

# Three-Phase Winding Ohmmeters & Tap Changer & Winding Analyzers **TWA Standard Series**

- Resistance measurement of all tap positions in all six windings performed in a single test
- True three-phase on-load tap changer (OLTC) DVtest (dynamic resistance measurement)
- Extremely quick measurement, single-step cable setup
- Rapid automatic demagnetization
- Fully automated test mode
- Built-in tap changer control unit
- Temperature measurement channel




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## Description

The TWA standard series instruments are designed for six-winding resistance measurement and simultaneous three phase on-load tap changer analysis of both the primary and the secondary transformer windings (provided by the TWA40 model). This is performed with a one single-step cable setup, with test currents of up to 40A. Each transformer configuration has a special measurement algorithm which is optimized for the fast stabilization of test results. The TWA

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.

The TWA has very high ability to cancel electrostatic and electromagnetic interference that exists in HV electric fields. It is achieved by a proprietary solution applied to both the hardware construction and the application software implementation.

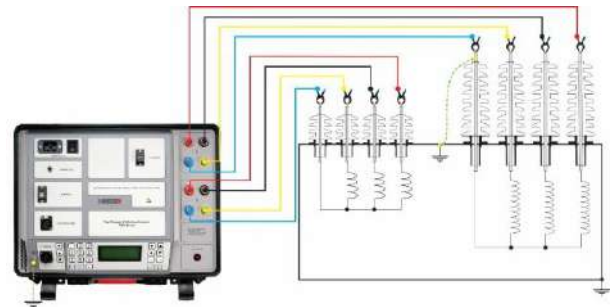
## Application

The list of the instrument application includes:

- A six-winding measurement of transformer winding resistances with a one-time cable connection
- Simultaneous (Quick YN) mode, which enables measuring the resistances of three transformer windings in the YN configuration simultaneously (TWA40D)
- DVtest (Dynamic resistance measurement) of OLTC, which can be performed simultaneously on all three phases, or on a single phase (TWA40D)
- An evaluation of OLTC synchronization between three phases (TWA40D)
- A measurement of OLTC motor current by using a dedicated channel (TWA40D)
- A three-phase or single-phase automatic transformer demagnetization

## Connecting the TWA to a Transformer

Using two sets of four cables, all bushings of the primary and the secondary sides are connected only once. The connection to the transformer is made using two-contact clamps that provide the four-wire Kelvin test method.



## Benefits and Features

### Test Voltage up to 55 V DC

The TWA injects the current with a voltage value as high as 55 V DC. This ensures that the magnetic core is saturated quickly, and duration of the test is as short as possible.

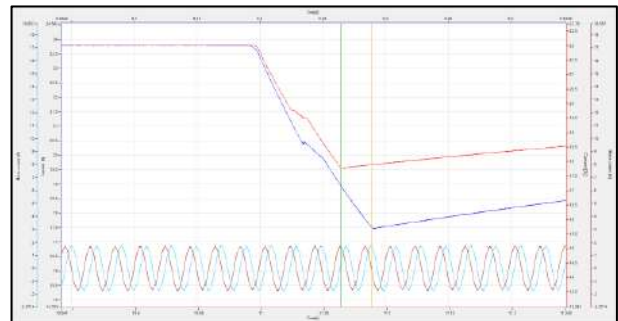
### Six-Winding Resistance Measurement

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, TWA 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.

### OLTC DVtest (DRM)

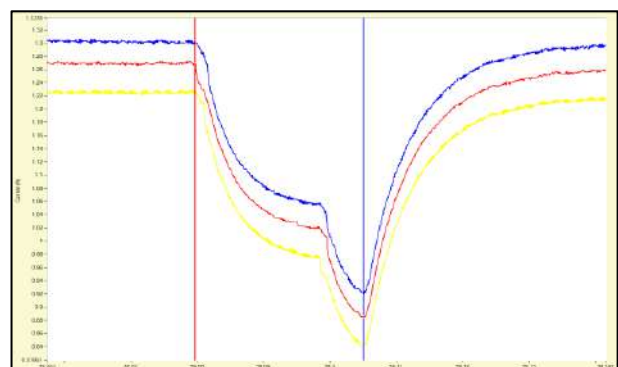
TWA can be used for measuring winding resistance of individual taps of a power transformer with OLTC without test current interruption between the tests. This way it checks whether the OLTC switches without an interruption. The moment a tap position is changed from one tap to another, the device detects a sudden, very short drop of the test current. These drops called "ripples" should be consistent, where any drop out-of-line should be investigated. OLTC malfunctions can be detected by analyzing transition ripple, transition time, and by visualizing DVtest (DRM) graphs. In addition, OLTC motor current is recorded using provided current clamps and displayed on the same graph. Analyzing

motor current graph can reveal possible mechanical issues related to OLTC mechanism.



