

## Model 6242B/300



## High Precision DCC Shunt Measurement System

- Currents to 3000A and higher
- Modular Design, Expandable Capabilities
- Ratio Ranges from 10 to 1,000,000
- Resistance and Temperature Curves
- Temperature Coefficient of Resistors
- Complete Turn Key System
- No coefficients to correct hardware errors
- Proven Technology
- Linearity < 0.01 ppm
- Complete Measurement Systems Available

## MODEL INFORMATION

Measurements International's (MI) series of Shunt Measurement Systems offers the best accuracy and lowest uncertainty of any commercial system available on the market today. The MI high current range extenders expand the measuring capabilities of the MI model 6010 and MI 6242 to measure lower resistance values at higher currents.

The MI series of 6010 Bridges and shunt measurement systems are used by the majority of National Measurement Laboratories and military labs worldwide as well as the US Air Force, US Army and US Navy.

The new series of MI 6010 and 6242 systems are

The MI 6010 and 6242 series of Shunt Measurement Systems provide the widest range with lowest uncertainty of any manufacturer.  
System accuracy: <2ppm compared to 15ppm from our nearest competitor.

Measurements International is the original manufacturer of the automated Resistance Measurement System. With the most current comparator experience in the industry, Measurements International shunt measurement systems are designed using sound metrology principles.

the only self calibrating bridge systems in the world. For years users would only perform interchange measurements at 1:1 ratios. On the MI series of DCC Resistance Bridges, self calibration is achieved using the interchange technique. 6010 and 6242 series bridges are commonly being used worldwide to calibrate other manufacturer's bridges and shunt measurement systems.

While other manufactures require the use of more than 50 coefficients to correct for systematic hardware errors in their bridges, MI Bridges require no corrections. Other manufacturers also claim to have the best accuracy and meet the military requirements for resistance measurements yet are unable measure 1:10 ratios with any accuracy.

**Don't be fooled or misled by other manufacturers claims, ask for references and consult any NMI in regards to modern resistance measurement systems**

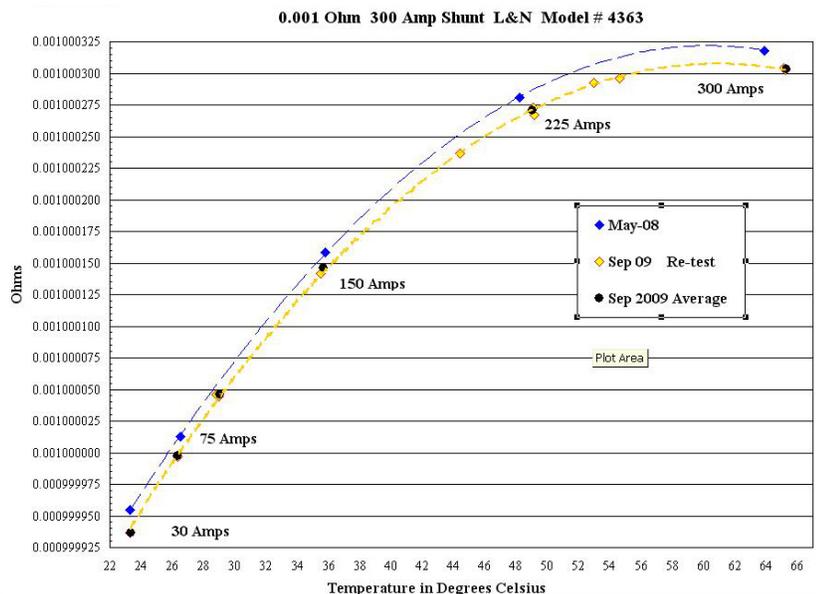
Ratio Range	Resistance Ω	Max Current A	Accuracy ppm
10	0.1	1	0.2
100	0.01	10	0.3
1000	0.001	100	0.4
10,000	0.0001	3000	2
100,000	0.00001	3000	2
1,000,000	0.000001	3000	2
1,000,000	0.0000001	3000	2

Standard resistors of 1Ω, 10Ω and 100Ω may also be used to extend the ratio for higher currents. For example if you had a 0.01Ω shunt at 100A it could be measured on the 100A range using a 10Ω standard or if you had a 0.1Ω shunt at 15A you can measure it on the 100A range using a 100Ω standard.

**Resistance/Temperature and Time/Temperature Curves**

All of the MI High Current Shunt Measurement systems have the capability of providing both the resistance/temperature curve as well as the time/temperature curve for the shunt being measured, a feature that only MI offers. The resistance temperature curve is found by measuring the shunt at several different current levels and plotting the equilibrium points. This type of curve determines the characteristics of the shunt when heat is dissipated by the shunt elements and is modeled by a 2nd order polynomial. Equilibrium is obtained when the temperature and resistance of the shunt reach a steady state at the current level being measured. Once the resistance/temperature equilibrium curve has been established the shape will not change, but the resistance will drift as does a typical resistance standard.

