

# MWA300/330A

## 3-Phase Ratio and Winding Resistance Analyzer



MWA330A with built-in 12-in industrial computer, shown above.

- **Combines TTR and resistance testing in one box - faster, more efficient testing**
- **55% smaller, 40% lighter than individual instruments**
- **Only one set of leads required - lighter, smaller and less expensive**
- **One test form - easier, faster to complete**
- **Built-in demagnetization**

### DESCRIPTION

The Megger MWA3xx Transformer Winding Analyzer is an advanced 3-phase transformer test system delivering portability, reduced set-up time, increased job-site safety, and effortless productivity. The MWA3xx provides complete ratio, phase and winding resistance measurements for a 3-phase transformer. All ratio and winding resistance tests are performed in one instrument, with only one 3-phase lead-set connection. The MWA3xx utilizes PowerDB as a single software platform saving the user additional time with only one set-up and one easy-to-use test form.

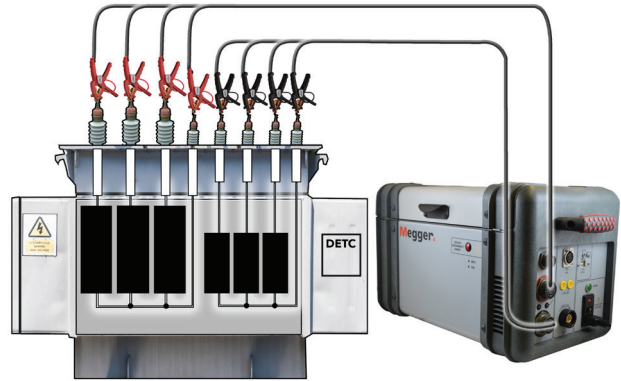
The MWA3xx effectively tests:

- Power transformers
- Distribution transformers
- CTs and VTs (PTs)
- Motors/generators

### TESTING PERFORMED

The following tests are easily performed with the MWA3xx, all with one instrument and one 3-phase lead-set connection.

- 3-phase turns ratio
- 3-phase winding resistance
- OLTC/continuity (make-before-break)
- 3 phase core demagnetization
- Magnetic balance / flux distribution
- Excitation current
- Polarity and phase angle deviation
- Auto vector detection
- Heat-run test



**3-Phase test connection (no interconnect boxes)**

### 3-Phase, 2-Winding Transformers - Resistance on all six windings

Once connected, the MWA3xx performs DC resistance measurements on all high- and low-side windings without reconnection. The test procedure is simple and efficient. Delivering eight-terminal/six-winding resistance measurement capability **without the need for inter-connect boxes** saves the user time by testing all six windings without having to disconnect and reconnect leads. The far-end of the measurement cable set is connected to each bushing/terminal of the transformer using a patented adjustable (100 mm – 4 in. opening) Kelvin clamp. This adjustable clamp removes the need for traditional dual leads (I & P) per phase, reducing the connections from 16 to 8 without the worry of misconnecting potential (P) for test current (I). The near-end of the cable is connected to the MWA3xx. Selected resistances of both

HV and LV windings will then be measured. The test sequence can be selected as 6-winding with dual injection simultaneous winding magnetization, up to 4-winding measurement of HV and LV separately, or single-winding test.

### 3-Phase turns ratio

Complexity in the measured ratio versus nameplate ratio occurs with most three-phase power transformers due to multipliers, such as  $\sqrt{3}$ , which are required to match the measured ratio to the nameplate ratio. Additionally, transformers with zig-zag windings are handled correctly with internal compensation allowing users to compare nameplate to actual with no corrections needed. The MWA3xx automatically applies the appropriate multiplier which provides a direct comparison to the nameplate ratio.

### Excitation current

The excitation current test at low voltage is very useful in locating problems such as defects in magnetic core balance, in magnetic core structure, shifting of windings, failures in the turn-to-turn insulation, or problems in tap changers.

### Winding balance

Winding balance (also referred to as magnetic balance) is performed to assess the health of the windings, core assembly condition, and flux distribution within the transformer. This test, performed safely and efficiently by the MWA3xx, is a measure of how well balanced (electrically) the transformer is versus nameplate specifications. Check with the factory to ensure your vector group is available with this feature.

### Phase angle deviation

Phase angle deviation is the phase relationship between in-phase vectors of the high-side windings versus the low-side windings. The phase deviation denotes the quality of the core and the winding and should exhibit very low values (0.01 degrees) when the core and windings are functioning properly. Shorted turns, a deteriorated, or damaged core can cause significant changes in the phase deviation values.

### LTC (OLTC) continuity

In normal LTC operation, continuity between the internal LTC contacts is maintained throughout each complete transition (from one tap position to the next). To check for this continuity, the MWA3xx continually monitors the transition current for each tap position. Any slight discontinuities are detected and reported.

