



# 2293

## Winding resistance meter with one-time-connection system



The Tettex 2293 is the result of extensive research and years of experience testing transformers. **It incorporates a fast and highly advanced procedure to measure winding resistance.** A simple one-time-connection system together with the simultaneous winding magnetization method drastically reduces measuring time.

The simultaneous winding magnetization (SWM) method guarantees fast and reliable measurements even on large power transformers with delta windings on the low voltage side, where stable measurements can be seldom reached using traditional winding resistance measurement instruments.

In addition, the new demagnetization function eliminates the magnetic remanence in the core after the application of a DC voltage. This feature can be used before performing other tests such as frequency response analysis (FRA), transformer turns ratio measurement (TTR) or recovery voltage measurement (RVM) which are adversely affected by remanence effects.

The transformer is discharged by a state-of-the-art discharge circuit in a fraction of the time taken by other instruments. The discharging function and the "Caution" indicator continue to operate even when line power is lost.

### FEATURES AND BENEFITS

- Resistance measurement made easy – simple one-time-connection system: **Once connected will test all phases and windings**
- Large 7" touch screen interface with **full graphical test visualization**
- Unique **simultaneous winding magnetization** method (SWM), equivalent to traditional equipment with up to 100 A test current
- **Tap changer control** signal
- **Heat run** function and **6 temperature measurement** channels with automatic resistance value correction
- **Data transfer** over USB memory-stick or direct to PC

### APPLICATIONS

Resistance measurement and demagnetization function for all types of highly inductive test objects.

- Power transformers
- Distribution transformers
- Generators and motors
- Instrument transformers

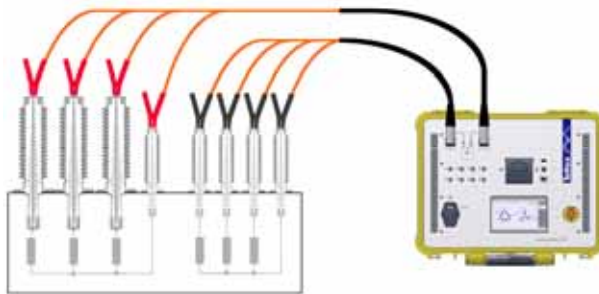
The 2293 is a valuable tool for factory test, acceptance test and regular maintenance.

*A test solution optimized for **easy and fast winding resistance measurement** on power and distribution transformers as well as motors and generators.*



## COMPLETE AUTOMATIC TEST PROCEDURE

The 2293 performs resistance measurements on all windings without any reconnection. The test procedure is simple and efficient. One end of the measurement cable set is connected to each bushing of the transformer using the special Kelvin clamp, while the other end is connected to the 2293.

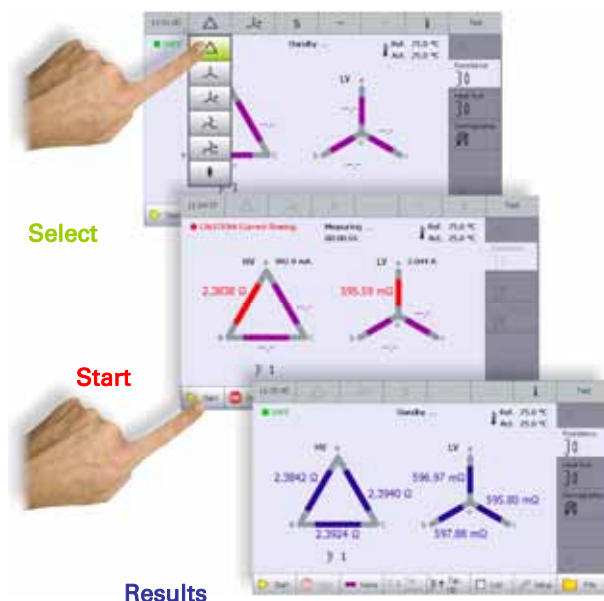


Once the cable set is connected to the test object, the instrument will automatically measure selected resistances of both windings and all phases. In addition, the motorized tap changer can be controlled to perform fully automated measurements on all taps. A complete transformer can be tested by a single person in a fraction of the time compared to traditional instruments.