In addition, environmental temperature, pressure and humidity can be measured and logged with shunt data.



## MI series of DCC Range Extenders

### 6511 DCC Range Extender with built in Power Supply

The 6511 was designed for users that do not require high currents but still need the best accuracy for their measurements. Three (3) ratios of 10, 100 and 1000 and a built in linear power supply of 5A or 10A are provided for the measurements of 0.1Ω, 0.01Ω and 0.001Ω high current resistors or shunts. The maximum output current of the 6511A is 100 mA for ratios 10 (1A) and 100 (10A) and 10mA for ratio 1000 for 10A in. If your application falls into this area then the 6511A is for you.

6511 Ranges	10 <sup>-3</sup> :1	10 <sup>-2</sup> :1	10 <sup>-1</sup> :1
6511 Uncertainties	0.4	0.3	0.3
6010/6511 Uncertainties	0.41	0.31	0.31



### 6011/100A DCC Range Extender

The 6011 is a precision DC Current Range Extender for currents up to 100A. Using innovative technological improvements to the direct current comparator, the linearity specification have been improved to less than 0.01 ppm over its entire range. The 6011 can be used as a stand-alone unit for dividing high currents down to workable levels. Full-scale output current of the 6011 is 100 mA on all ranges. Applications include calibration of DC Current Sources and in DCC Shunt measurement systems.

The 6011/100 has a built in reversing switch and automatic ranging of the 1, 10 and 100A ranges, there is only one input on the rear of the 6011. As a standalone unit applications include calibration of DC Current Sources up to 100A. All that is required is a DVM to measure the voltage across a standard resistor connected to the 6011 output and any power supply can be calibrated easily and efficiently.

Ranges	10 <sup>-3</sup> :1	10 <sup>-2</sup> :1	10 <sup>-1</sup> :1
Currents	100A	10A	1A
6011/100 Uncertainties	0.4ppm	0.3ppm	0.2ppm



When used in the shunt measurement system the system can be automated using a controller and the Model 6100A/100 DC power Supply.

Ranges	10 <sup>-6</sup> :1	10 <sup>-5</sup> :1	10 <sup>-4</sup> :1	10 <sup>-3</sup> :1	10 <sup>-2</sup> :1	10 <sup>-1</sup> :1
Currents	100	100	100	100	10	1
6010/6011/100 Uncertainties	2ppm	2ppm	1ppm	0.41ppm	0.31ppm	0.21ppm

The system can be powered from a 100V, 120V, 220V or 240V single phase supply. There is no requirement for special cooling or heat exhausts providing flexibility for room location. Mounted on wheels the 6010/100 can be moved about easily when required. Typical rack height is 1224 mm (48") which allows for a 20 channel scanner to be ordered with the system or added at a later date.

When mounted in the rack, shunt connection is made easily from the rear of the rack. Installation and operation is easy when used with the 6010 or 6242B Resistance Bridges.

### 6011/300 DCC Range Extender

The 6011/300 is a precision DC Current Range Extender for currents up to 300A. Using the same innovative technological improvements as used in the 6011/100 direct current comparator, the linearity specification has been improved to less than 0.01 ppm over its entire range. Full-scale output current of the 6010/300 system is 100 mA on all ranges.

The 6011/100 has a built in reversing switch and automatic ranging of the 1A, 10A, 100A and 300A ranges, there is only one input on the rear of the 6011. As a standalone unit the 6011/300 can be used to calibrate DC Current Sources up to 300A. All that is required is a DVM to measure the voltage across a standard resistor connected to the 6011/300 output and any power supply can be calibrated easily and efficiently.



Ranges	10 <sup>-3</sup> :1	10 <sup>-3</sup> :1	10 <sup>-2</sup> :1	10 <sup>-1</sup> :1
Current	300	100	10	1
6011/300 Uncertainties	0.4ppm	0.4ppm	0.3ppm	0.2ppm

When used in the 6010/300 Shunt Measurement System the system can be automated using a controller and a Model 6100A/300 DC power Supply.

Ranges	10 <sup>-6</sup> :1	10 <sup>-5</sup> :1	10 <sup>-4</sup> :1	10 <sup>-3</sup> :1	10 <sup>-2</sup> :1	10 <sup>-1</sup> :1
Current	300	300	300	100	10	1
6010/6011/300 Uncertainties	2ppm	2ppm	1ppm	0.41ppm	0.31ppm	0.21ppm

The system can be powered from a 120V or 240V single phase supply. There is no requirement for special cooling or heat exhausts providing flexibility for room location. Mounted on wheels the 6010/300 can be moved about easily when required. Typical rack height is 1224 mm (48") which allows for a 20 channel scanner to be ordered with the system or added at a later date.

