Discover the AccuBridge®Difference

AccuBridge® DCCT Measurement Systems

Products Guide

Calibration of voltage output DCCTs

Calibration of both voltage and current output DCCTs

- 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

Measurements International

Metrology is Our Science, Accuracy is Our Business™

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Resistors, High Current Shunts and Direct Current Comparator Transformers (DCCT)

Since 1992, the Measurements International's (MI) 6010 series has set the standard for research, calibration and measurement of resistors and shunts in both NMIs and calibration laboratories around the world. Now the time has come to advance this best-in-class, the MI 6010 series of DC Resistance and Temperature Bridges, taking advantage of AccuBridge® technology and usability. In particulare the MI 6010D High Performance Resistance Bridge is the culmination of years of engineering development, customer research and industrial design, to bring to market the new standard in resistance, shunt and DCCT research, measurement and calibration.

High Performance with increased Applications

The 6010 can be used to calibrate a wide range of resistance standards (0.1Ω to 100 kΩ) and with the addition of the MI series of range extenders and power supplies the calibration of high current shunts (1 uΩ to 100 mΩ).

In industrial current measurements, the best measurement uncertainties in DC current measurements are reached using DC current transformers (DCCTs). DCCTs have the advantage that their is no warm up period but are more capacitive and inductive than current shunts and so the reversal rate is fairly long to achieve the best accuracy. Several commercial DCCT devices are available on the market now with accuracies approaching 10^{-5}. For the application of research and calibration of the DCCT, MIL is pleased to announce the Model 6300 series of DCCT calibration systems where measurement uncertainties of less than a few ppm for DC currents from 1 A to 3 kA can be achieved.

The new MIL setup is based on proprietary high-current DC Range Extenders from MI with ratios up to 1:1,000,000. Two measurement techniques can be used to measure the transimpedance of a DCCT. The MI Model 6010D (Resistance Bridge) or the MI Model 6300A which uses two $8^{1/2}$ digit DMMs (3458A) as measuring devices. The 6010D, is developed around the well-established AccuBridge® technology, the transimpedance is obtained by accurately measuring the current ratio using the bridge. This 6010D system provides the best accuracy for the voltage output DCCTs. The 6300A is based on two $8^{1/2}$ digit DMMs (3458A). With this system the absolute value of the test current is required, which is limited by the DMM accuracy. The Model 6300A will measure both voltage and current output DCCTs.

Figure 1 shows a picture of a simple setup using the Model 6300A/100 which includes a Model 6011D Range Extender, a standard resistor, two DMM's and a 4210A Scanner for calibrating multiple DCCTs at the same time. This system can also be used for the calibration at currents up to 300 A by winding 3 turns of the primary current lead through the center hole of the DCCT under test extending the range of the 6011D. The uncertainty achieved in this particular calibration is < 0.5 ppm, limited by the behavior of the DCCT. In practice, the limit will be set by the amount of turns N that physically fit through the center hole of the DCCT. The uncertainty achieved in this particular calibration is <1 ppm, limited by the behavior of the DCCT.

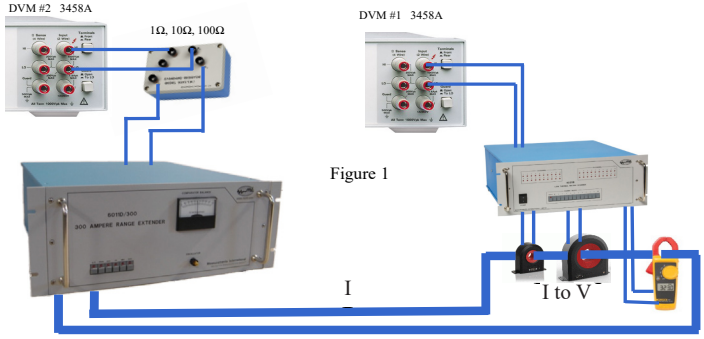

Figure 1

$$I = \frac{V}{R} \pm \frac{V}{R} * Ratio\ (Where\ ratio = 0.1\ to\ 0.001)$$

$$U = (DMM1_{UNC^2} + DMM2_{UNC^2} + R_{UNC^2} + EXT1_{UNC^2} + STD_{DEC^2})\ 1/2$$

Several configurations are available such as 100 A, 300 A, 400 A, 1000A, 2000 A and 3000 A. The 6010D/3000 system is shown in figure 2 and the Model 6300A shown in figure 3. The 6010D series is used to measure DCCT's with an internal resistor (voltage output) while the 6300A series is used to measure both current and voltage output DCCTs.

6010D/3000A DCCT Calibration System

Figure 2

For the calibration of Resistors, Shunts and voltage output DCCTs to 3000 A Available systems include 6010D-100, 6010D-300, 6010D-400, 6010D-1000, 6010D-2000 and 6010D-3000. Accuracy < 2 ppm at 3000 A.

6300/3000A DCCT Calibration System

Figure 3

For the calibration of Resistors, Shunts and both current and voltage voltage output DCCTs to 3000 A, Available systems include 6011D-100, 6011D-300, 6011D-400, 6011D-1000, 6011D -2000 and 6011D-3000. Accuracy < 5 ppm at 3000 A.

Specifications
6010D

Measurement Range	Current	Ratio	Accuracy
	150 mA to 1A	10	0.3 PPM[1]
	1A to 10A	100	0.3 PPM[1]
	10A to 100A	1000	0.3 PPM[1]
	100A to 300A	1000	< 1 PPM[1]
	300A to 1000 A	10,000	< 2 PPM[1]
	1000A to 3000A	100,000	< 2 PPM[1]
	1000A to 3000A	1,000,000	< 2 PPM[1]
Linearity	0.02 PPM		
Temperature Coefficent	0.02 PPM		
Communication	IEEE-488		
Test current accuracy			
	150 mA to 150 A	0.01%	
	150 mA to 300 A	0.01%	
	300 A to 3000 A	0.01% + 1 bit	

Specifications
6300

Measurement Range	Current	Ratio	Accuracy
	150 mA to 1A	10	< 7 PPM
	1A to 10A	100	< 7 PPM
	10A to 100A	1000	< 7 PPM
	100A to 300A	1000	< 7 PPM
	300A to 1000 A	10,000	< 7 PPM
	1000A to 3000A	100,000	< 7 PPM
	1000A to 3000A	1,000,000	< 7 PPM
Linearity	0.03 PPM		
Temperature Coefficent	1.2 (0.15) + 0.1PPM[3]		
Communication	IEEE-488		
Test current accuracy			
	150 mA to 100 A	4.6 (3.1)+0.3 PPM[2]	
	100 A to 1000 A	4.6 (3.1)+0.3 PPM[2]	
	1000 A to 3000 A	4.6 (3.1)+0.3 PPM[2]	

1. 2 sigma ratio Accuracy of the 6010D is 0.04 ppm.
2. Current accuracy is < 0.01% = 0.01 ppm in ratio.
3. 3458A accuracy without Acal and with Acal. (Accuracy depends on how well the 3458A can be calibrated)

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