Discover the "Blue Box" Difference

Electrical and Temperature Metrology Products Guide

Measurements International
Metrology is Our Science, Accuracy is Our Business™

Metrology is our Science, Accuracy is Our Business™

Measurements International (MI) is the world's premier metrology company. MI provides innovative Standards Technology for both the Metrology and AC Power Industries. For the Metrology industry MI designs, develops, and manufactures electrical and temperature metrology instruments using AccuBridge™ technology. For the AC power industry MI designs, develops and manufactures high-voltage transformer test instruments, capacitance/Inductance Bridges, voltage dividers, wattmeters and current transformers using the AccuLoss™ and two-stage-compensated current transformers. All instruments are manufactured with the highest quality in support of our customer's organization.

The Quantized Hall Resistance Standard is internationally recognized as the representation of the ohm and is the most stable resistance standard known. Many developing countries and industries are finding a need to provide highly accurate, traceable reference standards in support of their "hi-tech" environments. The 6800 system has been developed to meet the needs of National Laboratories and Primary Industrial Laboratories around the world.

Don't be misled by other manufacturers claims. Ask for references and consult any NMI in regards to modern resistance measurement systems.

AccuBridge™
Self Calibrating Primary Resistance Bridge

- Featuring true ratio self calibration
- Self Calibrating Master and Slave Current Source
- Self Calibrating Nanovolt Detector
- Binary wound current comparator
- Range 0.01Ω to 100KΩ
- Quantum Hall applications including Vxx (3 terminal Contact Resistance, Dissipation) and Vxy Measurements
- 7" touch screen and USB
- Accuracy < 20×10^{-9}
- Linearity < 5×10^{-9}

6800
Automated QHR "Turn Key" Intrinsic Resistance Standard with AccuBridge™ Measurement Technology

- Transportable & affordable
- Manual or IEEE488 controlled
- Accuracy to 10×10^{-9}
- Modular turn key system
- Transfer to 1Ω and 10KΩ Resistance Standard
- Built in controller

MI CALIBRATION SERVICES

DC Measurements
- ISO/IEC 17025 accredited calibration service
- Direct traceability to NRC, NIST, NPL UK and METAS
- Lowest uncertainty levels for resistance calibration from 1μΩ to 100TΩ
- Four different calibration methods available depending on the standard
- Fast and reliable turnaround time
- Email us at micallab@mintl.com with your inquiry

AC Calibration Service
- Power and Energy up to 240V, 5A
- High Voltage Capacitors
- AC Voltages to 100kV
- AC Currents to 2000A
- High Voltage Divider Calibration
- Current Transformer Calibration
- PD calibration to 250 kV

MI is fully Accredited in both AC & DC Measurement Disciplines
www.micallab.com

6242/300 or 6010/300
Resistance System

- 10uA to 300A
- Consisting of 6242/300 or 6010/300 self calibrating system
- Resistance range 0.1uΩ to 100MΩ with 6242B
- Bridge accuracy's as low as 50 x 10^{-9} with 6242B
- Resistance range 0.1uΩ to 100kΩ with 6010D
- Bridge accuracy's as low as 20 x 10^{-9} with 6010D
- Linearity < 5 x 10^{-9}
- Optional 4310 Resistance Standard
- Optional 4200 Series of Scanner
- Complete turnkey system

6242/5000 or 6010/5000
Resistance System

- 10uA to 5000A, (custom systems to 20 000 Amps and beyond available!)
- Consisting of 6242or 6010 self calibrating resistance Bridge
- Resistance range 0.1uΩ to 100MΩ with 6242B
- Bridge accuracy's to < 50 x 10^{-9} with 6242B
- Resistance range 0.1uΩ to 100kΩ with 6010D
- Bridge accuracy's to < 20 x 10^{-9} with 6010D
- Linearity < 5 x 10^{-9}
- Optional 4310 Resistance Standard
- Optional 4200 Series of Scanner
- Complete turn key system

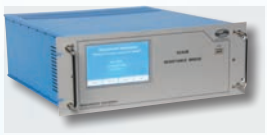
The MI series of 6010 Bridges are used in nearly every NMI around the world as well as the US AirForce, US Army, US Navy Primary and Lockheed's Laboratories for their superior speed and low uncertainties.

