

TTR®300 Series

3-Phase Transformer Turns Ratio Test Sets



TTR330

- Store and download test results in XML format, via RS-232, Ethernet or USB ports (depending on model)
- Works in the presence of high interference/ high voltage
- Capable of measuring all phase-shifting transformers
- Highest ratio measurement (45,000:1); highest accuracy (0.1%)
- Displays % error vs. name plate with pass/fail limits
- Capability for automatic vector detection when testing via PowerDB

DESCRIPTION

The TTR300 Series of three-phase transformer turns ratio test sets is designed to measure the turns ratio of power, instrument, and distribution transformers in a substation or manufacturing environment. A rugged and robust design makes these instruments well suited for use in a variety of harsh environments. Our leads are specially designed to provide the necessary flexibility needed in cold weather.

The TTR300 Series is ideal for use by power transformer manufacturers. Their unique testing procedures and storage capability allows an operator to set up and test difficult three-phase transformers (with multiple tap changers and bushing CTs) in a fraction of the time than it used to take with other TTRs. This test also includes a pass/fail limit of individual ratios.

The TTR300 Series also measures the phase deviation of the transformer primary versus secondary. This quickly indicates problems in the transformer such as partial shorted turns and core faults. This measurement is also useful in verifying phase errors in all types of PTs and CTs.

Each unit comes equipped with a remote-control switch for single person testing. This allows the operator to test transformers with LTCs very quickly.

The Series consists of three instruments:

TTR310

The most popular in the series, this unit features an easy-to-read, transreflective color display which can be seen in bright sunlight and provides the user interface for instrument set-up and test operation. The unit comes complete with the software application, PowerDB LITE.

The TTR310 has the ability to store test results, upload results to a PC (via RS232 serial port or USB), and/or print them in the field via optional thermal paper printer, without the use of an external computer.



TTR310 — text-based unit with color display

Three-Phase Transformer Turns Ratio Test Sets

Some of the features of the TTR310 consist of:

- Fully automatic operation (either stand-alone or remote-control)
- Field upgradeable to a TTR330 without compromise to calibration
- Built-in RS-232 port and optional thermal spool-paper printer allows for printing of test results, while in the field, and without the use of an external computer
- Built-in capability for storing test results into internal memory in an open data format for direct input into Excel® or XML format via PowerDB LITE

TTR300

The TTR300 is designed to be completely remote controlled via a PC running PowerDB LITE (included) or PowerDB (full version) PC software applications. Some of the features of the TTR300 are:

- Field upgradeable to a model TTR330 without compromise to calibration
- Built-in capability for storing test results into internal memory in an open XML data format via PowerDB LITE
- Quickly download test results via RS-232 serial port



TTR300 — remote controlled “black box” unit

TTR330

The TTR330 offers a new user interface which allows the operator to interact with the PowerDB ONBOARD software system via full QWERTY and navigation keypads as displayed on an 8.4" VGA bright-color screen. One of the primary benefits of this interface is that it displays the actual test form on the screen. An advanced feature of the TTR330 allows the user to customize these test forms via optional full-version PowerDB.

Other primary features of the TTR330 include three communications ports (two USB, one Ethernet). The USB “host” ports can be used for connecting directly to an optional printer (to print full size 8.5” x 11” completed test forms) and for data storage to a USB memory device (for later printing, analysis, archiving, and/or trending). The Ethernet port allows the TTR330 to interface (on a bi-directional basis) directly to a PC.



