Turns Ratio and Winding Resistance Analyzer

TWR-250B

- Multiple AC and DC tests on a three-phase transformer
- Test voltages up to 250 V AC
- Test currents up to 25 A DC
- Battery (built-in battery) or mains powered
- Large 10.1” graphical touch screen display
- One-time connection to a three-phase transformer
- Built-in tap changer control unit
- Built-in thermal printer

Description

TWR-B series instruments are three-phase, fully automatic test devices specially designed for winding resistance, on-load tap changer DVtest (DRM), demagnetization, turns ratio, phase shift, and excitation current measurements on transformers. It can also perform winding resistance measurement on any inductive object, such as rotating machines (motors and generators). The resistance measurement can also be performed on resistive test objects.

Tests on three-phase transformers are performed with a single-step cable setup. All 6-8 transformer terminals, 3 or 4 on HV side and 3 or 4 on LV side, can be connected at once. This significantly reduces testing time in the field, especially on large transformers.

Winding resistance can be performed with test currents of up to 25 A DC. Each transformer configuration has a special measurement algorithm which is optimized for the fast stabilization of test results. TWR-B instruments generate a true DC ripple-free current. Both the injection of the current and the discharge of energy from the magnetic circuit are automatically regulated.

TWR-B instruments determine 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. 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 TWR-B 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.

TWR-B lets users enter a transformer’s nameplate voltages for the turns ratio deviation calculation. This feature eliminates any error caused by an operator’s manual calculation. Obtained turns ratio test results are compared with the entered nameplate ratio and ratio deviation is automatically calculated.

TWR-B instruments have 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 proprietary hardware and software design solutions.

Applications

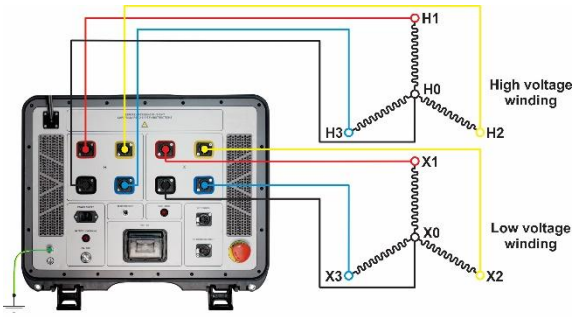
The list of instrument applications includes:

- Winding resistance measurement
- Demagnetization
- Turns ratio measurement
- Turns ratio deviation calculation
- Excitation current measurement
- Phase angle measurement
- Automatic vector group detection

Connecting TWR-B to Test Object

Three-Phase Transformer

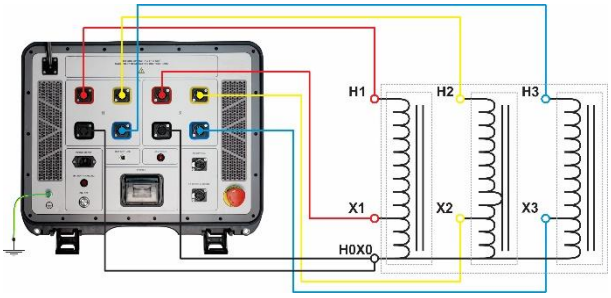
Using three or four H and three or four X cables, all bushings of HV and LV sides are connected at once.



Connecting TWR-B to a three-phase transformer

Three-Phase Autotransformer

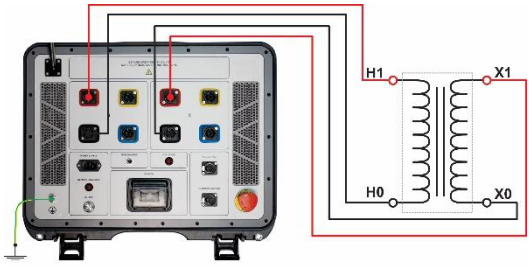
Using four H and four X cables, all bushings of HV and LV sides are connected at once. Both H and X neutral cables should be connected to autotransformer neutral bushing.



Connecting TWR-B to a three-phase autotransformer

Single-Phase Transformer

Although three-phase devices, TWR-B instruments can test single-phase transformers. Two H and two X cables are used for this purpose.



Connecting TWR-B to a single-phase transformer

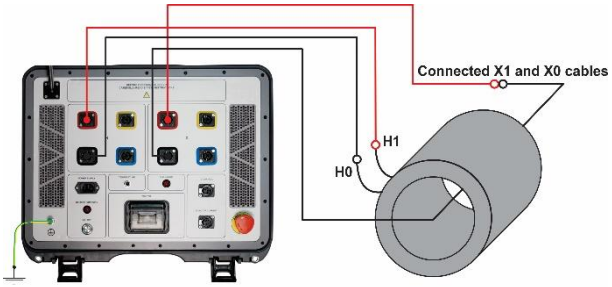
Single-Phase Autotransformer

Although three-phase devices, TWR-B instruments can test single-phase transformers. Two H and two X cables are used for this purpose. Both H and X neutral cables should be connected to autotransformer neutral bushing.