RESISTANCE RATIO BRIDGES

6010D
Automated Primary Resistance/Thermometry Bridge

- Featuring true ratio self calibration
- Range 0.001Ω to 100KΩ
- 7" touch screen and USB
- Accuracy < 40 x 10^{-9} for 1:1 ratios
- Accuracy < 40 x 10^{-9} for 10:1 ratios
- Linearity < 5 x 10^{-9}
- Binary wound current comparator
- Manual and automatic operation
- Full system solutions and full system integration with 4200 series of Matrix Scanners and 6011 Range Extenders

6242B
Automated Secondary Resistance/Temperature Bridge



- Featuring true ratio self calibration
- Range 0.001Ω to 100KΩ
- 7" touch screen and USB
- Accuracy < 10 x 10^{-8} for 1:1 ratios
  < 10 x 10^{-8} for 10:1 ratios
  up to 10KΩ
  < 7 x 10^{-6} at 100MΩ
- Linearity < 5 x 10^{-9}
- Binary wound current comparator
- Manual and Automatic Operation
- Full system solutions and full system integration with 4200 series of Matrix Scanners and 6011 Range Extenders

6000B
Automated Primary High Resistance Bridge

- Featuring true ratio self calibration
- Range 10kΩ to 1TΩ
- Built in 4 channel matrix scanner
- Accuracy < 20 x 10^{-9} for 10kΩ ratios
- Accuracy < 0.5 x 10^{-6} for 100MΩ
- Linearity < 5 x 10^{-9}
- Full system solutions and full system integration using MI 1000B 110V Source, 6000B software and 4200 series of Matrix Scanners

6600A
Dual Source Resistance Bridge

- Based on NMI Design
- Resistance Range: 100kΩ to 1PΩ
- More Accurate then Teraohmmeters
- Logging, Graphing and Measurement Analysis
- Automatic Operation
- Bridge Measurement Mode
- Direct Measurement Mode

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THERMOMETRY PRODUCTS

6010T
Automated Thermometry Bridge - 14:1 Ratio

- 0.01Ω to 10kΩ range
- Front or rear panel inputs
- Accuracy < 50 x 10^{-9}
- Linearity < 5 x 10^{-9}
- IEEE488 and manual operation
- AccuTcal™ Software for calibrating PRT's

6015T
Automated Thermometry Bridge - 1.5:1 Ratio

- Self Calibrating Ratio Bridge
- 0.1Ω to 100kΩ range
- Front or rear panel inputs
- Accuracy < 20 x 10^{-9}
- Linearity < 5 x 10^{-9}
- IEEE488 and manual operation
- AccuTcal™ Software for calibrating PRT's

6242T
Automatic Temperature Secondary Bridge - 13:1 Ratio

- 0.01Ω to 100kΩ range
- Front panel 6 channel scanner
- Keep Warm Currents
- Accuracy < 10 x 10^{-8}
- Linearity < 5 x 10^{-9}
- IEEE488 and manual operation
- AccuTcal™ Software for calibrating PRT's

MI9060
Precision Thermometer

- Accuracy +/- 0.01°C
- Resolution 0.0001°C
- Dual Channels
- Data Storage into USB flash disk
- Wireless data transfer to PC

SCANNERS

4210A
10 Channel Four Terminal Matrix Scanner
Tellurium Copper Terminals

- 10 four terminal tellurium copper inputs
- 2 four terminal tellurium copper outputs
- Sealed relays
- 4A carrying current
- 250 Volts
- Error contribution < 20 nV
- Insulation resistance 10^{14} Ω
- Front panel or IEEE operation

4210B
10 Channel Four Terminal Matrix Scanner
4 Conductor Teflon Cable

- 10 four wire teflon cable inputs
- 2 four wire teflon cable outputs
- Sealed relays
- 4A carrying current
- 250 Volts
- Error contribution < 20 nV
- Insulation resistance 10^{14} Ω
- Front panel or IEEE operation

4216A
16 Channel Four Terminal Matrix Scanner
Tellurium Copper Terminals

- 16 four terminal tellurium copper inputs
- 2 four terminal tellurium copper outputs
- Sealed relays
- 4A carrying current
- 250 Volts
- Error contribution < 20 nV
- Insulation resistance 10^{14} Ω
- Front panel or IEEE operation

4216B
16 Channel Four Terminal Matrix Scanner
4 Conductor Teflon Cable

- 16 four wire Teflon cable inputs
- 2 four wire Teflon Cable outputs
- Sealed relays
- 4A carrying current
- 250 Volts
- Error contribution < 20 nV
- Insulation resistance 10^{14} Ω
- Front panel or IEEE operation

4220A
20 Channel Four Terminal Matrix Scanner
Tellurium Copper Terminals

- 20 four terminal tellurium copper inputs
- 2 four terminal tellurium copper outputs
- Sealed relays
- 4A carrying current
- 250 Volts
- Error contribution < 20 nV
- Insulation resistance 10^{14} Ω
- Front panel or IEEE operation