TTR330 shown testing a pad mount three-phase transformer



The TTR330 offers the following:

- Fully automatic operation (stand-alone or remote-control) with user interface via on-screen customizable test forms
- Integrated PowerDB ONBOARD allows for data analysis and trending while in the field without the use of an external computer
- Built-in USB port and optional USB printer allows for 8.5"x 11" test forms printing without the use of a laptop
- Built-in capability for storing test results, in an open XML format, to either internal memory or to an external USB storage device
- Full 8.4" VGA color display

PowerDB LITE™ Acceptance & Maintenance Test Data Management Software

Testing can be performed in a remote control manner with PowerDB LITE. Control of the TTRs in this remote-control manner offers the following benefits:

- Easy to use interface between operator and instrument.
- Problems such as PASS/FAIL are flagged visually using a RED highlight.
- Easily recall transformer setups from a custom settings menu.
- Quickly download results to the PC for completing a transformer test report.

TRANSFORMER TURNS RATIO TEST

Press P1 for new operation instructions

CUSTOMER XYZ Electrical Testing **PHONE** _____
ADDRESS 89254 56th Street, Omaha NE 68147 **JOB #** SAMPLE-02
USER J.J. Sobczyk, Job Number: 8382 42nd Street, Omaha NE 68147
OWNER REPRESENTATIVE Tom Osborn **TELEPHONE** _____
DATE 10/18/2009 **TEMPERATURE** 64.4 **REL. LOCATION** SAN JACINTO
SUBSTATION OUTDOOR **POSITION** NORTH SIDE

UNPLATE DATA *Use P1 for new operation instructions*

Built-in Memory

The TTRs come equipped with sufficient internal memory to store test results. The outcome of the results are based on the model:

TTR310: stores up to 200 three-phase data sets in the field for later retrieval. Test results can be printed on an optional printer (using thermal spool paper) whenever a hard copy is desired, or the data can be downloaded to a PC for archiving, analysis, trending, and/or printing. The system software allows entry of the transformer alphanumeric serial number, transformer type and tap information for each test performed.

TTR330: stores up to 100,000 data sets in the field for later retrieval. Test results can be printed on an optional in-lid printer (using 8.5" x 11" thermal paper) whenever a hard copy is desired, or the data can later be downloaded to a PC for archiving, analysis and/or printing. Identification of individual test readings is also easily done. The system software allows entry of the transformer alphanumeric serial number, transformer type and tap information for each test performed.



Improved-style leads allow connection to any size transformer and are made of field-durable materials. Jaw opening for each connection is up to 4 in. (10 cm). Banana-plug input is ideal for use on small and specialized type transformers. The material is flexible for testing in all types of climates.

Expandable jaws, shown in inset, allows for testing any size transformer.

APPLICATIONS

The TTR300 Series applies voltage to the high-voltage winding of a transformer and accurately measures the resulting voltage from the low voltage winding. In addition to turns ratio, the units measure excitation current, phase angle deviation between the high- and low-voltage windings and percent ratio error.

Transformer Turns Ratio

Transformer turns ratio is the ratio of the number of turns in the high-voltage winding to that in the low-voltage winding. Complexity in the measured ratio versus nameplate ratio occurs with most three-phase power transformers because multipliers such as $\sqrt{3}$ are required to match the measured ratio to the nameplate ratio. The TTR300 Series automatically applies the multiplier in a form which allows the operator a direct comparison to the nameplate (or expected) ratio. The built-in calculator displays the % error versus nameplate for each tap and each winding, without the need for a computer.

Exciting Current

The TTR provides accurate measurement of exciting current (to 0.1 mA) which can help provide information about the condition of a transformer's core. Unwanted circulating currents or unintentional core grounds can increase the exciting current and indicate a problem.

Phase Angle Deviation and its Application

The phase angle deviation, displayed in either degrees (minutes) or radians, is the phase relationship between the voltage signal applied to the high-voltage winding and the voltage signal extracted from the low-voltage winding. The phase deviation, together with ratio error, can be used as a low-cost method of verifying accuracy class of all types of PTs and CTs at "zero burden."

The phase deviation between the high and low side of a transformer is generally very small. If there is deterioration or damage in the transformer core, however, the phase deviation can change significantly. The three-phase TTR can measure this phase relationship with the resolution of 0.1 minutes (equal to 1/600 of a degree), which is necessary to detect problems.