### On-Load Tap Changer Synchronization Check

DVtest (DRM) graphs can be recorded for all three phases simultaneously using TWA40D model, so the synchronization between phases can be checked. All three phase traces are plotted on the same graph.



### Simultaneous Winding Resistance Measurement of Three Phases

Additional testing mode, Quick YN, is enabled by the DV-TR software for the TWA40D model. In this mode, it is possible to simultaneously measure the resistances of three transformer

windings connected in the YN configuration. It is also possible to measure the resistances of all OLTC positions of all three phases in a single pass through the tap changer positions.

### DV-TR Software

The Windows-based DV-TR software enables control and observation of the test process, as well as saving and analyzing the results on a PC. The software provides an OLTC condition assessment through analysis of the graphs representing DVtest (DRM) values during the OLTC transitions. Additionally, the DV-TR measures and calculates the OLTC transition time, the ripple and the winding resistance for each tap changing operation. Customized test report can be generated, edited, saved in several file formats including pdf, and printed.

### On-Load Tap Changer Motor Current Recording Channel

The AC and/or DC current monitoring channel, available on TWA40D model, enables recording the OLTC mechanical drive motor current during OLTC operation. The motor current waveform (or another useful signal) is plotted on the same DV-TR generated DVtest (DRM) graph and can help in detecting OLTC mechanical problems. This channel allows triggering DVtest recording using OLTC motor current, which is useful for reactance tap changers.

### Automatic 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. TWA 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

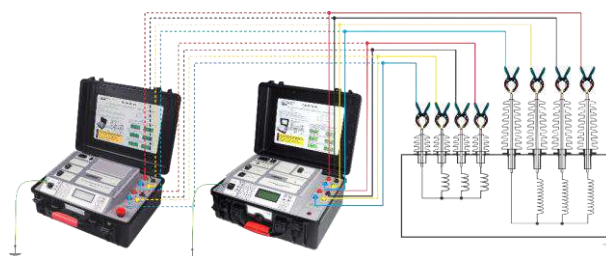
TWA instruments have a built-in tap changer control unit, which allows remote on-load tap changer operation. A single operator can perform complete testing very quickly.

### Automated Test in Multiple OLTC Positions

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

### Interchangeable cables with Three-phase Turns Ratio Testers TRT

TWA uses the same cable set as Three-phase Turns Ratio Tester TRT devices. 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 TWA and TRT one measurement system.



Connecting TWA Standard and TRT Standard to a transformer

## Technical Data

### Mains Power Supply

- Connection according to IEC/EN60320-1; UL498, CSA 22.2
- Mains supply: 90 V - 264 V AC, 50/60 Hz
- Input power: 1500 VA

### Output

- Test currents: 5 mA – 25 A DC (TWA25A)
- 5 mA – 40 A DC (TWA40D)
- Output voltage: up to 55 V DC

### Winding Resistance Measurement

- Measurement range: 0.1  $\mu\Omega$  - 10 k $\Omega$
- Measurement range / Typical accuracy:  
0.1  $\mu\Omega$  – 1.999 k $\Omega$ :  $\pm$  (0.1% rdg + 0.1% F.S.)  
2 k $\Omega$  – 9.999 k $\Omega$ :  $\pm$  (0.2% rdg + 0.1% F.S.)
- Measurement range / Resolution:  
0.1  $\mu\Omega$  – 999.9  $\mu\Omega$ : 0.1  $\mu\Omega$   
1.000 m $\Omega$  – 9.999 m $\Omega$ : 1  $\mu\Omega$   
10.00 m $\Omega$  – 99.99 m $\Omega$ : 10  $\mu\Omega$   
100.0 m $\Omega$  – 999.9 m $\Omega$ : 0.1 m $\Omega$   
1.000  $\Omega$  – 9.999  $\Omega$ : 1 m $\Omega$   
10.00  $\Omega$  – 99.99  $\Omega$ : 10 m $\Omega$   
100.0  $\Omega$  – 999.9  $\Omega$ : 0.1  $\Omega$   
1.000 k $\Omega$  – 9.999 k $\Omega$ : 1  $\Omega$

### OLTC DVtest

- Resolution:  
4 ms (TWA25A)  
0.1 ms (TWA40D)

### AC Current Measurement Channel

- Resolution: 0.1 ms (TWA40D)

### Current Clamp Meter Specifications

- Nominal current: 300 A<sub>RMS</sub> or 450 A DC<sub>PK</sub>
- Measuring ranges: 30 / 300 A
- Frequency range: DC to 20 kHz (-3 dB)
- Resolution:  $\pm$ 50 /  $\pm$ 100 mA
- Accuracy:  $\pm$ 1% rdg

### Temperature Measurement

- Measurement range  
-50  $^{\circ}$ C – +180  $^{\circ}$ C / -58  $^{\circ}$ F – +356  $^{\circ}$ F
- Thermometer Pt100 class B
- Resolution 0.1  $^{\circ}$ C