## GRAPHICAL INTERFACE

The 7" touch screen full graphical interface guides the operator through the test procedure.

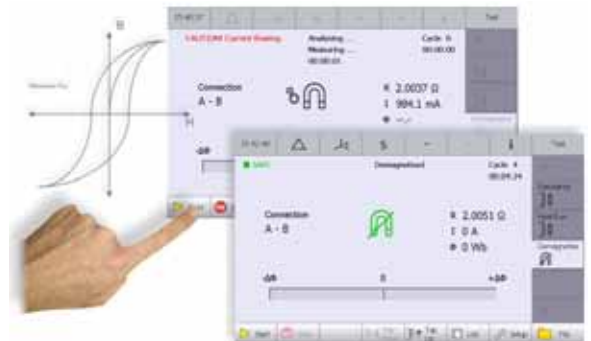
Select the test object by touching the appropriate icon and press start – The unit then visualizes each test cycle and displays the results graphically or in list format.



## DEMAGNETIZATION FUNCTION

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

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



## 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 are available as CSV and can be easily exported.

## DATA HANDLING AND TEST REPORTS

The 2293 allows easy data handling. Results can be saved on a USB memory stick or transferred to any computer. In addition the instrument can be connected via Ethernet to a LAN. It also includes a thermal printer for immediate report printing.



Results can also be saved in the instrument's memory while continuing testing, to be downloaded later after having returned to the office.



## TECHNICAL SPECIFICATIONS

### Resistance Measurement

Max. Measuring Current	32 A (user selectable)
Max. Charging Voltage	100 V
Range	0.1 $\mu\Omega$ ... 300 k $\Omega$

Resistance	Accuracy <sup>(1)</sup>
0.1 $\mu\Omega$ ... 300 $\mu\Omega$	0.1% $\pm$ 0.5 $\mu\Omega$
300.1 $\mu\Omega$ ... 30 k $\Omega$	0.1%
30.01 k $\Omega$ ... 300 k $\Omega$	1%

### Mains Power Supply

Voltage	90 VAC ... 264 VAC
Maximum Power	1 kW
Frequency	47 Hz ... 63 Hz

### Environmental

Operating temperature	-10°C ... +60°C
Storage temperature	-20°C ... +70°C
Humidity	5% ... 90% r.h. non-condensing

### Mechanical

Dimensions (W x D x H)	521 mm x 425 mm x 216 mm
Weight <sup>(2)</sup>	17.8 kg

<sup>(2)</sup> Measuring cables not included

<sup>(1)</sup> at temperature 0 ... 50°C at highest available current

### Functions

- 8 measuring channels (2 x 3 phases and 2 x 1 neutral)
- 6 temperature channels with automatic resistance correction
- Advanced 7" graphical touch screen interface
- High efficient DC supply with SWM (simultaneous winding magnetization)
- SWM mode and Classic mode (for traditional resistance measurement method)
- Turbo discharge circuit
- Automated demagnetizing function with flux indicator
- Automatic heat run function
- Tap changer control signal to automate test procedures on transformers with motorized tap changer
- Internal memory >10'000 measurements
- USB and LAN connections. Data can be saved on a memory stick or directly transferred to PC
- Charges any inductive load and works with any resistive or inductive test object
- Heavy duty protection circuit
- Safety circuit ensures discharge even when line power is lost
- Caution indicator
- Built-in printer

## SCOPE OF SUPPLY

Measuring unit, cable set (10 m), carrying bag, test certificate, user manual

### Options

2293/TEMP1	Temperature probe for liquids
2293/TEMP2	Magnetic temperature probe for metallic test objects
2293/TAP	Tap changer connection cable
2293/10HV	10 m extension cable for HV winding (Red)
2293/10LV	10 m extension cable for LV winding (Black)



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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.

**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.



**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.

**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.



**OC60E**  
Oil Cell Tester

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

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