Shown above, 1:1 test jig, cat. no. 2005-249

SPECIFICATIONS

Input Power

120V, $\pm 10\%$ 60Hz, ± 2 Hz, 100 VA
240V, $\pm 10\%$ 50Hz, ± 2 Hz, 100 VA (-47)

Excitation Voltage

8, 40, or 80 V rms, automatically or manually selected

Excitation Current Range and Accuracy

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

Phase Deviation Range and Accuracy

± 90 degrees, 1 decimal point for the minutes display, 2 decimal points for the degree display, or for the centi-radian display
Accuracy: ± 3 minutes (± 0.05 degrees)

Turns Ratio Range and 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)
Resolution: 5 digit for all ratios

Printer Interface

TTR300: Not applicable
TTR310: RS-232 port
TTR330: USB

Computer Interface

TTR300 and TTR310: RS-232 port
TTR330: Ethernet

User Interface

TTR300: Not applicable
TTR310: 5.7 in., color display, text on-screen view, numeric keypad
TTR330: 8.4 in., full-color VGA, test forms on-screen view, full QWERTY keypad and navigational pushbuttons

Internal Data Storage

TTR310: up to 200 data sets
TTR330: up to 100,000 data sets

Communication/Control Software

PowerDB LITE and PowerDB (full version, optional)
TTR330: PowerDB ONBOARD

Transformer Winding Phase Relationship

ANSI C57.12.70-1978
CE/IEC 76-1:1993 and Publication 616:1978
AS-2374, Part 4-1982 (Australian Standard)

Safety/EMC/Vibration

Safety: IEC-1010-1
CE: IEC 61326-1
Vibration: ISTA Guidelines (packaged), IEC61010 (unpackaged)

Temperature Range

Operating: 23° F to 122° F (-5° C to 50° C)
Storage: -22° F to 140° F (-30° C to 60° C)

Relative Humidity

0 to 90% noncondensing

Measuring Time

8 to 20 seconds depending on mode of operation and type of transformer

Measurement Method

ANSI/IEEE C57.12.90




Dimensions

Instrument:
8.5 H x 21.5 W x 13 D in. (216 H x 546.1 W x 330.2 D mm)
Case:
25 H x 19 W x 26 D in. (635 H x 483 W x 660 D mm)

Weight

Catalog No.	TTR300	TTR310	TTR330
Instrument with Standard Leads	24 lb (10.8 kg)	25 lb (11.3 kg)	28 lb (12.7 kg)
Instrument with Optional Leads, 30 ft (10 m)	46 lb (20.9 kg)	47 lb (21.3 kg)	50 lb (22.7 kg)
Instrument with Transit Case	83 lb (37.6 kg)	84 lb (38.1 kg)	87 lb (39.4 kg)

Case: 37 lb (16.7 kg)

FEATURES AND BENEFITS GUIDE	  		
	TTR300	TTR310	TTR330
Remote controllable	■	■	■
Works in the presence of high interference/high voltage	■	■	■
Displays % error vs. name plate with pass/fail limits	■	■	■
Measures the widest turns ratio range in the industry (45,000:1) and provides the highest accuracy (0.1%)	■	■	■
Enables operator to enter the ratio of transformer and all of its taps letting operator know immediately when a tap is outside acceptable limits so problem can be flagged	■	■	■
Equipped with “Remote TEST” switch for single person testing, allowing the operator to test transformers with “LTCs” quickly	■	■	■
Measures phase deviation of the transformer primary vs. secondary; quickly indicates problems in the transformer such as partial shorted turns and core faults. Useful in verifying phase errors in PTs and CTs.	■	■	■
Rugged, lightweight design ideal for a harsh field and substation environment	■	■	■
User selectable standards: ANSI, IEC, and Australian. Meets IEC 1010 and other standards such as CSA and UL	■	■	■
“Quick Test” mode provides a fast determination of turns ratio single- and three-phase transformers	■	■	■
Capability for automatic vector detection when testing via PowerDB	■	■	■
Capability for testing phase-shifting and tilted transformers, in accordance with IEC61378, when testing via PowerDB	■	■	■
Printing of test results without the use of a computer	N/A	4” thermal spool paper	8.5” x 11” thermal paper
Software			
PowerDB LITE	■	■	■
“PowerDB ONBOARD” allows for operation of the unit through on-screen customizable test forms			■
Full version PowerDB	Optional	Optional	Optional
Communications port			
Printer interface	N/A	RS-232	USB
Internal data storage (data sets)	N/A	200	100,000
External storage device	N/A	USB	USB
Computer interface	RS-232	RS-232	Ethernet
User interface			
Display type	N/A	5.7” color VGA	8.4” color VGA
On-screen view	N/A	Text	Test forms
Keypad	N/A	Numeric	QWERTY