## 6010/400 Shunt Measurement Systems

If higher current and better accuracy is required, the 6010/400 system is a precision DC Current Range Extender System for currents up to 400A using the 6013 High Current Range Extender. Using the same innovative dual slave technology, the 6013 can be used to calibrate DC Current Sources up to 400A. All that is required is a DVM to measure the voltage across a standard resistor connected to the 6013 output and any power supply by other manufacturers can be calibrated easily and efficiently. The 6013 only has one range of 1:1000. It is compact and operates from both a 100V, 120V, 220V or 240V single phase supply.

6013/400 Range                       $10^{-3} : 1$   
 Uncertainties (PPM)                < 1

As a shunt measurement system, the 6010/400 consists of a 6010/100A module and the 6013/400 module. The system also features a built in reversing switch and automatic ranging and is supplied in a rack on wheels for easy installation. Connection of the shunt is made at the side of the 6013 rack where two copper plates extend through the side panel. This effectively removes any heat loss due to poor connections to the shunt wires. In the high current shunt measurement system, the output current of the 6013 range extender (with ratio of 1000:1) feeds directly into the 6011/100A range extender as automatic ranging is performed inside the 6011/100. The 6011/100 Range Extender is a precision DC Current Range Extender with ratios of 1000:1 (100A), 100:1(10A) and 10:1(1A). Used with the model 6013 ratios of 1,000,000:1 can be achieved.



6010/6011/6013 Ranges	$10^{-6}:1$	$10^{-5}:1$	$10^{-4}:1$	$10^{-3}:1$	$10^{-2}:1$	$10^{-1}:1$
Current Ranges (Amps)	400A	400A	400A	100A	10A	1A
6010/6011/6013 Uncertainties	1 ppm	1 ppm	1 ppm	0.41 ppm	0.31 ppm	0.21 ppm

The 6010/400 system can be powered from a 240V single phase supply. There is no requirement for special cooling or heat exhausts providing flexibility for room location. Mounted on wheels the 6010/400 can be moved about easily when required. Typical rack height is 1224 mm (48") which allows for a 20 channel scanner to be ordered with the system or added at a later date.

## 6010/1000/2000/3000 Shunt Measurement Systems

If higher current is required, the 6010/1000, 6010/2000 or 6010/3000 are precision DC Current Range Extender Systems for currents up to 3000A using the 6014 High Current Range Extender. Using the same innovative technological improvements to the direct current comparator, the 6014 can be used to calibrate DC Current Sources up to 3000A. All that is required is a DVM to measure the voltage across a standard resistor connected to the 6014 output and any power supply can be calibrated easily and efficiently. The 6014 has one range of 1:1000. It is compact and operates from both a 100V, 120V, 220V or 240V single phase supply.

6014/3000 Range  $10^{-3} : 1$   
 Uncertainties (PPM)  $< 2$

As a shunt measurement system, the 6010/1000/2000/3000 consists of a 6010/100A module and the 6014/1000, 6014/2000 or 6014/3000 module. The system also features a built in reversing switch and automatic ranging and is supplied in a rack on wheels for easy installation. Connection of the shunt is made at the side of the rack where two copper plates extend through the side panel. This effectively removes any heat loss due to poor connections to the shunt wires. In the high current shunt measurement system, the output current of the 6014 range extender (with ratio of 1000:1) feeds directly into the 6011/100A range extender as automatic ranging is performed inside the 6011/100. The 6011/100 Range Extender is a precision DC Current Range Extender with ratios of 1000:1, 100:1 and 10:1. Used with the model 6014 ratios of 1,000,000:1 can be achieved.



6010/6011/6014 Ranges	$10^{-6}:1$	$10^{-5}:1$	$10^{-4}:1$	$10^{-3}:1$	$10^{-2}:1$	$10^{-1}:1$
Current	3000	3000	3000	100	10	1
6010/6011/6014 Uncertainties	2	2	1	0.41	0.31	0.21

For currents of 1000A and higher, the system can be powered from a 240V single phase or 208/360 three phase supply. The total power consumed is a result of the external load placed on the Current Sources. With a 2V compliance, the power can be as high as 3000A x 2V = 6000W if there are no losses in the leads. This type of power is high enough to raise the temperature in your calibration laboratory. As a result MI recommends venting at the top of the rack directly into the ventilation system return to remove this heat from the laboratory if this is an issue.

Mounted on wheels the 6010/1000/2000/3000 can be moved about easily when required. Installation and operation is easy when used with the 6010 or 6242 Resistance Bridges.

