Tettex INSTRUMENTS

TTR 2796

Fully automated three phase 250V Transformer Turns Ratio Meter

A close collaboration with major transformer manufacturers has lead to the new Tettex 2796 Transformer Turns Ratio Meter. It combines mobility and user friendly handling with unmatched accuracy of up to 0.03%. The higher test voltage of 250V together with the high precision assures authentic results especially on large power transformers. Advanced analysis features like trending allow the user to detect problems at an early stage. The automatic winding connection identification feature aids to find the correct transformer configuration. With the optional arbitrary phase shift software special transformers with irregular vector groups can also be measured.

During production and also in the field the TTR2796 is a highly valued diagnostic instrument. Within half a minute after connecting the measurement cables to the terminals of the transformer, the voltage ratio, turns ratio, ratio deviation, excitation current and phase deviation are displayed.

FEATURES AND BENEFITS

- Fully automated measurement of **turns ratio**, **voltage ratio**, **phase displacement**, and **excitation current.**
- Better transformer excitation due to **higher test voltage** of 250V.
- **Highest accuracy** on the market - up to 0,03%.
- **Ratios** of up to **50'000** can be measured
- **Measurement of phase displacement of transformers** with irregular vector groups like: phase shifting, rectifier, arc-furnace and traction transformers.
- **Automatic Winding Connection Identification** (AWCI) and **automatic vector group detection** supports quick and easy operation.
- **Quick setup** with intuitive guide-through user interface. Test setups and results can be stored and recalled, printed out with the **built-in printer** or used for later analysis.
- **Lightweight, rugged and compact design** allows use in harsh environment (field proof). Closed case is IP65 waterproof, open case is splash proof.
- **Safety connection control feature** proofs test setup before applying regular test voltage to guarantee safety of the personnel and instrument.
- Free external **application software** allows data exchange and **advanced analysis** of results on a computer (USB connection) including automatic **report generation**.
- **Remote tap changer switch** enables convenient testing of **multi-tap transformers.**

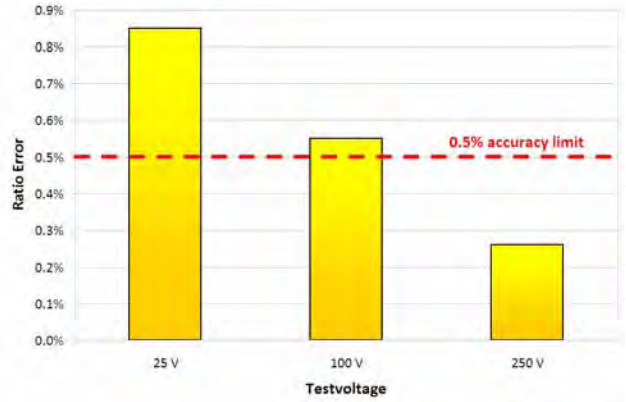
APPLICATIONS

Turns ratio, voltage ratio, phase displacement and excitation current measurements according to ANSI, IEC and Australian standards on:

- Power- and distribution transformers
- Special transformers; like phase shifting-, rectifier-, arc-furnace- and traction- transformers.
- Instrument transformers

INCREASED TEST VOLTAGE UP TO 250V

Working closely together with major transformer manufacturers has revealed that an increased test voltage gives better results when measuring turns and voltage ratio of large power transformers. Comparison measurements on a 350MVA transformer with tertiary winding show significantly improved accuracy with higher test voltage.

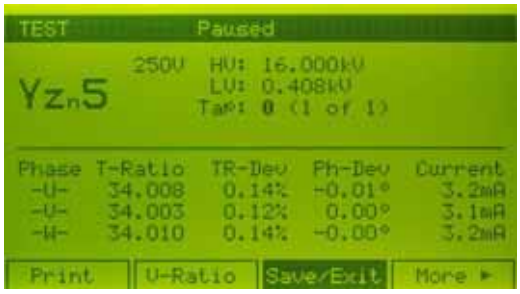


With 250V the measured error is below the 0.5% accuracy limit (red dotted line) specified in the IEC 60076-1 and IEEE C57.12.00-2006-1.

More detailed information and field results can be found in the Tettex Information N° 50 at:
www.haefely.com/30-downloads .

