

# Handheld Turns Ratio & Winding Resistance Tester **TWR-H**

- Unique handheld instrument on the market
- Performs 3 different tests:
  - Turns ratio
  - Winding resistance
  - Demagnetization
- Single-phase test voltage up to 40 V AC
- Two DC current sources:
  - Test current up to 2 A DC for transformer HV side
  - Test current up to 10 A DC for transformer LV side
- Extremely lightweight – only 1.4 kg / 3.1 lbs
- Battery-powered
- Tests single-phase and three-phase transformers



## Description

TWR-H is a handheld, battery operated, fully automatic test set specially designed for turns ratio, phase shift, and excitation current of transformers, and winding resistance measurement of transformers and other inductive objects, such as motors and generators. It can also perform demagnetization of transformers, motors, and generators.

Transformer turns ratio is determined by applying AC voltage across high voltage winding, accurately measuring AC voltage across the corresponding unloaded transformer winding, and then displaying the ratio of these voltages.

User can enter a transformer's nameplate voltages, so that turns ratio deviation can be calculated. This feature eliminates any error otherwise caused by an operator's manual calculation. TWR-H compares measured turns

ratio with the nameplate ratio and prints out the % of error for each test.

Winding resistance is determined by injecting DC current through a winding, accurately measuring DC voltage across the winding, and then calculating resistance as the ratio of voltage and current.

The device generates true DC ripple-free currents. Both the injection of the current and the discharge of energy from transformer magnetic circuit are automatically regulated.

## Application

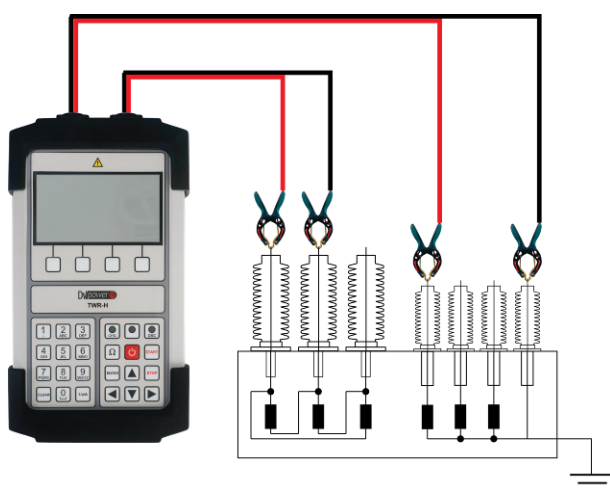
The list of instrument application includes:

- Winding resistance measurement of distribution and instrument transformers, and motors and generators
- Turns ratio measurement of distribution transformers
- Turns ratio verification of instrument transformers
- Turns ratio deviation calculation
- Excitation current measurement of distribution and instrument transformers
- Phase angle measurement of distribution and instrument transformers
- Polarity check of instrument transformers
- Demagnetization of distribution and instrument transformers, and motors and generators

## Connecting TWR-H to Test Object

### Distribution Transformer

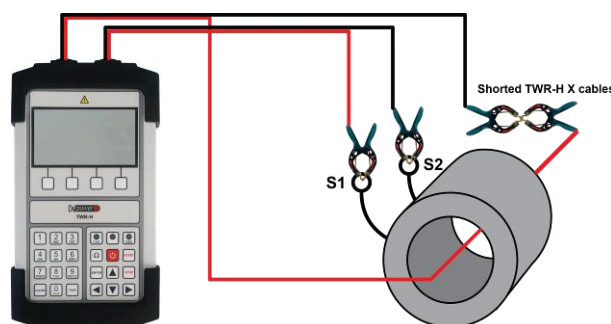
Using two sets of cables, TWR-H can be connected to one phase at transformer HV side, and one phase at transformer LV side, simultaneously. Connecting to both sides is necessary for turns ratio measurement. For winding resistance measurement, TWR-H can be connected to either transformer HV side or LV side, or to both in case when HV and LV winding resistances are going to be measured simultaneously.



Connecting TWR-H to a three-phase distribution transformer

### Current Transformer (CT)

TWR-H can be connected to both primary and secondary side of a current transformer (CT) simultaneously. Connecting to both sides is necessary for turns ratio verification. 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 TWR-H “X” test cables must be connected to the primary of a CT. If there are no primary terminals, the TWR-H “X” cables should be slid through the CT core and short-circuited.