### Vector recognition

When the transformer nameplate data is unavailable, or to confirm compliance to specified nameplate configurations, the MWA3xx provides the capability for automatic vector group detection.

### Polarity

The MWA3xx quickly and efficiently checks for correct polarity between high and low side windings.

### Automated heat-run interval testing

The MWA3xx performs automated single or multi-core heat run testing. It uses the standard accepted methods, IEC60076-2-1993

## 3-Phase Ratio and Winding Resistance Analyzer

& C57.12.90 2013, for this test, allowing users to perform factory testing automatically. Reports included within software also meets IEEE and IEC standard requirements but does allow manipulation to fit individual customer requirements.

### Auto core demagnetization

In order to avoid problems related to core saturation, the MWA3xx comes standard with a core demagnetization function which safely demagnetizes the transformer core after DC testing.

### PowerDB™ Software

PowerDB software provides the unit with a common “user interface” to minimize operator training and provides a seamless interface to the computer application – PowerDB Lite.

### Two Interface Options

#### Externally controlled – MWA300

The MWA300 is a “black box” style package that is remote-controlled by PowerDB software running on an external PC (not provided).

#### Built-in 305 mm (12 in.) touch-screen computer – MWA330A

The optional built-in touch-screen computer software provides an industrial, high visibility screen for use on any day – bright or cloudy – and works under the toughest environments. Providing the same test capabilities as the MWA300, the MWA330A comes equipped with an internal computer providing a 305 mm (12 in.) color display with touch-screen interface.

### FEATURES AND BENEFITS

- “One-time” 3-phase connection tests all six windings for faster and safer testing.
- No switchbox required, ensuring easier and safer operation.
- Unique Kelvin clamps with patented adjustable jaws each open to 100 mm (4-in.) as well as banana plug input for connection to terminal blocks – no need for special lead sets, and minimal operator error due to lead connections.
- Industrial grade 305 mm (12 in.) bright-color touch-screen display available as an option. Usable in direct sunlight, harsh environments – no need for IT intervention, safely stores results and reports.
- Checks the contact and timing health of LTC (OLTC) tap changers.
- Single-person testing of LTCs is provided standard for use with optional remote tap controller (RTC-1).
- PC interface via USB for remote control operation and downloading of test results for ease of use.

## 3-Phase Ratio and Winding Resistance Analyzer

## SPECIFICATIONS

## Input Power

**MWA3xx:** 108 to 132 V, (207 to 253 V\*), 58 - 62 Hz, 660 VA

**MWA3XX-47:** 207 to 253 V, (108 to 132 V\*), 48 - 52 Hz, 660 VA

\*Input fuse change required - 6.3A fuse for 120 V nominal and 4.0A fuse for 230 V nominal line input.

## Internal Data Storage

**MWA330A** (built-in computer): up to 100,000 data sets

## Communication/Control Software

**MWA3xx:** PowerDB Lite

**MWA330A:** Controlled via built-in industrial PC or external customer PC.

The MWA330A's internal computer is designed to control a limited number of Megger instruments including the DELTA4000 as well as the Megger S1 and MIT Series DC insulation testers.

## Environmental

**Operating:** -10° C to +50° C (14° F to 122° F)

**Storage:** -30° C to +70° C (-22° F to +158° F)

**Relative Humidity:** 0-90% non-condensing

## Case

Ruggedized case (metal/plastic trim) with removable lid and soft-side pouch with carrying strap

## Safety/EMC/Vibration

Conforms to the requirements of:

IEC 61010-1:2010

ASTMD999.75,

IEC 61326-1:2012\* (both emissions and immunity)

\* - see manual

## Dimensions/Weight

## Dimensions

290 x 290 x 460 mm (11 x 11 x 18 in.) does not include handles

## Weight

Standard unit: 14.5 kg (32 lbs)

## Transformer Winding Phase Relationship

ANSI C57.12.70-1978

CEI/IEC 76-1:1993 and Publication 616:1978

AS-2374, Part 4-1982 (Australian Standard)

DC Specifications (Winding resistance, LTC/continuity, core demagnetization, heat-run)

## Resistance

## Resistance ranges:

Current Range (A)	Resistance Range ( $\Omega$ )	Resolution ( $\Omega$ )
10 A	10 $\mu\Omega$ to 0.2 $\Omega$	0.000001
10 A	0.2 $\Omega$ to 2 $\Omega$	0.0001
1 A	100 $\mu\Omega$ to 2 $\Omega$	0.00001
1 A	2 $\Omega$ to 20 $\Omega$	0.001
100mA	1 m $\Omega$ to 20 $\Omega$	0.0001
100mA	20 $\Omega$ to 200 $\Omega$	0.01
10 mA	10 m $\Omega$ to 200 $\Omega$	0.001
10 mA	200 $\Omega$ to 2000 $\Omega$	0.1