ORDERING INFORMATION

Item (Qty)	Cat. No.	Item (Qty)	Cat. No.
Three-Phase TTR, remote controlled	TTR300	Optional Accessories	
Three-Phase TTR, stand alone or remote controlled	TTR310	3-ø shielded test lead set, X and H winding, 30 ft (9.1 m), 7.5 ft (4.5 m) span	37093-KIT
Three-Phase TTR with PowerDB ONBOARD	TTR330	3-ø shielded test lead set, X and H winding, 60 ft (18 m), 30 ft (9.1 m) span	37094-KIT
Note: 120 V 60-Hz operation standard. For 230 V, 50-Hz operation Add -47 to Cat. No.		1-ø shielded test lead set, X and H winding, 30 ft (9.1 m), 15 ft (4.5 m) span	37095-KIT
Included Accessories		Universal lead sets, compatible with Megger MTO3XX Series products (up to 10 A DC max)	
Canvas carrying bag for test leads	2005-265	3-phase, 4-wire shielded test leads (H & X), complete with color coded universal Kelvin clamps	
Power supply cord, 8 ft (2.5 m), 120 V	17032-4	30 ft (9 m), 15 ft (4.5 m) span	36486-6
Power supply cord, 8 ft (2.5 m), 230 V	17032-13	60 ft (18 m), 30 ft (9 m) span	36486-5
Ground lead, 15 ft (4.6 m)	4702-7	100 ft (30 m), 50 ft (15 m) span	36486-14
Hand-held TEST switch assy for remote operation	30915-220	33 ft (10 m) extension	36486-9
PowerDB LITE software		TTR printer package for TTR310 120 V, 60 Hz	1001-390
RS232 cable for connecting to a PC for use with TTR300 and TTR310	CA-RS232	230 V, 50 Hz	1001-401
Ethernet cable for connecting to a PC for use with TTR330	36798	USB portable thermal printer (120/240V) for TTR330	1005-521
Transformer Vector Voltage Diagram Set (for ANSI, IEC, and AS Standards) for TTR310	35298 35299 35300	Replacement/spare battery pack for TTR310 printer	37077
1:1 test jig (instrument self test)	2005-249	Bushing clips (6)	MC7144
Spare fuse kits:		Transit case (for instrument, leads and accessories)	2005-340
for TTR300 and TTR310	35026-3	TTR check box	550555
for TTR300-47 and TTR310-47	35026-4	TTR calibration standard	550055
for TTR330	35026-5	Optional Replacement Lead Sets for older style TTR C/N550503	
for TTR330-47	35026-2	3-ø "H" lead, 30 ft (9m) with old style H connector	30915-541
Instruction manuals:		3-ø "X" lead, 30 ft (9m) with old style X connector	30915-540
for TTR300	TTR300_UG	3-ø lead set adapter to allow use of lead sets (30915-xxx) above	37087
for TTR310	TTR310_UG		
for TTR330	TTR330_UG		

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ISO STATEMENT

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