TTR™100-1
Handheld TTR

- **Single- and three-phase transformer testing (up to 1 MVA)**
- **Lightweight, handheld**
- **Battery powered, line rechargeable**
- **Tests turns ratio, phase displacement, excitation current, winding resistance and polarity**
- **RS232 for data transfer**
- **Stores 200 test results and 100 user-defined transformer test settings**

DESCRIPTION

The Megger TTR100-1 is an automatic handheld, battery operated transformer turns ratio test set used to measure the turns ratio, excitation current, phase displacement, dc resistance and polarity of windings in single- and three-phase distribution transformers (tested phase by phase), potential & current transformers, and tapped transformers. Deviations in the mentioned measurements will quickly indicate problems in transformer windings or in the magnetic core circuits.

The unique design of the TTR100-1 allows the user to operate the test set while holding it in one hand. Realizing the extreme environments in which the TTR100-1 must operate, special attention has been paid to making it extra rugged, with a high impact, shock resistant case, yet incredibly lightweight at 3.3 lb. (1.5 kg). It weights less than any other commercially available instrument on the market.

Its rugged and robust design makes this instrument well suited for use in a variety of harsh environments. The TTR100-1 is particularly suited for testing in substations and transformer-manufacturing environments where testing single and three-phase transformers can be performed. The TTR100-1 provides reliable results, helping the user in determining the condition of the transformer under test. It features a high contrast LCD screen which can be seen in bright or ambient light.

The TTR100-1 and its lead set utilizes a METAL connection on both the instrument end and lead. This enhanced feature makes the instrument much more robust, improving reliability even under the harshest conditions.

This unit measures the highest turns ratio in the industry with an accuracy of 0.2% or better and with the lowest excitation voltage. Another excellent feature of this TTR is the ability to accurately measure phase deviation (in minutes or centiradians) of the transformer primary versus secondary. This measurement is also useful in verifying phase errors in PTs and CTs.

The TTR100-1 features special software capabilities. It comes equipped with sufficient onboard memory to store up to 200 test results (including test report header information) in the field for later retrieval, as well as 100 user-defined transformer settings. Test results can be downloaded to a PC. 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 (numerical, alphabetical, or alpha-numerical) for each test performed.

The TTR100-1 comes with a Windows® based software program that permits download of test data from the instrument to a PC database. Data stored in the database can be retrieved at a later date and test reports can be printed to assist in the preparation of management and/or analysis reports.

APPLICATIONS

The proper operation of a transformer relies almost entirely on the electrical properties of its windings. To ensure continued proper operation, transformers are tested to verify that their electrical properties have not changed from design specifications. A TTR is an extremely useful instrument for testing transformer windings because it can locate several types of problems within a single- or a three-phase transformer. It is also ideal to use for testing in meter shops for the inspection of CTs and PTs. It can determine the no-load accuracy of CTs and PTs and also determine the need to further test faulty CTs and PTs.

The TTR100-1 applies voltage, with voltage ratio being directly proportional to turns ratio, 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 unit measures excitation current, phase angle deviation between the high and low voltage windings, percent ratio error, dc winding resistance and polarity.

Transformer Turns Ratio

Transformer turns tatio is the ratio of the number of turns in the high voltage winding to that in the low voltage winding.

A transformer turns ratio test set such as the TTR100-1 can directly measure the ratio of single phase, as well as three phase transformers. Transformer ratio can change due to several factors, including physical damage from faults, deteriorated insulation, contamination and shipping damage. If a transformer ratio deviates more than 0.5 percent from the rated voltage ratio, it may not operate reliably. To measure small ratio changes such as this, the accuracy of a Megger TTR100-1 is required.

Excitation Current

The TTR100-1 is capable of measuring exciting current by applying voltage to one of the transformers windings. An accurate measurement of exciting current can provide information about the condition of a transformer's core. Unwanted circulating currents or unintentional grounds can affect the exciting current and indicate a problem.

Phase Angle Deviation

The phase angle deviation is the relationship between the voltage signal applied to the high voltage winding and the voltage signal extracted from the low voltage winding.

The phase deviation between the high and low side of a transformer is generally very small. However, the phase deviation can change significantly if there is deterioration or damage in the transformer core. The TTR100-1 can measure this phase relationship with the resolution necessary to detect a problem.

Additional information about a transformer's electrical properties can be found in the IEEE Standard Test Code for Transformers, C57.12.90 or IEC 600076.1 (2000).

