# Measurements International

*Metrology is Our Science, Accuracy is Our Business™*

# 6000B AUTOMATIC HIGH RESISTANCE RATIO BRIDGE

## Featuring

- True Ratio Self Calibration
- Range 10 kΩ to 1 TΩ
- Built In 4 Channel Matrix Scanner
- Accuracy < $20 \times 10^{-9}$ for 10 kΩ Ratios
- Accuracy < $0.5 \times 10^{-6}$ for 100 MΩ
- Linearity < $5 \times 10^{-9}$
- Full System Solutions and Full System Integration Using MI 1000B 100 V Source, 6000B Software and 4200 Series of Matrix Scanners

## Overview

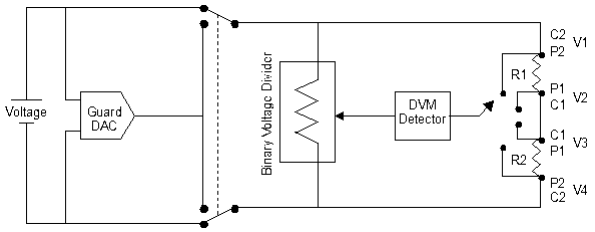
The model 6000B is a fully automated bridge using the Cutkosky Divider principle. This technology offers new solutions for measuring high value resistors more accurately and at lower currents. The Cutkosky or Binary Voltage Divider Technology, solves all errors normally associated with a direct current comparator while offering significantly improved uncertainties. An internal guard circuit is used to guard the measuring circuit. This guard may also be used to drive the measuring leads, a guarded detector and resistor enclosures to increase the effective insulation resistance and improve overall performance.

The system requires a stable voltage source (Model 1000B) and a DVM detector (Fluke 8508A, Agilent 3458A, or Keithley 2000). Optimum performance is achieved using the Agilent 3458A as a guarded detector.

The model 6000B has a four-channel matrix scanner with inputs labeled R1, R2, R3 and R4. The number of inputs can be expanded to 40 when the 6000B is used in conjunction with 4200 Series Low Thermal Four Terminal Matrix Scanners.

Calibration of the 6000B is performed easily and automatically. Calibration data is stored to file for history analysis. New calibration data is compared to the last calibration data for tracking drift of the BVD.

The principle of the 6000B Automated High Resistance Ratio Bridge is based on the Binary Voltage Divider (BVD). The reference to the BVD is supplied from a stable voltage reference, Model 1000B. The Model 1000B is a low drift, stable, low noise, programmable DC reference. The DC reference is connected to the rear of the 6000B Source input terminals. The DVM detector with an input impedance of 10 GΩ or higher is used to measure the difference between the output of the BVD and the test voltage. An isolated guard circuit is provided to guard the BVD and the DVM detector when performing measurements. The guard voltage can also be used to drive the cans and/or shields of resistors under test to reduce leakage problems between the case and the resistor.



**System Software and Applications**

The Measurements International's 6000 SW controls all of the above automatically. The software features report generation, historical analysis, while tracking and correcting for resistor drift rates. All measurement data is displayed in graph form as the measurement progresses. All uncertainties are calculated at 2 sigma.

For SR104 measurements, the 6000 SW allows users to measure the temperature of the SR104 at time of measurement using an external thermistor. The thermistor is placed in the well of the SR104 and is measured against a 1 MΩ reference resistor. The 1 MΩ standard resistor is used to keep the current in the thermistor as low as possible as not to cause self heating. The software can then apply a correction for 23 °C or 25 °C.

The 6000B can also be used in conjunction with Measurements International's 4200 Series Matrix Scanner and 4220-1 interface adapter for calibration of SR1010 series of Hamon resistance boxes.