AUTOMATIC WINDING CONNECTION IDENTIFICATION (AWCI)

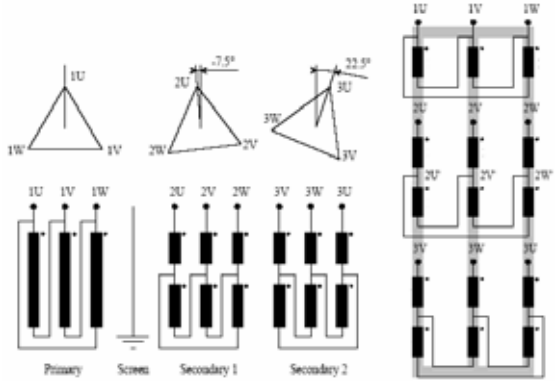
The Automatic Winding Connection Identification (AWCI) aids testing of unknown transformer configurations. The AWCI acts like a nameplate guesser and detects the transformer configuration and vector group of the most common three phase transformers.



To assure the safety of the operator the TTR 2796 first applies a low test voltage to check for reversed connection and then the test voltage is applied. In “Auto Voltage” mode the test voltage is automatically set to the highest voltage possible. Or the user can choose manually between four different test voltages. After starting the test the TTR 2796 delivers results of voltage ratio, turns ratio, ratio deviation, excitation current and phase deviation within half a minute.

MEASURING ARBITRARY PHASE-SHIFTS

Arbitrary phase shifts or those that do not follow the 30° phase steps between the primary and secondary winding are common in special transformers like phase-shifting, rectifier / furnace and traction transformers.



The Figure above shows the schematic of a three- phase transformer with an irregular vector group of Dd11.75 (-7.5°) and Dd0.75 (22.5°).

With the optional Arbitrary Phase-Shift (APS) feature, the TTR 2796 can measure turns and voltage ratio, phase displacement and excitation current of these special-type transformers.

Traditional practice either uses a three phase supply or a single-phase to three phase voltage converter. The TTR 2796 achieves this using the regular single phase supply without additional hardware making it a more versatile and compact solution.

The license enabled APS feature is embedded in the application software. It controls the TTR 2796 through a USB connection from a computer (not included).

APPLICATION SOFTWARE APSW 2796

The included TTR APSW 2796 software offers remote setup and control of the TTR 2796 from a computer through a USB connection. Additionally advanced analysis is available like customized graphs, trending and report generation capabilities. Pre-captured measurements as well as live data can be analyzed, stored or recalled.

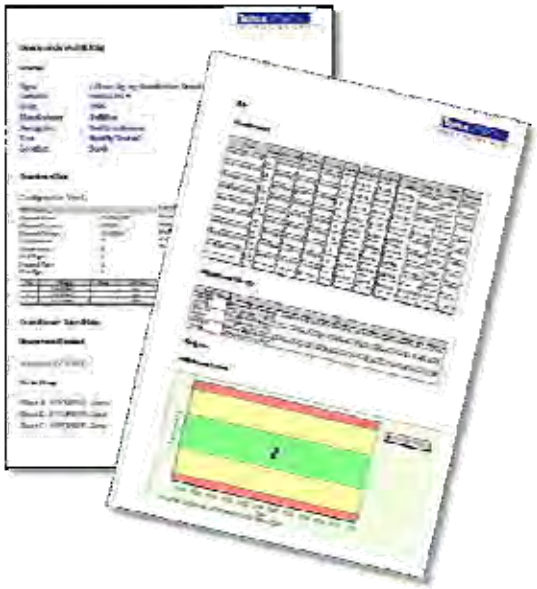
The comprehensive user interface guides the operator through the setup steps by entering nameplate info, transformer vector group, environmental conditions and user comments.

Setting parameters of multi-tapped transformers is greatly simplified by an intuitive setup wizard that enables the user to easily program the taps for primary, secondary or tertiary windings.

Measurements are performed via the MEASURE window. Values of the actual measurement are shown in the top while the history of all measurements taken is recorded in the bottom of the screen. Automated or manual test of taps are controlled and performed by the software.

The software offers additional tools for in depth analysis of the measured transformer data. Flexible graphs allow quick comparison of several measurement series from live or pre-captured data. Additional limit lines show a colourful graphical interpretation of preset margins.

Setups of the TTR 2796 can be stored on, or recalled from the hard-disk or memory-stick. By pre-configuring test setups, the test time during manufacturing or onsite can be greatly reduced. Measurements that are taken onsite and stored inside the TTR 2796 memory can be uploaded at a later moment to a PC via the remote software for more detailed evaluation and analysis of the test results.



REPORTING

Full reports are automatically generated in XML-, HTML- and CSV- format.