4220B
20 Channel Four Terminal Matrix Scanner
4 Conductor Teflon Cable

- 20 four wire Teflon cable inputs
- 2 four wire Teflon Cable outputs
- Sealed relays
- 4A carrying current
- 250 Volts
- Error contribution < 20 nV
- Insulation resistance 10^{14} Ω
- Front panel or IEEE operation

DC SOURCES FOR USE AS STAND ALONE OR WITH 6000B HIGH RESISTANCE BRIDGE, 8000A POTENTIOMETER

1000A
100V Reference Standard Manual Selection

- 7 selectable voltage ranges of **1, 2, 5, 10, 20, 50 & 100 volt**
- Stability: < 1 PPM - 8 hours
- 6000B or stand alone

1000B
Automated 110V Reference Standard

- DC output from 0 to 110V
- Stability: < 0.1 PPM - 24 hours
- 6000B, 8000A or stand alone

HIGHER CURRENT SYSTEMS ARE AVAILABLE!

RANGE EXTENDERS AND POWER SUPPLIES

6011D/100/300/400
400A Range Extender and Power Supply

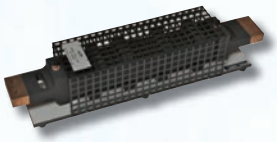
- 100, 300, 400 amp capability
- Automatic Range selection
- 10:1, 100:1, 1000:1, 10,000:1, 100,000:1, 1,000,000:1 Ratios
- 10;1, 100:1, 1000:1 Ratio Accuracy < 0.2 x 10^{-6}
- 10,000:1, 100,000:1, 1,000,000:1 Ratio Accuracy <1 x 10^{-6}
- Self-balancing
- For use with the Self Calibrating 6010D or 6242B Resistance Ratio Bridge
- Built in Reversing Switch
- IEEE488 or manual operation

6011D/1000/3000/5000
5000A Range Extender and Power Supply

- 1000, 3000, 5000 amp capability
- Shielded Rack
- Automatic Range selection
- 10:1, 100:1, 1000:1, 10,000:1, 100,000:1, 1,000,000:1 Ratios
- 10;1, 100:1, 1000:1 Ratio Accuracy < 0.3 x 10^{-6}
- 10,000:1, 100,000:1, 1,000,000:1 Ratio Accuracy <1 x 10^{-6}
- Self-balancing
- For use with the Self Calibrating 6010D or 6242B Resistance/Ratio Bridge
- Built in Reversing Switch
- IEEE488 or manual operation

HIGH CURRENT RESISTORS AND SHUNTS

9332
Series of High Current Resistors from 10A to 3000A with Optional Air Moving Fans



- Based on NMI design with controlled current distribution
- Stability < 10 x 10^{-6} long term
- Air or oil cooled applications
- Special values available on request
- Implanted thermocouples
- Improved power dissipation

9311A
Multiple Value Resistor Shunt

- 9 Current ranges
- 0.1mA to 300A
- Accuracy to <0.01%
- Improved temperature coefficient < Temperature coefficient 3 x 10^{-6}/°C
- Rack or bench top

9312A
Multiple Value Resistor Shunt

- Calibration of high current meters
- 9 current ranges
- 5μΩ to 500μΩ
- Accuracy's to <0.02%
- Improved temperature coefficient
- Rack or bench top use

9313A
Multiple Value Resistor Shunt

- 5 current ranges
- 1mΩ to 1Ω
- Accuracy's to <0.02%
- Improved temperature coefficient
- Rack or bench top use

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PRIMARY OIL RESISTORS 0.1Ω TO 100KΩ

9210A-1 (Primary)
1Ω Resistor with Carrying Case

- Replacement for Thomas 1Ω
- Temperature Coefficient <0.05 x 10^{-6}/°C
- Long term drift < 0.2 x 10^{-6}/year
- No pressure coefficient
- Maximum dissipation 100 milli-watts
- Highest performance dissipation 10 milli-watts

9210A-0.1 (Primary)
0.1Ω Resistor with Carrying Case

- Temperature Coefficient <0.05 x 10^{-6}/°C
- Long term drift < 0.1 x 10^{-6}/year
- No pressure coefficient
- Maximum dissipation 1 watt
- Highest performance dissipation 100 milli-watts

9210B (Primary)
Decade Values 1Ω, 10Ω, 100Ω, 1KΩ, 10KΩ, 100KΩ with Optional Carrying Case

- Temperature Coefficient < 2 x 10^{-7} /°C
- Long term drift < 2 x 10^{-7}/year
- Low pressure coefficient
- Maximum dissipation 300 milli-watts
- Highest performance dissipation 10 milli-watts

Well designed! The most accurate result can be achieved with minimized temperature co-efficient, pressure co-efficient and power effects in the measurement!