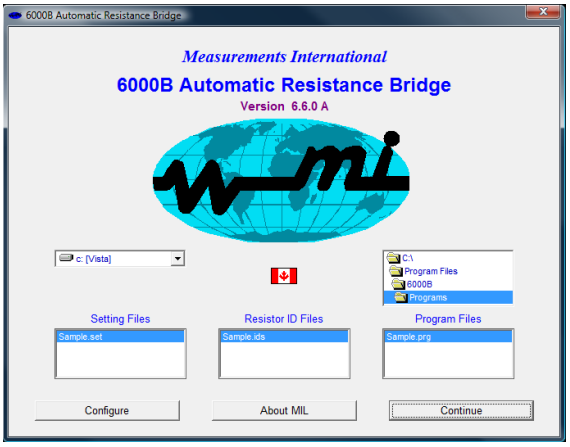
Combined with the Measurements International model 9300A air bath, alpha and beta calculations can be performed automatically on resistors under test. All data can be exported directly to Excel for various test patterns or mainframe applications. External atmospheric pressure, humidity and temperature indicators are optional and the entire system can be enclosed in a 4 or 6 ft. rack. Resistor baths (oil or air), instrument controllers, printers, system software, IEEE interface, installation and training are all available for complete system packages.

**6000 SW – Windows Operating Software**

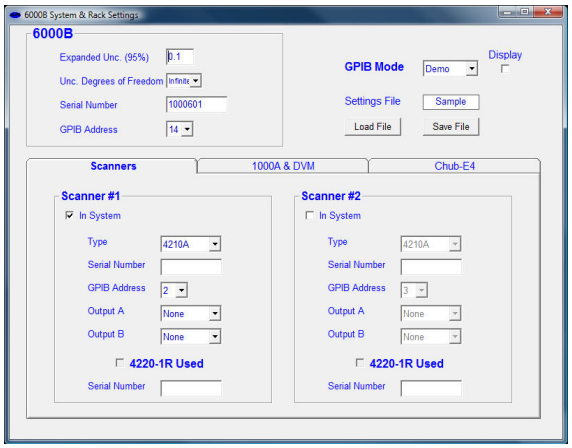
Measurements International's 6000 SW was developed by metrologists for metrologists. The software features real time uncertainty analysis, graphing, history logging and graphing, data storage with export to Excel and regression analysis. The 6000 SW provides ultimate programmability and control for all your high value resistor measurements now and in the future.