**Accuracy:**  $\pm 0.25\%$  Range  $\pm 0.25\%$  Rdg

**Resolution:** Up to 4 digits

## Excitation Current Specifications

## Range and Accuracy

0 to 500 mA, 3 digit resolution,  $\pm(2\%$  of reading + 1 digit)

## AC Specifications (Turns Ratio, Winding Balance)

## Range and Turns Ratio Accuracy:

## 8 V AC:

$\pm 0.1\%$  (0.8 to 2000)

$\pm 0.25\%$  (2001 to 4000)

$\pm 0.35\%$  (4001 to 8000)

## 40 V AC:

$\pm 0.1\%$  (0.8 to 2000)

$\pm 0.15\%$  (2001 to 4000)

$\pm 0.3\%$  (4001 to 10,000)

$\pm 0.35\%$  (10,001 to 25,000)

## 80 V AC:

$\pm 0.1\%$  (0.8 to 2000)

$\pm 0.15\%$  (2001 to 4000)

$\pm 0.25\%$  (4001 to 10,000)

$\pm 0.30\%$  (10,001 to 45,000)

## Phase Specifications (Phase angle deviation, Phase-shift analysis, auto Vector detection)

Input voltages: 8, 40, and 80 V AC

Range and Accuracy

$\pm 90$  degrees, 2 decimal points for the degree display, or for the centi-radian display

Accuracy:  $\pm 3$  minutes (from 0.8:1 – 2,000:1)

## OPTIONAL ACCESSORIES

### Test Leads

Newly designed test leads, shown in image below, are universal and can be used for winding resistance (MTO3XX) or turns ratio (TTR3xx) instruments. Expandable jaws, shown in inset, allow for testing any size transformer.

This new design allows tangle and hassle free connection to transformer.



Available in 9m (30 ft), 18 m (60 ft) and 30 m (100 ft) lengths

### Remote Tap Controller

The RTC-1 is a manually operated remote tap controller designed to provide a more efficient method of controlling (on)load tap changer (LTC) while performing routine tests on power transformers. It removes the need to be physically close to the LTC while testing or to have a second person controlling the LTC while operating the test instrument. A 9 m (30 ft) three-conductor cable is provided to allow proximity to the test instrument while performing testing and advancing tap positions as required throughout the test.



Foam Lined Transit Case Cat # 2005-115



HV Strobe and Leads

Cat # 1004-639

Length: 18 m (60 ft)


Weight: 1.1 kg (2.3 lb)

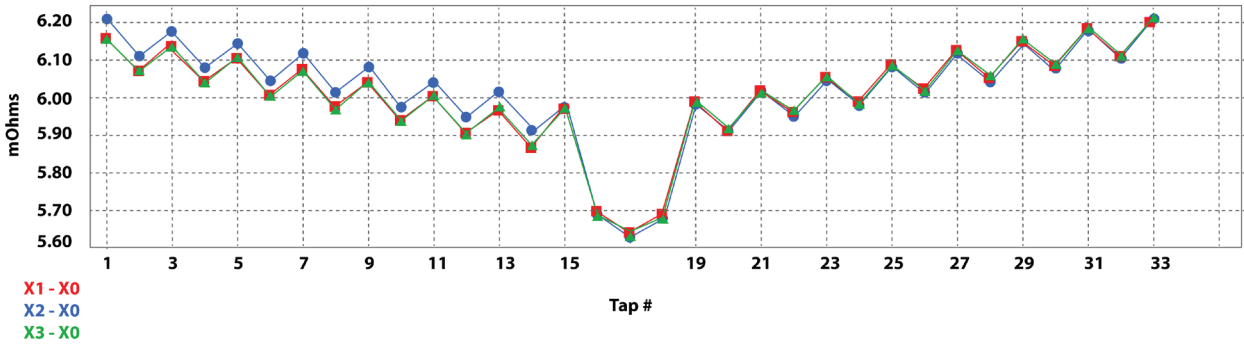
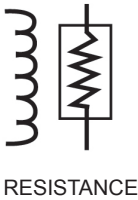
ONE INTUITIVE, COMPREHENSIVE TEST FORM

First High Tap Voltage \_\_\_\_\_  
Last High Tap Voltage \_\_\_\_\_  
# of Tests   9  