AIR RESISTORS

9331R
High Stability Reference Resistors

- 1Ω to 100kΩ
- Operating Range 18°C to 28°C
- Custom Values Available
- Metal Foil Technology
- Ultra Low Temperature Coefficient

9331 (Secondary)
Series of Four Terminal Air Resistors from 1mΩ to 100MΩ with Optional Carrying Case

- Resistance range 1mΩ to 100M
- Wide operating range 18°C to 28°C
- 12 month stabilities low as 2 x 10^{-6}
- Nominal initial accuracy < 2 x 10^{-6}
- Temperature coefficients < 0.4 x 10^{-6}/°C
- Special values available on request

9331G (Primary)
Series of Primary High Value 2 Terminal Resistors from100M to 100T with Optional Carrying Case

- Based on NIST design
- High stability
- 100MΩ to 100TΩ
- Split guard circuit
- Internal temperature sensor
- Custom values available

Highly efficient, reliable, accurate resistance standards for any and all laboratories!

OIL BATHS

9400 Series
Standard Resistor Oil Bath 75 Liters

- Designed for use with cryogenic current comparator
- Electrical and audibly quiet operation
- Stability and uniformity < 2mK
- Temperature band protection
- Peltier cooled
- Adjustable stir speed
- Pressure option
- IEEE488 & RS232
- Interfaces to 6010, 6242 & 6000B for automatic measurements of temperature coefficients using MI software

9400L
Standard Resistor Oil Bath 150 Liters

- 150L Large Capacity Bath
- Electrical and audibly quiet operation
- Stability and uniformity < 10 mK
- Temperature band protection
- Peltier cooled
- Quiet Operation
- IEEE488 & RS232

9400B
Bench top Resistor Oil Bath 20 Liters

- 20L Large Capacity Bath
- Electrical and audibly quiet operation
- Stability and uniformity < 10 mK
- Temperature band protection
- Peltier cooled
- Quiet Operation
- IEEE488 & RS232
- Interfaces to 6010, 6242 & 6000B for automatic measurements of temperature coefficients using MI software

AIR BATHS

9300
Temperature Controlled Standard Resistor Air Bath

- Stability and uniformity < 50 mK
- Large working area
- Temperature band protection
- Peltier cooled
- Light weight and portable
- Temperature range 15°C to 40°C

9300A
Temperature Controlled Standard Resistor Air Bath with GPIB

- Stability and uniformity < 15 mK
- Large working area (4 SR104's)
- Temperature band protection
- Peltier cooled
- Stainless steel construction
- Temperature range 15°C to 40°C
- IEEE488
- Interfaces to 6010, 6242 & 6000B for automatic measurements of temperature coefficients using MI software

TEMPERATURE CONTROLLED RESISTANCE STANDARDS

4304 (4 Element)
Temperature Controlled Traveling Resistance Standard

- Battery Backup
- 1Ω, 10kΩ, 1MΩ & 100MΩ Values
- Stability < 2 x 10^{-6}/year
- Temperature coefficient < 0.005 x 10^{-6}
- Temperature regulation ±0.01°C/year
- Other values available upon request
- Eliminates oil bath requirement

4310 (10 Element)
Temperature Controlled Fixed Resistance Standard

- 6 to 10 decade values available (0.1Ω to 100MΩ)
- Thermometry values available
- Four terminal connections
- Stability < 2 x 10^{-6}/year
- Temperature coefficient < 0.005 x 10^{-6}/°C
- Temperature regulation ±0.01°C/year
- Eliminates oil bath requirement

4310HR (4 to 6 Elements)
Temperature Controlled High Resistance Standard

- 100M to 10T or 1G to 100T
- N type connectors
- Temperature coefficient ± 0.2 PPM/°C
- Eliminates air bath requirements
- Ambient temperature range: 23°C ± 5°C
- Temperature regulation: ± 0.01 °C/year
- Guarded resistance element chamber

Best in the class with its proven stability, and excellent performance for the applications of being as a transfer standard or working under the rugged condition!