Winding Resistance

Measuring the DC resistance of transformer windings will aid in identifying problems such as shorted or open windings, as well as loose connections.

The Megger TTR100-1 can measure the DC resistance of both single phase and three phase transformer windings.

Transformer Polarity

Polarity of a distribution transformer becomes of interest in order to determine its proper connection within a power network.

The Megger TTR100-1 will identify subtractive and additive polarity of the single-phase distribution transformers.

Polarity is also critical for CTs and PTs where incorrect polarity can cause serious problems.

FEATURES AND BENEFITS

- Powered by rechargeable battery, provides up to fifteen hours of field operation.
- Report header information such as company name, substation name, transformer manufacturer, transformer ratio, operator, temperature and %RH can be entered and saved via the alphanumeric keypad.
- Measures the widest turns ratio range in the industry (20,000:1) with the highest accuracy (±0.2%, 0.8 to 4000) at a low excitation voltage.
- Enables the operator to enter the ratio of the transformer and all of its taps. This allows the operator to know immediately when a tap is outside the acceptable limits so that problem taps can be easily identified.
- Records ratio and phase errors for bushing CTs to an accuracy of ±0.2% nameplate. This reduces the need for heavy test equipment and improves set-up time.
- Measures the phase deviation (in minutes, degrees or centiradians) 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 PTs and CTs.
- Perfect for meter shops, the TTR100-1 can be used for inspection purposes by using it to determine the no-load accuracy of most CTs and PTs. It also can be used to determine the need to further test potentially faulty CTs and PTs.
- The TTR100-1 is ideal for use by transformer manufacturers. Its unique testing procedures and storage capability allows an operator to set up and test single and three-phase transformers (with multiple tap changers and bushing CTs) in minimal time.
- A "Quick Test" mode provides a fast determination of the turns ratio, excitation current, phase angle deviation, and winding resistance in single- and three-phase transformers, PTs and CTs. In addition, polarity is provided for PTs, CTs and single-phase transformers.

- Displays all measured and calculated values for each test including ratio, excitation current, ratio error, phase angle deviation, transformer vector group, winding resistance and polarity thus providing comprehensive and conclusive data.
- Rugged, lightweight design ideally suited for a harsh field and substation environment.
- Three user selectable standards: ANSI, IEC, and Australian. Also meets IEC61010-1, CE, and IP54 requirements for protection against ingress of dust and water.
- Six user selectable languages: English, French, German, Italian, Portuguese and Spanish.

SPECIFICATIONS

Type of Power
Rechargeable NiMH battery pack, 3.6 V dc, 3800 mAh

Battery Life
Up to 15 hours of field operation

Charger Input Voltage
100-250 V ac, 50/60 Hz ±2 Hz Unit can be operated while charging. Charging time is approximately three hours

Excitation Voltage
8 V rms for testing distribution or power transformers, and PTs; 1.5 V ac RMS, or 8 V ac RMS for testing CTs

Test Frequency
55 Hz internally generated providing a universal 50/60 Hz test set

Excitation Current Range
0 to 100 mA, 4-digit resolution

Turns Ratio Range
8 V ac: 0.8 to 20,000, 5 digit resolution (for transformers and PT testing)
1.5 V ac: 5.0 to 2200, 5 digit resolution (for CT testing)

Phase Deviation Range
±90°, 1 decimal point for the minutes display, 2 decimal points for the degree display, or for the centiradian display

Winding Resistance Range
0 to 2000 Ω, 4 digit resolution

Transformer Vector Group
1PH0 or 1PH6

Transformer Polarity
Additive or Subtractive

Current (rms) Accuracy
±5% rdg ±0.5 mA

Phase Deviation Accuracy
±5 minutes

Turns Ratio Accuracy*
±0.20% (0.8 to 4,000)
±0.25% (4,001 to 10,000)
±0.30% (10,001 to 20,000)
**For Excitation Current Values no greater than preset value.*

Winding Resistance Accuracy
±(10% of reading + 1 digit) for 10 Ω to 2000 Ω range
±(10% ±1 mΩ) for 10 mΩ to 9.99 Ω range
±(10% ±0.5 mΩ) for 0.1 mΩ to 9.99 mΩ range

PC
RS232C port, 9-pin, 57.6 Kbaud

Display full graphics
LCD module, wide temperature range, 128 x 64 dots (21 characters by 8 lines)

Test Result Storage
Internal, nonvolatile memory for storing up to 200 sets of single-phase measured and calculated ratio, exciting current, phase, ratio error, winding resistance, polarity, vector group, plus header information (company, substation, transformer manufacturer, transformer rating, instrument serial number, temperature, relative humidity, and operator name).
In addition, up to 100 user-defined transformer settings can be stored.