Connecting TWR-H to an unmounted current transformer (CT)

## Benefits and Features

### Two Output DC Sources

A common issue when testing winding resistance of distribution transformers is the selection of test current. Distribution transformers have high turns ratio, and therefore high difference between rated HV and LV currents. Testing HV and LV winding with the same current source can be challenging – test current must be less than or equal to 10% of the HV rated current, which is very often too low for LV winding. For this reason, TWR-H has two output DC sources – one for transformer HV side, and the other for transformer LV side. This way, transformer HV and LV windings can be tested using different test currents.

### Multiple Tests

Built-in AC and two output DC sources enable performing multiple tests on a same transformer – winding resistance, demagnetization, turns ratio, excitation current, and phase angle – with a single cable and test setup.

### Internal Battery

TWR-H is powered by internal, user-replaceable, rechargeable Li-Ion battery. A full day of testing can be performed with fully charged battery. TWR-H can also be operated while connected to mains power supply.

### Memory

TWR-H has 100 transformer records. Up to 15 winding resistance and 15 turns ratio results can be stored in each transformer record.

### DV-TR Software

All results from TWR-H internal memory can be easily transferred to a DV-TR software via Bluetooth communication. This allows user to analyze results in the office, to print them, or to create customized test reports. The software is included in the purchase price.

## Technical Data

### Battery

- Type: Li-Ion, 14.8 V, 2.9 Ah
- Rechargeable
- User replaceable

### Power Supply Adapter

- Input voltage: 90 – 264 V AC, 50/60 Hz
- Output voltage: 12-19 V DC
- Output current: 2 A DC

### Output AC Source

- Voltage: 40 V, 10 V, 1 V

### Output DC Source 1

- Current: 2 A, 1 A, 500 mA, 100 mA, 50 mA, 10 mA, 5 mA

### Output DC Source 2

- Current: 10 A, 5 A, 2 A, 1 A, 500 mA

### Turns Ratio Measurement

- Measurement range:  
0.8 – 20 000 @40 & 10 V AC  
0.8 – 4 000 @1 V AC

- Resolution: 5 digits

- Typical accuracy:

@40 V AC

0.8 – 999:  $\pm 0.1\%$

1 000 – 3 999:  $\pm 0.15\%$

4 000 – 14 999:  $\pm 0.25\%$

15 000 – 20 000:  $\pm 0.3\%$

@10 V AC

0.8 – 999:  $\pm 0.2\%$

1 000 – 3 999:  $\pm 0.2\%$

4 000 – 14 999:  $\pm 0.25\%$

15 000 – 20 000:  $\pm 0.3\%$

@1 V AC

0.8 – 999:  $\pm 0.2\%$

1 000 – 4 000:  $\pm 0.2\%$

### Excitation Current Measurement

- Measurement range: 0 – 1 A
- Resolution: 0.1 mA
- Typical accuracy:  $\pm(1\% \text{ rdg} + 0.5 \text{ mA})$

### Phase Angle Measurement

- Measurement range: 0 – 360°
- Resolution: 0.01°
- Typical accuracy:  $\pm 0.06^\circ$

### Winding Resistance Measurement

- Measurement range: 1  $\mu\Omega$  – 3 k $\Omega$
- Range / resolution:
 

|                                     |                 |
|-------------------------------------|-----------------|
| 1 $\mu\Omega$ – 9.999 m $\Omega$    | 1 $\mu\Omega$   |
| 10.00 m $\Omega$ – 99.99 m $\Omega$ | 0.01 m $\Omega$ |
| 100.0 m $\Omega$ – 999.9 m $\Omega$ | 0.1 m $\Omega$  |
| 1.000 $\Omega$ – 9.999 $\Omega$     | 0.001 $\Omega$  |
| 10.00 $\Omega$ – 99.99 $\Omega$     | 0.01 $\Omega$   |
| 100.0 $\Omega$ – 999.9 $\Omega$     | 0.1 $\Omega$    |
| 1.000 k $\Omega$ – 3.000 k $\Omega$ | 1 $\Omega$      |
- Typical accuracy:  $\pm(0.5\% \text{ rdg} + 0.5\% \text{ F.S.})$

### Display

- LCD 4.8" display, 240 x 128 pixels

### Interface

- Bluetooth

### Internal Memory

- 100 transformer records
- Each record contains up to 30 results

### Warranty

- 3 years + additional 1 year upon registration  
[on DV Power official website](#)

## Environmental Conditions

- Operating temperature:  
-20 °C – +55 °C / -4 °F – +131 °F
- Storage & transportation:  
-40 °C – +70°C / -40 °F – +158 °F
- Humidity: 0% – 95% relative humidity, non-condensing