VOLTAGE MEASUREMENT

8000A (10V)
Automated Potentiometer

- Built in 20 channel scanner
- Interfaces to 4200 Series of Scanners for additional channels
- Bi Polar Voltage Measurements
- Accuracy < 0.05 x 10^{-6}
- Linearity < 0.01 x 10^{-6}
- Standard Cell Protection
- Voltage maintenance programs
- Range to 10 volts
- Calibration of fluke 5700A/5720A
- Linearity calibration of DMM's
- Windows system operating software

8000A RVB
Ratio Verification Box

- Ratio verifications of 8000A to 0.02 PPM
- Requires two Standard Resistors of 10KΩ and 100kΩ

8001A (Extender)
Automated 1200 Volt DC Divider

- Calibrate the calibrator
- 30V, 120V, 300V and 1200V ranges
- Accuracy < 1 PPM
- Self calibrating using 8000A
- Bipolar voltage measurements
- Optional lab temperature, humidity and pressure monitoring

Measurements International
25th
Celebrating 25 Years of Excellence in Metrology

Measurements International
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1987
Measurements International (MI) is founded. Developed
Four Terminal Automated Resistance Scanner Model 4220A

1990
Developed first commercial Automated Potentiometer based on the Binary Voltage Divider Technology (BVD) , Model 8000A Range 1mV to 10V Accuracy < $5 * 10^{-8}$

1992
Develops first commercial automated Direct Current Comparator Resistance Bridge (DCC) Model 6010A, Range 1Ω to 10kΩ, Accuracy 10^{-7}

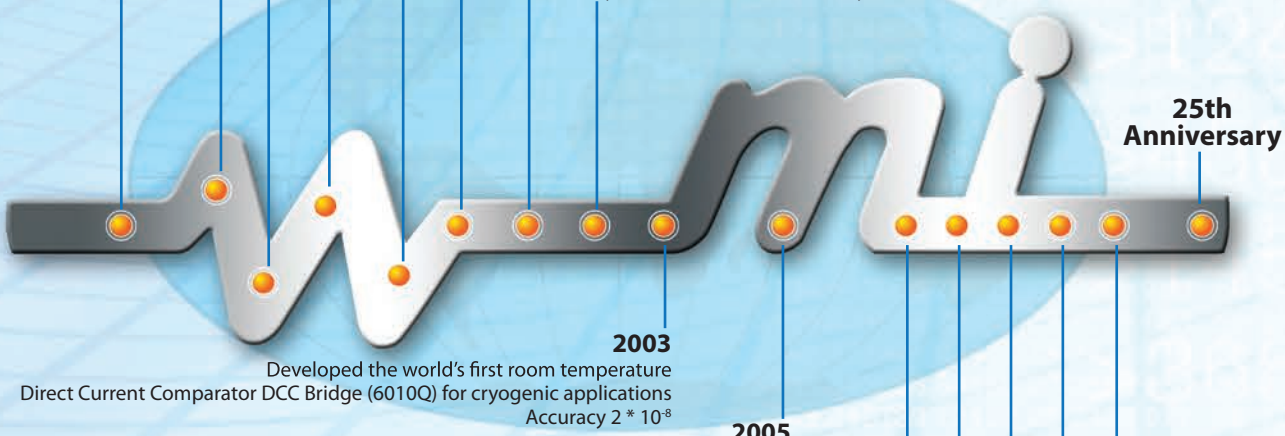
1993
Developed first commercial automated High Resistance Bridge for the measurement of resistors. Range 10kΩ to 100MΩ, Accuracy 10^{-6}

1993
MI USA was founded

1997
Re-develops DCC Technology which resulted in the world famous 6010B Resistance Bridge from 0.001Ω to 10kΩ, Accuracy 10^{-7}

1998
Develops 20,000 A Direct Current Comparator for the LHC at CERN

2002
Develops the world's first and only portable cryogenic QUANTΩ (QHR) System Model 6800A Accuracy $1 * 10^{-8}$



2003
Developed the world's first room temperature Direct Current Comparator DCC Bridge (6010Q) for cryogenic applications Accuracy $2 * 10^{-8}$

2005
Develops first commercial automated High Resistance Bridge based on the binary voltage divider technology to 100V, Model 6000B Accuracy $2 * 10^{-8}$
MI Europe was founded

2006
Develops first self calibrating Direct Current Comparator Ratio Bridge.
Model 6242B with touch screen display.
Range 1Ω to 100MΩ Accuracy $5 * 10^{-8}$

2008
Develops world's first AccuBridge™ Technology DCC Resistance Bridge with complete self calibration.
Range 0.1Ω to 100kΩ Accuracy $2 * 10^{-8}$

2009
Develops first commercial Dual Source Bridge Technology for the measurement of high value resistors Range 10kΩ to 100TΩ
Voltage 1V to 1000V

2010
MI China was founded
Develops first automated Direct Current Comparator Resistance Bridge Model 6010D with touch screen display Range 0.01Ωto 100kΩ, Accuracy $4* 10^{-8}$

2011
Develops first automated high current 3000A Direct Current Comparator DCC Shunt Measurement System Ratio 1,000,000:1

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