Connecting TWR-B to a single-phase autotransformer

Current Transformer

TWR-B instruments can also be used for winding resistance measurement, demagnetization, and 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 secondary side of CTs. For that reason, H test cables must be connected to CT secondary winding, and X test cables must be connected to CT primary winding. If there are no primary terminals, X cables should be slid through the CT core and short-circuited.



Connecting TWR-B to an unmounted current transformer

Benefits and Features

Internal Battery

Battery installed in TWR-B instruments enables performing tests onsite even when external power supply is not available.

Test Voltage up to 250 V AC

TWR-B instruments can output the highest test voltage of 250 V AC. This provides accurate turns ratio and magnetic balance measurements on large power transformers and autotransformers used in power generation and transmission.

Test Current up to 25 A DC

TWR-B instruments can output the highest test current of 25 A DC. This enables fast and accurate winding resistance measurements on large power transformers and autotransformers used in power generation and transmission.

Six-Winding Resistance Measurement

Connecting all 3 phases at HV and LV side at the same time enable resistance measurement of all 6 transformer windings in a single test. If measurement of both HV and LV sides is selected, TWR-B will inject a current through corresponding HV and LV windings which are mounted on the same core limb. This enables fast saturation of transformer core and therefore fast results stabilization of measured results.

Automatic Vector Group Detection

TWR-B instruments can automatically detect vector groups of three-phase transformers and autotransformers.

Transformer Demagnetization

After a DC current test, such as a winding resistance measurement, the magnetic core of a transformer may be magnetized. Also, when disconnecting a transformer from a service, some amount of magnetic flux trapped in the core could be present. Demagnetizing the magnetic core of a transformer requires alternating current applied with decreasing magnitude down to zero. TWR-B instruments provide this alternating current by internally changing the polarity of a controlled DC current. During the demagnetization process the test current is supplied with decreasing magnitude for each step, following the proprietary developed program.

Tap Changer Control Unit

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

Automated Test in Multiple OLTC Positions

Built-in tap changer control unit allows fully automated tests in multiple OLTC positions. TWR-B instruments can control the entire process of measurements and changing taps automatically.

Memory

TWR-B instruments have internal SD card of 32 GB memory space. This enables saving tens of thousands of results and test templates.

Built-in Printer

Built-in thermal printer, 58 mm (2.3 in) wide, is a standard accessory. All numerical results can be printed either right after the test or later from any previously saved result.

USB Flash Drive

Results can be exported to a USB memory through an integrated USB flash drive for further analysis and processing with powerful DV-TR software.

Large Graphical Touch Screen Display

TWR-B instruments come equipped with a large 10.1” graphical touch screen display. This makes test preparation, test execution, and analysis of test results as easy as possible. Test template can be prepared and saved in the office, making the test execution in the field possible with only a few clicks. All test results are presented both numerically and graphically, for easy and convenient analysis.

DV-TR Software

The DV-TR software is included in the purchase price, and all updates are provided free of charge. Its primary function is to download test results from the TWR-B device for further processing. All results are presented both numerically and graphically, for 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.

Technical Data

Mains Power Supply

- Connection: according to IEC/EN60320-1; UL498, CSA 22.2
- Mains supply: 90 – 264 V AC, 50/60 Hz

Battery

- Type: Li-Ion, 14.4 V, 6.8 Ah
- Rechargeable

Output AC Source

- TWR250B test voltages: 1 V – 250 V

Output DC Source

- TWR250B test current: 5 mA – 25 A
- TWR250B test voltage: up to 50 V

Turns Ratio Measurement

- Range: 0.8 – 50 000
- Resolution: 5 digits

Excitation Current Measurement

- Range: 0 – 2 A

Phase Angle Measurement

- Range: 0 – 360°
- Resolution: 0.01°

Winding Resistance Measurement

- Measurement range: 0.1 µΩ – 100 kΩ

OLTC DVtest (DRM)

- Resolution: 1 ms

AC Current Measurement Channel

- Resolution: 1 ms

Current Clamp Meter Specifications

- Measuring ranges: 30 / 300 A
- Frequency range: DC to 20 kHz (-3 dB)
- Resolution: ±50 / ±100 mA
- Accuracy: ±1% rdg

Temperature Measurement

- Measurement range
  -50 ºC – +180 ºC / -58 ºF – +356 ºF
- Thermometer Pt100 class B
- Resolution 0.1 ºC