# 6000B AUTOMATIC HIGH RESISTANCE RATIO BRIDGE

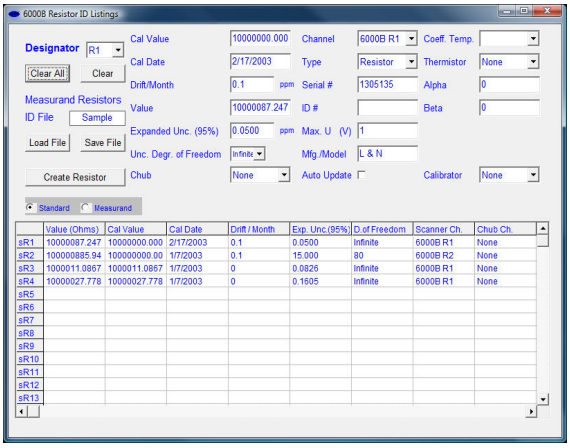
## 6000 SW – Windows Operating Software



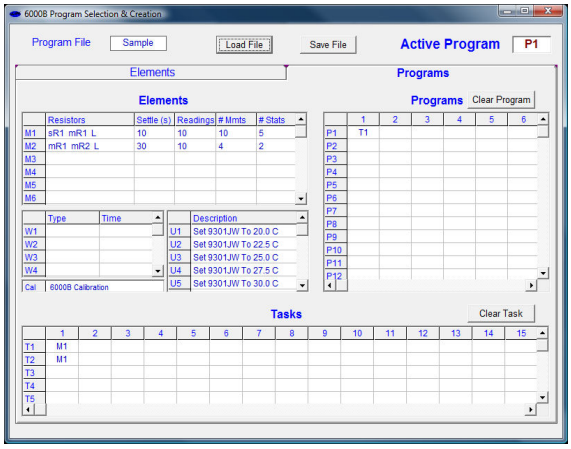

Intro Screen



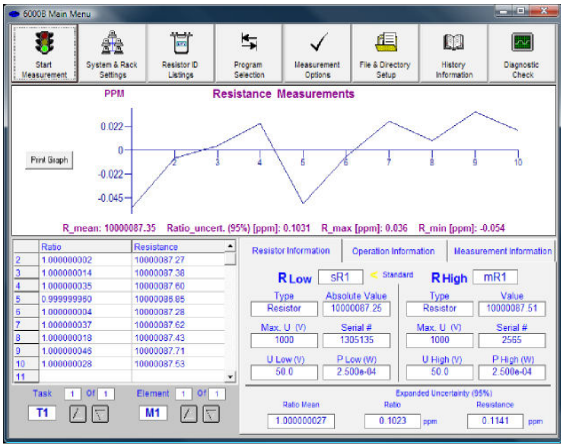

System & Rack Settings



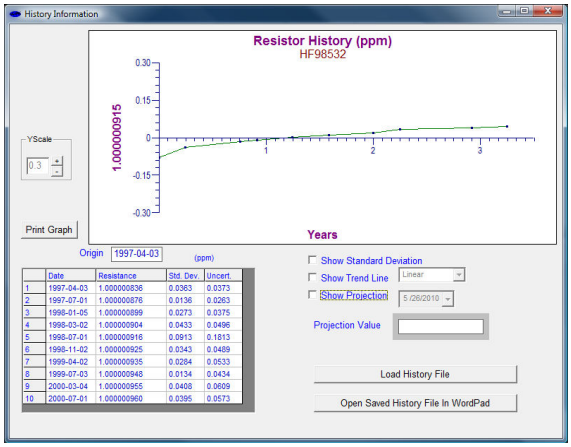

Resistor ID Screen




Program Selection




Main Menu




Resistor History

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# 6000B AUTOMATIC HIGH RESISTANCE RATIO BRIDGE

## Specifications: Rev 6

| Resistor Range | Accuracy (95 %) (2 σ) Ratio 0.1 through 10 | Applied Voltage |
|---|---|---|
| 10 kΩ to 10 kΩ | < $0.02 \times 10^{-6}$ | 10 V to 20 V |
| 10 kΩ to 100 kΩ | < $0.1 \times 10^{-6}$ | 10 V to 50 V |
| 100 kΩ to 1 MΩ | < $0.1 \times 10^{-6}$ | 10 V to 110 V |
| 1 MΩ to 10 MΩ | < $0.1 \times 10^{-6}$ | 10 V to 110 V |
| 10 MΩ to 100 MΩ | < $0.5 \times 10^{-6}$ | 10 V to 110 V |
| 100 MΩ to 1 GΩ | < $5 \times 10^{-6}$ | 10 V to 110 V |
| *Measurements above 1 GΩ Require Special Resistor Configurations* | | |
| 10 GΩ | < $20 \times 10^{-6}$ | 10 V to 110 V |
| 100 GΩ | < $200 \times 10^{-6}$ | 10 V to 110 V |
| 1 TΩ | < $500 \times 10^{-6}$ | 10 V to 110 V |
| | | |
| Ratio 100:1 | < $2 \times 10^{-6}$ | 10 V to 110 V |
| Ratio 1000:1 | < $20 \times 10^{-6}$ | 10 V to 110 V |

*Note: Specifications are achievable with the resistors in MIL 9400A Oil Bath at 25 °C ± 20 m°C for 10 kΩ & 100 kΩ measurements and MIL 9300A Air Bath at 23 °C ± 10 m°C for 1 MΩ to 1 TΩ measurements.*

| | |
|---|---|
| **Linearity** | 0.005 ppm |
| **Short Term Drift (2 Hours) Stabilization** | < 0.2 ppm for 8 hours |
| **Operating Environment** | 18 °C to 34 °C, 10 % to 80 % |
| **Warranty** | 1 Year Parts & Labour |

**Accessories:**

1000B - Programmable Voltage Source - 110 V
4200 - Series Scanners - 10, 16, and 20 Channel
9400 - Standard Resistor Oil Bath
9300A - Standard Resistor Air Bath/GPIB

**How to Order:**

Model: 6000B - Automatic
High Resistance Ratio Bridge

**Dimensions (L × W × H):**
378 × 439 × 267 (mm)

**Weight:**
15 kg max

**Shipping Weight:**
20 kg

**Mains Power:**
100 $V_{ac}$/120 $V_{ac}$/220 $V_{ac}$/240 $V_{ac}$
50/60 Hz

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