HIGH SIDE TAPS TO LOW SIDE NOMINAL TURNS RATION TESTS																		
#	TAP H/L		VOLTAGE H/L		TEST V	TTR	H <sub>1</sub> -H <sub>2</sub> /X <sub>1</sub> -X <sub>2</sub>				H <sub>2</sub> -H <sub>1</sub> /X <sub>2</sub> -X <sub>3</sub>				H <sub>3</sub> -H <sub>2</sub> /X <sub>3</sub> -X <sub>1</sub>			
							ACTUAL TTR	% ERROR	I exc mA	Phase (Deg)	ACTUAL TVR	% ERROR	I exc mA	Phase (Deg)	ACTUAL TVR	% ERROR	I exc mA	Phase (Deg)
1	Yd1		345,000	23,000	8	12.990	12.948	-0.33	0.9	0.13°	12.958	-0.25	0.8	0.13°	12.952	-0.29	1.0	0.12°
2	Yd1		345,000	23,000	40	12.990	12.944	-0.38	3.6	0.12°	12.953	-0.29	3.0	0.12°	12.945	-0.35	3.8	0.11°



		Test current (A)		MEASURED RESISTANCE				Units: mΩ		Make/Break Transition 			
		Reading Stability (%)											
#	Tap	1U-1N		1V-1N		1W-1N		Winding Difference %	Make/Break				
26	1	10.0938 100.00	99.9	10.0657 100.00	100.00	10.0701 100.00	100.01	0.171	5 ms	Pass	Pass	Pass	
27	2	10.0860 100.00	100.00	10.0664 50.00	100.00	10.0682 100.00	100.01	0.153	5 ms	Pass	Pass	Pass	
28	3	10.0798 100.00	100.00	10.0673 100.00	100.00	10.0664 100.00	100.01	0.157	5 ms	Pass	Pass	Pass	
29	4	10.0763 100.00	100.00	10.0693 100.00	100.00	10.0653 100.00	100.02	0.202	5 ms	Pass	Pass	Pass	
30	5	10.0719 100.00	100.00	10.0681 100.00	100.00	10.0648 100.00	100.02	0.196	5 ms	Pass	Pass	Pass	
31	6	10.0708 100.00	100.01	10.0715 100.00	99.9	10.0645 100.00	100.02	0.246	5 ms	Pass	Pass	Pass	
32	7	10.0699 100.00	100.01	10.0745 100.00	99.9	10.0643 50.00	100.02	0.282	5 ms	Pass	Pass	Pass	



## ORDERING INFORMATION

Item (Qty)	Cat. No.	Item (Qty)	Cat. No.
<b>Externally controlled Model MWA 300 Series</b>		<b>Optional Accessories</b>	
3-Phase Winding Analyzer, remote control only, nominal 120 V, 60 Hz*	MWA300	3-phase, 4-wire shielded test lead sets compatible with MTO3xx, MWA3xx & TTR3xx series instruments (up to 10A max), complete with color-coded Kelvin clamps:	
3-Phase Winding Analyzer, remote control only, nominal 230 V, 50 Hz*	MWA300-47	3-phase universal, 9 m (30 ft) H & X	2008-30-KIT
		3-phase universal, 18 m (60 ft) H & X	2008-60-KIT
		3-phase universal, 30 m (100 ft) H & X	2008-100-KIT
		3-phase universal, 9 m (30 ft) H	2008-113-30
<b>Built-in Computer Model MWA 330A Series</b>		3-phase universal, 9 m (30 ft) X	2008-114-30
3-Phase Winding Analyzer, on board industrial computer with 305 mm (12 in.) touch screen nominal 120 V, 60Hz*	MWA330A	3-phase universal, 18 m (60 ft) H	2008-113-60
3-Phase Winding Analyzer, on board industrial computer with 305 mm (12 in.) touch screen nominal 230 V, 50Hz*	MWA330A-47	3-phase universal, 18 m (60 ft) X	2008-114-60
		3-phase universal, 30 m (100 ft) H	2008-113-100
<b>Included Accessories</b>		3-phase universal, 30 m (100 ft) X	2008-114-100
AC power cord (IEC60320-C13 to US Standard) (MWA300/330A only)	17032	3-phase universal, 10 m (33 ft) X, Extension	36486-7
AC power cord (IEC60320-C13 to EU Standard)	17032-13	3-phase universal, 10 m (33 ft) H, Extension	36486-8
AC power cord (to UK Standard) (MWA300-47 and MWA330A-47 only)	17032-12	3-phase universal, 10 m (33 ft) H & X Extension	36486-9
USB 2.0 standard type A to B Cable 2 m (7 ft)	CA-USB	Remote tap controller, manual operation, model RTC-1, complete with quick guide, and red/black/white (total 3) alligator clips	1007-502
USB memory stick contains: user guide, PowerDB Lite, software related documents	1009-316	HV strobe c/w 18 m (60 ft) lead	1004-639
Quick Guide, EN/ES/DE/FR	2008-071	Verification resistor, 10A, 10 m ohms	1006-512-2
Ground lead, 9 m (30 ft)	2002-131	Foam lined transit case	2005-115
Canvas carrying bag	2005-265	Turns ratio calibration standard	Y550055

\*Please refer to **Input Power** under Specifications above for details.