



2293

Automatic Transformer Winding Analyzer



The 2293 is an automatic winding analyzer, optimized for three phase power and distribution transformer measurements.

It uniquely combines winding resistance measurement, turns ratio measurement, core demagnetisation, transformer type detection and heat run test (cooling curve) in the fastest one instrument solution on the market.

A simple one-time-connect-all system drastically reduces measuring time: once connected all tests can be done in a row without any reconnection.

The built-in simultaneous winding magnetization method (patent pending) guarantees fast and reliable resistance measurements. Stable measurements are reached – even on large power transformers with delta windings on the low voltage side.

A progressive method for measuring transformer turns ratio guarantees results closer to the nominal ratio even in large power transformers with tertiary windings.

In addition, the demagnetisation function eliminates the magnetic remanence in the core after the application of DC voltage, impulse tests or flash over. Magnetic remanence can cause faulty measurements, high inrush currents and incorrect operation of protective relays.

Personnel safety is guaranteed by an emergency button as well as a state-of-the-art active discharge circuit and a “Caution” indicator that continue to operate even without line power.

FEATURES AND BENEFITS

- Multipurpose winding analyzer: **transformer winding resistance, turns ratio, demagnetisation, type detection and heat run test** (cooling curve) in one instrument.
- **Setup made easy** – simple one-time-connection system: once connected will test all phases and windings.
- **Easy operation** on touch screen interface with **full graphical test visualization**.
- Unique **simultaneous winding magnetisation** method for winding resistance measurements, equivalent to traditional equipment with up to 100 A test current.
- Advanced procedure **for turns ratio and phase displacement** measurement.
- **Demagnetisation function** - transformer is returned to a demagnetized status after measurement.
- **Tap changer control** signal.
- **Data transfer** over USB memory-stick or LAN

APPLICATIONS

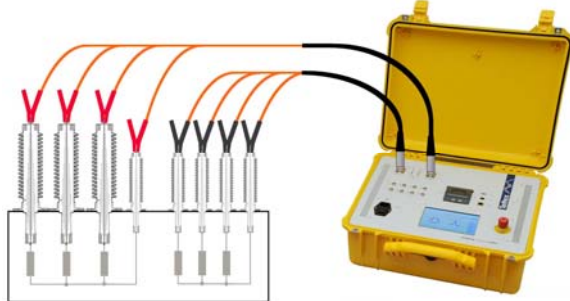
The 2293 is a valuable tool for factory test, acceptance test and regular maintenance on:

- Power transformers
- Distribution transformers
- All type of HV windings



COMPLETE AUTOMATIC TEST PROCEDURE

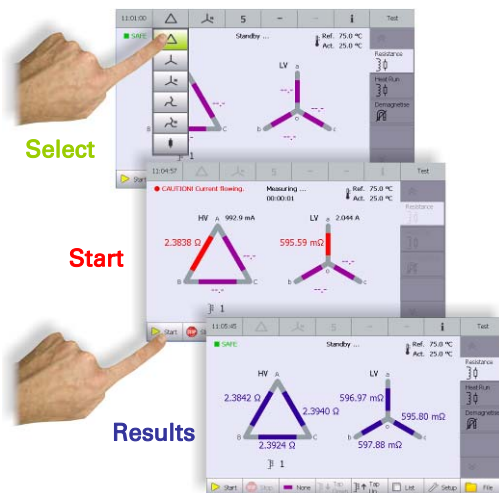
The 2293 performs turns ratio, resistance measurements and demagnetization on all windings without any reconnections.



Once the cable set is connected to the test object, the instrument will automatically measure the turns ratio of all taps. Then - without reconnection - the winding resistance can be measured. Finally the demagnetization function will put the transformer in a demagnetized state. A complete transformer can be tested by a single person in a fraction of time compared to traditional instruments.

WINDING RESISTANCE

The Simultaneous Winding Magnetisation method together with the integrated DC power-supply guarantees fast and reliable winding resistance measurements. The 7" touch screen full graphical interface guides the operator through the single test procedures.



Select the test object by touching the appropriate icon and press start – the unit then visualizes each test cycle and displays the results graphically or in list format.

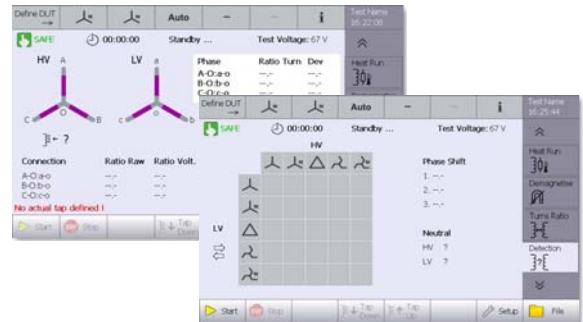
DATA HANDLING AND TEST REPORTS

The 2293 allows easy data handling. Results can be saved on a USB memory stick or a simple test report can be printed with the built-in thermal printer. Remote control is also supported through the Ethernet interface.



