TENSORMETER

a new dimension of resistance measurements

Tensormeter RTM1 Product Overview

- Tensormeter device front panel with 8 signal connectors, reference and trigger connector

- Simultaneously determine Sheet & Hall resistance at highest precision and extremely low noise
- Measure irregularly shaped samples without need for lithographic patterning
- Replace several other devices (Lock-in Amplifier, Source-Measure-Unit, Digital Multimeter, Analog Matrix Switch)
- Save measuring time, achieve higher throughput

Materials Research and Characterization

- High precision to study small effects
- Flexibility for custom measurement sequences
- Controlled sourcing
- 2D materials
- Magnetic materials
- Transverse resistance

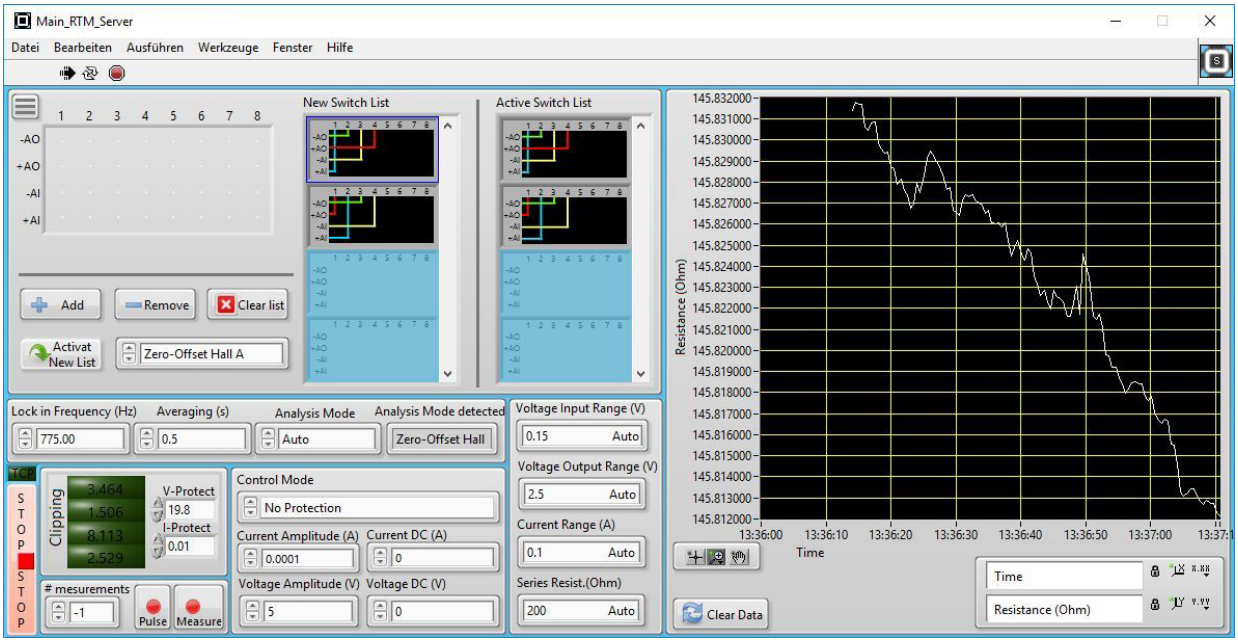
Improved Wafer and Device Testing

- High stability
- Faster binning
- Tighter specs
- DC and AC
- Fewer contacts
- Integrated calibration

Unique Measurements

- Irregular sample shapes
- van-der-Pauw
- Zero-offset Hall
- Dummy compensation
- Device differential
- Pulse and measure
- Custom protocols
- Up to 8 contacts

Interface



Graphical user interface of the server background program, which relays communications between the Tensormeter and the user.

Electrical Specifications

Sensing precision:	<0.1 ppm
Continuous dynamic range:	>8 digits
Symmetrical output:	DC – 20 kHz, ±20 V, ±100 mA
Output noise floor:	< -140 dBFS
Pulse and arbitrary function output with 10 µs resolution	
Input demodulation at multiple frequencies up to 20 kHz	
Differential input noise:	3 nV/√Hz 500 fA /√Hz
Differential input bias current:	1 nA
Optional input transformer for sub-nV/√Hz measuments on low-R DUTs	
Gain change with temperature:	100 ppm/K <1 ppm/K (ratiometric)
DC offset voltage change with temperature:	1 µV/K
Fully controllable integrated 8x4 switching matrix	
Arbitrary function reference input/output:	single-ended ±10 V
Trigger input/output:	single-ended 5V TTL

Software and Communication Protocol Specifications

TCP-based user connection independent of platform and software
Client communication examples for LabView and Python (more on request)
Tensormeter RTM1 connects via USB2.0 to a Windows-PC Software and drivers are provided as Windows Executable Installer
For target OS other than Windows, a small relay computer can be provided
All functions can be controlled from the GUI or via TCP

