 0,05^\circ$

### Display

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

### Interface

- USB (standard)
- RS232 (optional)

### Data Storage

- TRT33B can store up to 10 000 test results

### Environmental Conditions

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

### Dimensions and Weight

- Dimensions (W x H x D):  
480 x 190 x 385 mm  
18.90 x 7.48 x 15.16 in
- Weight: 8 kg / 17.6 lbs

### Warranty

- 3 years

### Applicable Standards

- Installation/Overtoltage category: II
- Pollution degree: 2
- Safety: LVD 2006/95/EC (CE Conform)  
Standard EN 61010-1:2001
- EMC: Directive 2004/108/EC (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



Cable plastic case – large size



Cable plastic case with wheels – large size



Cable plastic case – medium size



Cable plastic case with wheels – medium size



TRTC Verification Calibrator



## Order Info

Instrument with included accessories	Article No
True Three-phase Transformer Turns Ratio Tester TRT33B	TRT33BX-N-00
DV-Win PC software including USB cable	
Built-in tap changer control unit	
Tap changer control cable 5 m (16.4 ft)	
Mains power cable	
Ground (PE) cable	

Recommended	Article No
H winding test lead set, 4 x 10 m (32.8 ft) with TTA clamps	HC-10-4LMCWC
X winding test lead set, 4 x 10 m (32.8 ft) with TTA clamps	XC-10-4LFCWC
Cable plastic case – large size	CABLE-CAS-03

Optional	Article No
H winding test lead set, 4 x 5 m (16.4 ft) with TTA clamps	HC-05-4LMCWC
X winding test lead set, 4 x 5 m (16.4 ft) with TTA clamps	XC-05-4LFCWC
H winding test lead set, 4 x 15 m (49.2 ft) with TTA clamps	HC-15-4LMCWC
X winding test lead set, 4 x 15 m (49.2 ft) with TTA clamps	XC-15-4LFCWC
H winding test lead set, 4 x 20 m (65.6 ft) with TTA clamps	HC-20-4LMCWC
X winding test lead set, 4 x 20 m (65.6 ft) with TTA clamps	XC-20-4LFCWC
H winding cable extension set, 4 x 5 m (16.4 ft)	HE-05-4LMCFC
X winding cable extension set, 4 x 5 m (16.4 ft)	XE-05-4LFCMC
H winding cable extension set, 4 x 10 m (32.8 ft)	HE-10-4LMCFC
X winding cable extension set, 4 x 10 m (32.8 ft)	XE-10-4LFCMC
H winding cable extension set, 4 x 15 m (49.2 ft)	HE-15-4LMCFC
X winding cable extension set, 4 x 15 m (49.2 ft)	XE-15-4LFCMC
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
Transport case	HARD-CASE-LC
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-00
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
Cable bag	CABLE-BAG-00