## Dimensions and Weight

- Dimensions (W x H x D):  
170 x 310 x 58 mm / 6.69 x 12.21 x 2.28 in
- Weight: 1.4 kg / 3.1 lbs

## Environmental protection (IP rating)

- Device: IP40
- Device in plastic case: IP67 (closed lid)

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

## 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

## Transformer testing standards

- IEEE C57.152-2013
- IEC 60076-1:2011
- AS/NZS 6076 1:2014
- CIGRE 445 2011



H winding current and sense cables with small TTA clamps



X winding current and sense cables with small TTA clamps



Jumper cable with small TTA clamps



Mains power cable with power supply adapter 18 V / 3 A



Plastic transport case for TWR-H, TRT-H & RMO-TH



Test shunt

## Ordering Info

| Instrument                                             | Article No   |
|--------------------------------------------------------|--------------|
| Handheld Turns Ratio & Winding Resistance Tester TWR-H | TWRH000-N-01 |

| Included accessories                                   |
|--------------------------------------------------------|
| Windows-based DV-TR PC software                        |
| Mains power cable with power supply adapter 18 V / 3 A |
| Plastic transport case for TWR-H, TRT-H & RMO-TH       |
| Carrying belts                                         |

| Standard accessories                                                                                 | Article No   |
|------------------------------------------------------------------------------------------------------|--------------|
| H winding current and sense cables 2 m (6.56 ft), 2.5 mm <sup>2</sup> (14 AWG) with small TTA clamps | HCS-02-2NCWS |
| X winding current and sense cables 2 m (6.56 ft), 2.5 mm <sup>2</sup> (14 AWG) with small TTA clamps | XCS-02-2NCWS |
| Jumper cable 2 m (6.56 ft), 2.5 mm <sup>2</sup> (14 AWG) with small TTA clamps                       | JCX-02-2WSWS |

| Optional accessories                                                                                 | Article No   |
|------------------------------------------------------------------------------------------------------|--------------|
| H winding current and sense cables 1 m (3.28 ft), 2.5 mm <sup>2</sup> (14 AWG) with small TTA clamps | HCS-01-2NCWS |
| X winding current and sense cables 1 m (3.28 ft), 2.5 mm <sup>2</sup> (14 AWG) with small TTA clamps | XCS-01-2NCWS |
| H winding current and sense cables 3 m (9.84 ft), 2.5 mm <sup>2</sup> (14 AWG) with small TTA clamps | HCS-03-2NCWS |
| X winding current and sense cables 3 m (9.84 ft), 2.5 mm <sup>2</sup> (14 AWG) with small TTA clamps | XCS-03-2NCWS |
| H winding current and sense cables 5 m (16.4 ft), 2.5 mm <sup>2</sup> (14 AWG) with small TTA clamps | HCS-05-2NCWS |
| X winding current and sense cables 5 m (16.4 ft), 2.5 mm <sup>2</sup> (14 AWG) with small TTA clamps | XCS-05-2NCWS |
| H winding current and sense cables 10 m (32.8 ft), 4 mm <sup>2</sup> (12 AWG) with small TTA clamps  | HCS-10-4NCWS |
| X winding current and sense cables 10 m (32.8 ft), 4 mm <sup>2</sup> (12 AWG) with small TTA clamps  | XCS-10-4NCWS |
| H winding current and sense cables 2 m (6.56 ft), 2.5 mm <sup>2</sup> (14 AWG) with test probes      | HCS-02-2NCTP |
| X winding current and sense cables 2 m (6.56 ft), 2.5 mm <sup>2</sup> (14 AWG) with test probes      | XCS-02-2NCTP |
| Jumper cable 1 m (3.28 ft), 2.5 mm <sup>2</sup> (14 AWG) with small TTA clamps                       | JCX-01-2WSWS |
| Test shunt 150 A / 150 mV                                                                            | SHUNT-150-MK |
| Li-Ion battery 14.8 V 2900 mAh within fire retardant battery bag                                     | LION-BAT-002 |
| Fire retardant battery bag                                                                           | FIR-RTBBAG-0 |
| Plastic transport case for TWR-H, TRT-H & RMO-TH                                                     | HARD-CASE-TW |
| Verification Calibrator TRTC                                                                         | TRTC-05-4800 |
| H winding current and sense cables 1 m (3.28 ft) 2.5 mm <sup>2</sup> (14 AWG) with banana plugs      | HCS-01-2NCBP |
| X winding current and sense cables 1 m (3.28 ft) 2.5 mm <sup>2</sup> (14 AWG) with banana plugs      | XCS-01-2NCBP |
| Cable bag                                                                                            | CABLE-BAG-00 |

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