Hardware, Power and Environmental Specifications

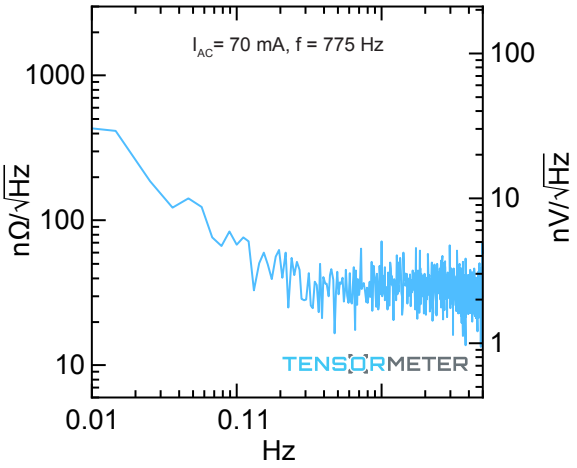
19” rack-mountable device, 3 height units, 25 cm depth
Power demand < 30 W, PSU included, user-specified AC connector
Operation range: 0 – 70 °C, non-condensing humidity
Free convection cooling (can be closed at expense of warmup time)
All front connectors are BNC, 50 Ω type
USB Type B communication connector
Channel and power LED indicators are user-dimmable or can be switched off

Typical Measurement Examples

- Low noise AC & DC 4-wire measurements in standard geometries (Kelvin, Hall layouts)
- Presets for van-der-Pauw switched connection 4-wire measurements
- New Zero-Offset Hall 4-wire preset grants independent longitudinal and transverse resistance
- Ultra-low noise and high stability Hall measurements outclassing other equipment
- Sub-ppm relative resistance change investigations
- Eliminate sample & device drifts with ratiometric resistance measurements
- High drive harmonic distortion measurements, Pulse & Measure routines, Custom presets

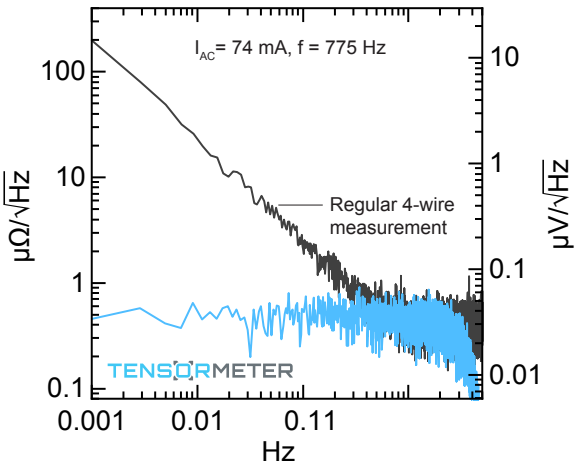
Low Resistive Sensors and Specimen

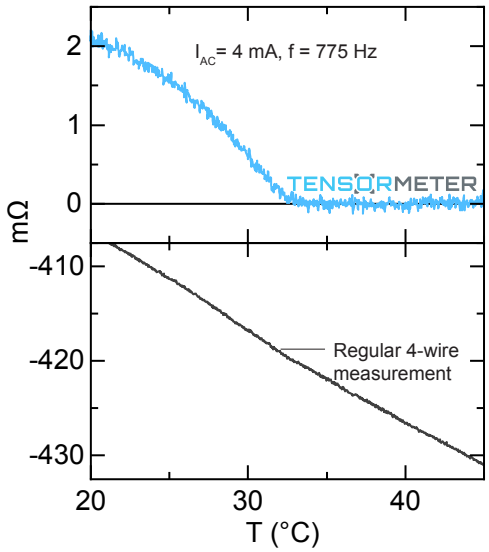
Differential Input Noise Spectrum of a resistive sensor. Ultra-low wideband & 1/f noise AC measurements allow accurate sensor characterization and operation.



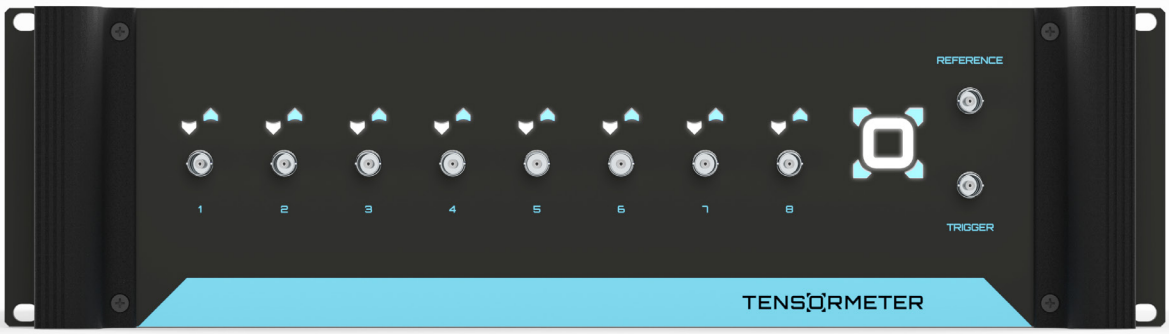
Zero-Offset Hall: Eliminate Drift and Parasitics

Differential Input Noise Spectrum of a Hall measurement on a thin film sample. The Zero-Offset Hall preset of the RTM1 eliminates thermal drift and allows long integration and orders of magnitude improved sensitivity compared to regular 4-wire Hall measurements.





Loss of magnetization during warmup of an antiferromagnetic sample monitored in Hall Resistance. The Zero-Offset Hall preset of the RTM1 (top) clearly shows the loss of signal. On the contrary, parasitic signal contributions overshadow the useful magnetization signal in a regular 4-wire Hall measurement of the same sample (bottom).



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tensometer@hzdri.de

HZDR Innovation GmbH
Bautzner Landstraße 400
01328 Dresden, Germany

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