## Bridge Tools Software

MI provides the best uncertainties in a shunt measurement system and we offer a total solution in our 6010 or 6242 Bridge Tools Software. Not only does the software give you control to all the systems above, it can also be used to interface to temperature/humidity and pressure modules for recording these parameters at the time of measurement. Data from all the measurements are stored into a text file which can be easily imported to excel for plotting both the shunt value and temperature/resistance curves for the shunt. Features of the bridge Tools Software include the following:

- 1) Automatic control of all MI Bridges, Scanners, Shunt Measurement Systems, Calibrators, Oil Baths and Air Baths
- 2) Importing calibration and measure files to excel.
- 3) Automatic calculation of Temperature Coefficients for up to 20 resistors at a time using a fixed bath and a variable bath
- 4) Automatic measurements of air/oil bath temperatures
- 5) Automatic measurement of the temperature of shunts
- 6) Generation of Temperature Resistance graphs on shunt measurements

<b>Specifications</b>			
Measurement Range	150mA to 400A	1 $\mu\Omega$ to 1 $\Omega$	
	400A to 3000A	0.1 $\mu$ to 1 $\Omega$	
Linearity	$\pm 0.01$ ppm of full scale		
Warm-up time to full rated accuracy	1 minute		
Temperature Coefficient	0.01 ppm/ $^{\circ}\text{C}$		
Communication	IEEE 488		
Test Current Resolution	$\pm 16$ bits		
Test Current Accuracy	0 to 5A	$\pm 1\%$	
	5A to 100A	$\pm 1\%$	
	100A to 3000A	$\pm 0.01 + 450\text{mA}$	
Test Current Stability	0-100A	$\pm 0.01\%$ of range + 1 bit for 8 hours	
	100A to 3000A	$\pm 0.1\% + 100\text{mA}$	
Compliance Voltage	0 to 100A	4.2 V	
	100A to 3000A	3.3V	
Operating Temperature to full Specification			
Maximum Operating Range (< 50%RH)	+10 $^{\circ}\text{C}$ to +40 $^{\circ}\text{C}$	+50 $^{\circ}\text{F}$ to 104 $^{\circ}\text{F}$	
Temperature Storage Range	-20 $^{\circ}\text{C}$ to +60 $^{\circ}\text{C}$	-4 $^{\circ}\text{F}$ to +140 $^{\circ}\text{F}$	
Operating Humidity	20% to 70% RH	Storage Humidity	15% to 80% RH
Warranty	2 Years		

**Accessories**

**Model 4200 Series** Matrix Scanners

An efficient method of reducing the cost of calibration, models offer 10, 16, and 20 channels with either binding posts or wire inputs.



**Model 9400** Standard Resistor Oil Bath

A stable and quiet oil bath with the capacity of 80 litres used for the maintenance of oil resistors. the 9400 is Peltier cooled, GPIB controllable, and. Also available is the optional 16 channel interconnect panel.



**Model 9210** Primary Resistance Standard

Based on a specially treated evanohm alloy, and using a proprietary process to improve stability and temperature coefficient, the 9210A is the most stable resistor commercially available. the long term drift rate is better than 0.2 ppm per year and TC is less than 0.05 ppm/°C.



**Model 9300A** Standard Resistor Air Bath

GPIB Controllable and uses solid state cooling, the 9300A is a cost effective means to maintain the temperature of up to 4 SR104's or 15 model 9331 air resistors from 15°C to 40°C with stability < 50mK. Ideal for establishing temperature coefficients.



**Model 9332** Current Shunts

The models 9332, DC Current Shunts are the latest development from Measurements International series of DC resistors and shunts.



**Cables** Measurements International can supply custom high current cables capable of handling any amperage up to and above 3000A.

Distributed By:

Form MI 66, Rev. 6, Dated 09-0-03 (QAP19, App. "N")

Data Subject to Change - Rev. 0 0710

**MI-Canada**  
 Measurements International Ltd  
 PO Box 2359, 118 Commerce Drive  
 Prescott, Ontario, Canada K0E 1T0  
  
 Toll Free: 1-800-324-4988  
  
 Phone: (613) 925-5934  
 Fax: (613) 925-1195  
 Email: sales@mintl.com

**MI-USA**  
 Measurements International Inc.  
 815 Eyrie Dr Unit #4  
 Oviedo, FL 32765  
  
 Toll Free: 1-866-684-6393  
  
 Phone: (407) 706-0328  
 Fax: (407) 706-0318  
 Email: sales@mintl.com

**MI-China**  
 Room 4011, Anzhen Plaza  
 2 Andingmenwai Street  
 Dongcheng District  
 Beijing, China, 100013  
  
 Phone: 86 10 5127 8576  
 Fax: 86 10 5127 8532  
 Email: sales@mintl.com

**MI-Europe**  
 Družstevní 845  
 686 05 Uherské Hradiště  
 Czech Republic  
  
 Phone: (420) 731 440 663  
 Fax: (420) 572 572 358  
 Email: sales@mintl.com

[www.mintl.com](http://www.mintl.com)