### Display

- LCD display with backlight, visible in bright sunlight

### Interface

- USB
- RS-232 (optional)

### Internal Memory

- 500 memory positions

### Environmental Conditions

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

### Dimensions and Weight

- Dimensions (W x H x D):  
478 x 194 x 389 mm / 18.8 x 7.6 x 15.3 in
- Weight: 12.8 kg / 28.3 lbs

### Warranty

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

### 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

<b>H winding test lead set with TTA clamps</b>	<b>X winding test lead set with TTA clamps</b>	<b>Current clamp 30/300 A</b>	<b>Plastic transport case</b>
<b>Cable plastic case - large size</b>	<b>Cable plastic case with wheels - large size</b>	<b>Cable plastic case - medium size</b>	<b>Cable plastic case with wheels - medium size</b>
<b>Tap changer control cable</b>	<b>Test shunt</b>	<b>Temperature sensor with cable</b>	<b>Cable bag</b>




## TWA Standard Series – Models

### TWA40D

	<p><b>The highest test current:</b></p> <p>25 A DC for winding resistance measurement 40 A DC for OLTC synchronization checking</p> <p><b>Winding resistance measurement:</b></p> <p>Sequential (phase by phase) Simultaneous (all phases at once), when transformer is YN connected</p> <p><b>DVtest:</b></p> <p>Recording DVtest current and OLTC motor current Resolution 0.1 ms</p> <p><b>Demagnetization:</b></p> <p>Three-phase and single-phase</p>
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### TWA25A

	<p><b>The highest test current:</b></p> <p>25 A DC for winding resistance measurement</p> <p><b>Winding resistance measurement:</b></p> <p>Sequential (phase by phase)</p> <p><b>DVtest:</b></p> <p>Recording DVtest current Resolution 4 ms</p> <p><b>Demagnetization:</b></p> <p>Three-phase and single-phase</p>
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## Ordering Info

Instrument	Article No
Tap Changer & Winding Analyzer TWA40D	<a href="#">TWA40DX-N-03</a>
Three-Phase Winding Ohmmeter TWA25A	<a href="#">TWA25AX-N-03</a>

Included accessories
DV-TR 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
Plastic transport case

Standard accessories	Article No
H winding test lead set, 4 x 10 m (32.8 ft) with TTA clamps (compatible with TWA and TRT series)	<a href="#">HC-10-4FMCWC</a>
X winding test lead set, 4 x 10 m (32.8 ft) with TTA clamps (compatible with TWA and TRT series)	<a href="#">XC-10-4FFCWC</a>
Current clamp 30/300 A power supplied from the instrument with 5 m (16.4 ft) extension (TWA40D)	<a href="#">CACL-0300-06</a>
Cable plastic case - large size	<a href="#">CABLE-CAS-03</a>

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)	<a href="#">HC-05-4FMCWC</a>
X winding test lead set, 4 x 5 m (16.4 ft) with TTA clamps (compatible with TWA and TRT series)	<a href="#">XC-05-4FFCWC</a>
H winding test lead set, 4 x 15 m (49.2 ft) with TTA clamps (compatible with TWA and TRT series)	<a href="#">HC-15-4FMCWC</a>
X winding test lead set, 4 x 15 m (49.2 ft) with TTA clamps (compatible with TWA and TRT series)	<a href="#">XC-15-4FFCWC</a>
H winding test lead set, 4 x 20 m (65.6 ft) with TTA clamps (compatible with TWA and TRT series)	<a href="#">HC-20-4FMCWC</a>
X winding test lead set, 4 x 20 m (65.6 ft) with TTA clamps (compatible with TWA and TRT series)	<a href="#">XC-20-4FFCWC</a>
H winding cable extension set, 4 x 5 m (16.4 ft) (compatible with TWA and TRT series)	<a href="#">HE-05-4FMCFC</a>
X winding cable extension set, 4 x 5 m (16.4 ft) (compatible with TWA and TRT series)	<a href="#">XE-05-4FFCMC</a>

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
Temperature sensor 1 x 50 mm + 5 m (16.4 ft) cable	TEMP1-050-05
Temperature sensor 1 x 50 mm + 10 m (32.8 ft) cable	TEMP1-050-10
Temperature sensor 1 x 50 mm + 15 m (49.2 ft) cable	TEMP1-050-15
Temperature sensor 1 x 50 mm + 20 m (65.6 ft) cable	TEMP1-050-20
Test shunt 1 mΩ (150 A / 150 mV)	SHUNT-150-MK
Plastic transport case – medium size	PLCAS-P00-02
Plastic transport case with wheels – medium size	PLCAS-P00-W2
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 - large size	CABLE-CAS-03
Cable plastic case with wheels - large size	CABLE-CAS-W3
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-08-4FMCMC
X connection between instrument and switchbox, 4 x 0,8 m (2.62 ft)	XE-08-4FFCFC