Display

- 10.1” graphical touch screen display

Interface

- Ethernet
- USB

Internal Memory

- SD card 32 GB

Environmental Conditions

- Operating temperature:
  -20 °C – +60 °C / -4 °F – +140 °F
- Storage & transportation temperature:
  -40 °C – +70 °C / -40 °F – +158 °F
- Humidity: 0 – 95% relative humidity, non-condensing

Dimensions and Weight

- Dimensions (W x H x D):
  503 x 193 x 406 mm / 19.8 x 7.6 x 16.0 in
- Weight:11.0 kg/ 24.3 lbs

Warranty

- 3 years + 1 additional year upon registration on DV Power official website

Printer

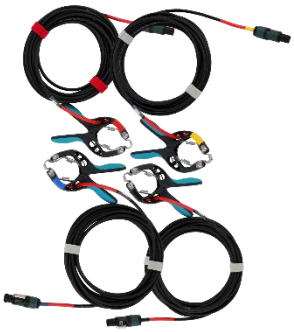
- Built-in thermal printer
- Paper width 58 mm / 2.3 in
- Printer operating temperature:
  -20 °C – +70 °C / -4 °F – +158 °F

Applicable Standards

- Installation/Overvoltage category: II
- Pollution degree: 2
- Safety: LVD 2014/35/EU (CE Conform)
  Standard EN 61010-1:2010
- EMC: Directive 2014/30/EU (CE Conform)
  Standard EN 61326-1:2013

All specifications herein are valid at ambient temperature of +25 °C / +77 °F and standard accessories.
Specifications are subject to change without notice.

Accessories



H winding test lead set with TTA clamps

X winding test lead set with TTA clamps

Current clamp 30/300 A

Plastic transport case

Cable plastic case – large size

Cable plastic case with wheels – large size

Cable plastic case – medium size

Cable plastic case with wheels – medium size

Tap changer control cable

Test shunt

Temperature sensor with cable

Safety strobe light

TRTC Verification Calibrator

H winding test lead set with banana plugs

X winding test lead set with banana plugs

Cable bag

Ordering Info

Instrument	Article No
Turns Ratio and Winding Resistance Analyzer TWR250B	TWR250B-N-03

Included Accessories
Windows-based DV-TR PC software
USB cable
Ethernet cable
Tap changer control cable 5 m (16.4 ft)
Mains power cable
Ground (PE) cable
Debug adapter
Plastic transport case

Standard Accessories	Article No
H winding test lead set, 4 x 10 m (32.8 ft) with TTA clamps	HC-10-4FNCWC
X winding test lead set, 4 x 10 m (32.8 ft) with TTA clamps	XC-10-4FNCWC
Current clamp 30/300 A power supplied from the instrument with extension 5 m (16.4 ft)	CACL-0300-06
Cable plastic case – large size	CABLE-CAS-03

Optional Accessories	Article No
H winding test lead set, 4 x 5 m (16.4 ft) with TTA clamps	HC-05-4FNCWC
X winding test lead set, 4 x 5 m (16.4 ft) with TTA clamps	XC-05-4FNCWC
H winding test lead set, 4 x 15 m (49.2 ft) with TTA clamps	HC-15-4FNCWC
X winding test lead set, 4 x 15 m (49.2 ft) with TTA clamps	XC-15-4FNCWC
H winding test lead set, 4 x 20 m (65.6 ft) with TTA clamps	HC-20-4FNCWC
X winding test lead set, 4 x 20 m (65.6 ft) with TTA clamps	XC-20-4FNCWC
Temperature sensor 1 x 50 mm (1.97 in) with 5 m (16.4 ft) cable	TEMP1-050-05
Temperature sensor 1 x 50 mm (1.97 in) with 10 m (32.8 ft) cable	TEMP1-050-10
Temperature sensor 1 x 50 mm (1.97 in) with 15 m (49.2 ft) cable	TEMP1-050-15
Temperature sensor 1 x 50 mm (1.97 in) with 20 m (65.6 ft) cable	TEMP1-050-20
Test shunt 1 mΩ (150 A / 150 mV)	SHUNT-150-MK
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
Thermal paper roll 58 mm (2.3 in)	PRINT-058-RO
Verification Calibrator TRTC	TRTC-05-4800
H winding test lead set, 4 x 1 m (3.28 ft) with banana plugs	HC-01-4LNCBP
X winding test lead set, 4 x 1 m (3.28 ft) with banana plugs	XC-01-4LNCBP
Cable bag	CABLE-BAG-00

B-TWRRNN-304-EN
Date published: 2025-12-02
Subject to change without notice

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