URNS RATIO

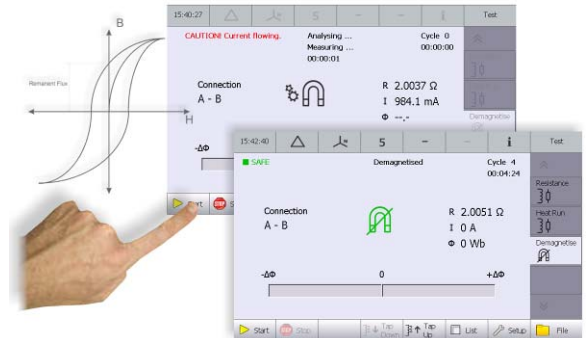
The AC power-supply integrated in the 2293 allows for full-automatic measurement of turns and voltage ratio, ratio deviation, phase displacement and excitation current of transformers.



The type detection part of the software works as a nameplate guesser. It helps the user to determine the correct transformer configuration by showing the possible types and eliminating the wrong vector-groups during the automatic detection process.

DEMAGNETISATION FUNCTION

Applying a DC current to an inductive test object, like a power transformer, magnetises the core. The resulting magnetic remanence will have an adverse effect on other measurements.



The 2293 includes a fully automatic demagnetisation feature which eliminates the magnetic remanence. Select the test object by touching the appropriate icon and press start – the unit visualizes the whole demagnetisation cycle and performs the correct core demagnetisation.

This feature can be used before other tests such as frequency response analysis (FRA), transformer turns ratio measurement (TTR) which are adversely affected by remanence effects.

HEAT RUN TEST

The 2293, which can measure HV and LV side resistances simultaneously and accurately, is the perfect tool for resistance measurements during a heat run test. The instrument provides efficient and accurate acquisition of the required data points to allow drawing the necessary cooling curve. Results can be easily exported.



TECHNICAL SPECIFICATIONS

Resistance Measurement

Max. Measuring Current DC	32 A (user selectable)
Max. Charging Voltage DC	100 V
Range	0.1 $\mu\Omega$... 300 k Ω
Resistance	Accuracy ⁽¹⁾
0.1 $\mu\Omega$... 300 $\mu\Omega$	0.1% \pm 0.5 $\mu\Omega$
300.1 $\mu\Omega$... 30 k Ω	0.1%
30.01 k Ω ... 300 k Ω	1%

Ratio measurement

Max. Supply Current AC	1 A _{Peak} / 700 mA _{RMS}
Max. Meas. Voltage AC	95 V _{Peak} / 67 V _{RMS}
Range	1.0 ... 100'000
Ratio	Accuracy ⁽¹⁾
1.0 ... 100	0.05%
100 ... 2'000	0.1%
2'000 ... 20'000	1%
20'000 ... 100'000	5%
Phase (Ratio measurement)	Typical Accuracy ⁽²⁾
1.0 ... 500	\pm 0.25°
500 ... 10'000	\pm 1.00°
Phase (Clock number detection)	Accuracy ⁽²⁾
1.0 ... 500	\pm 0.05°

Mains Power Supply

Voltage	90 VAC ... 264 VAC
Maximum Power	1000 W
Frequency	47 Hz ... 63 Hz

Environmental

Operating temperature	-10°C ... +60°C
Storage temperature	-20°C ... +70°C
Humidity	5% ... 95% r.h., non-condensing
Vibration	MIL-STD-810G Table 514.6C-II. Category Common carrier

Mechanical

Dimensions (W x D x H)	521 mm x 425 mm x 216 mm
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General

8 measuring channels, 6 built-in temperature channels, 7" graphical touch screen interface, tap changer control signal, built-in printer, USB and LAN connections for data exchange

⁽¹⁾ at temperature 0 ... +50°C at highest available current ⁽²⁾ at 0 ... +50°C at highest available voltage ⁽³⁾ Unit only without measuring cables

SCOPE OF SUPPLY



OPTIONS

Hardware

- Temperature measuring probe "oil"
- Temperature measuring probe "surface"
- Remote tap changer controller
- Extension cable +10m (for HV or LV side)
- 2293 19" rack version

Software

- Turns Ratio Measurement incl. Transformer Type Detection

a brand of

HAEFELY



Haefely is a subsidiary
of Hubbell Incorporated.





Tettex Instruments offers a complete portfolio for transformer testing



TTR 2795 / TTR 2796

Transformer Turns Ratio Meter
with 100/250 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 aging) 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.



MIDAS 2880

Mobile Insulation Diagnosis & Analysing System

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



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