The graphs itself are also separately stored in jpg-format to make the easy handling complete.

The XML- and HTML-files can be opened in e.g. Internet Explorer and from there directly printed or copied into a Microsoft Word document.

To further expand the powerful analysis functionality of the APSW2796 the automatic generated CSV-file can be directly opened in Microsoft EXCEL where customer specific data processing and calculations are possible.

Example of XML-report printout

TECHNICAL SPECIFICATIONS

General

Excitation voltage	2.5 V, 25 V, 100 V and 250 V; automatic or manual selectable
Excitation current	max. 1 A
Display	5.2" dot matrix LCD 240x128 module with backlight
Memory	Stores up to 100 complete test results / test setups
Printer	Thermal strip printer, paper width 58mm
Interfaces	Computer: USB 2.0 client (with supplied adapter) Tap changer: 3 pole contact in/out (potential free)
Operating temperature	- 10°C* ... 55°C * - 10°C typical, - 5°C guaranteed
Storage temperature	- 20°C ... 70°C
Humidity	5 .. 95 % r.h. non-condensing
Mains	95 ... 240 V AC, 50/60 Hz, max. 1.3 A
Dimension (L x W x D)	41 cm x 31 cm x 17 cm (16" x 12.2" x 7")
Weight	8.8 kg (19 lbs) excl. cables

Measurement Ranges and Accuracy

	Accuracy (1)		
Ratio	**@ 250 V**	**@ 100 V**	**@ 25 V**
0.8 .. 100	± 0.03%	± 0.05 %	± 0.05 %
101 .. 1000	± 0.05 %	± 0.05 %	± 0.05 %
1501 .. 2000	± 0.05 %	± 0.05 %	± 0.10 %
2001 .. 4000	± 0.05 %	± 0.05 %	± 0.20 %
4001 .. 13000	± 0.15 %	± 0.25 %	n/a
13001 .. 20000	± 0.15 %	n/a	n/a
20001 .. 50000	± 0.60 %	n/a	n/a

Excitation Current	Range	Resolution	Accuracy
	0 ... 1 A	0.1 mA	± 1 mA

Phase Angle	Range	Resolution	Accuracy
	± 180°	0.01°	± 0.05°

(1) At excitation voltage, values valid after a warm-up-time of 30 min

SCOPE OF SUPPLY

TTR 2796 instrument in shell case, cable bag, two 3-phase cable sets (5 m spider and two sets of clamps), two 3-phase extension cable sets (10 m), remote control, data storage and report generation software, USB cable for remote operation, mains cable, manual, calibration certificate.

ACCESSORIES & OPTIONS

- **Software Arbitrary Phase Shift (APS)**

The Arbitrary Phase-Shift (APS) feature allows the TTR 2796 measure turns and voltage ratio, phase displacement and excitation current of special-type transformers with arbitrary phase shifts.
The software runs on an external computer (not included) connected through USB.

- **279x/TAP**

External Tap Test Start Switch 2796TAP is used for convenient remote tap changer testing.

- **279x/10**

Additional two 3-phase extension cables, 10 m.
Used to extend the reach of the basic connection set by another 10 m.
The final length results in total 25 m (10+10+5) with this additional cable set.

Tettex INSTRUMENTS

Tettex Instruments offers a complete portfolio for transformer testing

TTR 2795
Transformer Turns Ratio Meter With 100 V Test Voltage

Onsite testing of turns and voltage ratio, phase displacement and excitation current. Automatic winding connection identification and vector group detection. Remotely controllable via USB.

RVM 5462
Recovery Voltage Meter

Mobile system for non-destructive diagnosis of the state of paper-oil insulation (effect of moisture content and ageing) using the recovery voltage method.

OC60E
Oil Cell Tester

Fully automated digital liquid electrical test set designed to reliably and accurately test the dielectric strength of insulation liquids.

FRA 5310
Frequency Response Analyser

Detection of winding movements and mechanical failures of transformers. Active probing assures reliable and repetitive measurement results. Advanced analysis and touch screen operation.

2291 / 2292
High Current Resistance Meter

DC resistance measurement of highly inductive circuits like transformer windings. High DC current of 50 A allows precise measurement of 0.1 µ Ω to 20 kΩ.

MIDAS 2880
Mobile Insulation Diagnosis & Analysing System

The ideal tool for periodic maintenance and inspection of high voltage insulation losses, dissipation factor (tan δ), power factor and capacitance of power transformers, bushings, motors, generators etc.

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