Computer Software
Included ComLink software for downloading of data to a PC, data storage to database and report printout

Test Leads
Supplied with one complete set of single-phase leads, 6 ft (1.8 m) in length.
Note: The TTR100-1 utilizes metal connectors on both the unit and leads versus plastic connectors on the legacy TTR100 model.

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)

Safety/EMC/Vibration
Meets the requirements of IEC-1010-1, CE and ASTM D999.75

Temperature Range
Operating: -4° F to 131° F (-20° C to 55° C)
Storage: -58° F to 140° F (-50° C to 60° C)

Relative Humidity
Operating: 0 to 90% noncondensing
Storage: 0 to 95% noncondensing

Protective Devices
High voltage side shorting relays, transient voltage suppressors and gas surge voltage protectors

Measuring Time
8 to 20 seconds for a single-phase distribution transformer

Measurement Method
ANSI/IEEE C57.12.90 and IEC 600076.1 (2000)

Dimensions
9.5 H x 4.5 W x 1.875 D in. (241 H x 115 W x 48 D mm)

Weight
Approx. 3.3 lbs (1.5 kg), instrument only, without leads

Protective Instrument Carrying Case
Neoprene case with carrying strap and attachable pouch for universal charger and 6 ft. (1.8 m) test leads, single-phase connection (two leads for the H winding and three leads for the secondary winding with tap).

OPTIONAL ACCESSORIES

Test Leads

Sets of 12 ft (3.6 m) and 20 ft (6 m) test leads are available for the H winding and three leads for the secondary winding with tap).

Battery Pack (not shown)

A NIMH battery pack for use when additional testing time is required. The battery pack can be charged in the TTR100-1 while it is in use or not.

Rated at 3.6 V dc, 3800 mAh

Transit Case (not shown)

Rugged semi-hard padded case for storing/shipping the instrument, all leads and other accessories.

ORDERING INFORMATION

Order a TTR100-1 configured to your specific application. To determine the catalog number, fill in the blanks below with the corresponding number from the detailed information boxes.

Ordering Example:

To order a TTR100-1 for North American application and instruction manual in the English language, request catalog number TTR100-1-NA-ENG

TTR100-1 — N A — E N G

Fill in these blanks with the corresponding letter or number.

TTR100-1 — X X — X X X

Country
NA = North America
UK = United Kingdom
EU = European Union
(***Determines power cord requirement)***

Instruction Manual
ENG = English
FRN = French
SPN = Spanish

Item (Qty)	Cat. No.
Included Accessories	
Test Leads	
"X" winding, 6 ft (1.8 m)	2007-714-6
"H" winding, 6 ft (1.8 m)	2007-716-6
PC interface cable	33147-18
Battery pack	35753
Universal battery charger	35757
Power cable for battery charger	Determined by Country
Protective neoprene carrying case and accessory pouch	55-20008
Software for uploading test results to a PC	35794-2
Quickstart guide	55-20013
Instruction manual	AVTMTTR100-1-XXX (XXX = language code)

Item (Qty)	Cat. No.
Optional Accessories	
Test Leads	
"X" winding, 12 ft (3.6 m)	2007-714-12
"H" winding, 12 ft (3.6 m)	2007-716-12
"X" winding, 20 ft (6 m)	2007-714-20
"H" winding, 20 ft (6 m)	2007-716-20
"X" winding, 33 ft (10 m)	2007-714-33
"Y" winding, 33 ft (10 m)	2007-716-33
Cable bag - backpack	2012-180
Additional battery pack	35753
Optional Accessories are ordered separately	
Optional replacement leadsets for older style TTR100 (plastic connector)	
"X" winding, 12 ft (3.6 m)	35502-510
"H" winding, 12 ft (3.6 m)	35502-520

SALES OFFICE
Megger
4545 W. Davis Street
Dallas, TX 75211 USA
T 800-723-2861
E sales@megger.com

TTR100-1_DS_US_V03
www.megger.com
ISO 9001:2008
The word 'Megger' is a registered trademark