

## Scope of Accreditation For ICC Instrument Co. Inc

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In recognition of a successful assessment to ISO/IEC 17025:2005 & ANSI Z540-1, accreditation is granted to **ICC Instrument Co. Inc** to perform the following Calibrations:

Accreditation granted through: April 24, 2012

### Calibration

#### Length - Dimensional Metrology – Hand Tools and Precision Gages 1D

Calibration Parameter/Equipment	Range	Best Measurement Capability (+/-) <sup>2</sup>	Remarks
Indicators <sup>2</sup>	0 in to 4 in	(57 + 7L) μin	Gage Blocks
Micrometers - OD <sup>2</sup>	0 in to 1 in	(54 + 2.4L) μin	Gage Blocks, Optical Flats
	1 in to 8 in	(49 + 11L) μin	
Height Gages <sup>2</sup>	0 in to 24 in	(900 + 6L) μin	Gage Blocks, End Rods
Calipers <sup>2</sup>	0 in to 24 in	(480 + 9L) μin	Gage Blocks, End Rods
Steel Rules	0 in to 72 in	0.013 in	Certified Steel Rule

#### Length - Dimensional Metrology – Artifacts and Standards 1D

Calibration Parameter/Equipment	Range	Best Measurement Capability (+/-) <sup>2</sup>	Remarks
Cylindrical Plugs <sup>2,4</sup>	0.010 in to 1.0 in	(32 + 2L) μin	Laser Micrometer

#### Mass – Scale and Balances

Calibration Parameter/Equipment	Range	Best Measurement Capability (+/-) <sup>2</sup>	Remarks
0.01 mg Resolution	0 g to 200 g	0.3 mg	ASTM Class1, Class 2 / NIST Class S Weights
1 mg Resolution	0 kg to 5 kg	14 mg	
0.001 lb Resolution	0 lb to 100 lb	0.002 lb	NIST Class F Weights
0.1 lb Resolution	0 lb to 820 lb	0.12 lb	
1 lb Resolution	0 lb to 5 000 lb	1.7 lb	

**Mass – Pressure**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Pressure – Source <sup>2</sup>	4 inH <sub>2</sub> O to 650 inH <sub>2</sub> O 10 psi to 1 000 psi	0.0003 inH <sub>2</sub> O/inH <sub>2</sub> O + 0.004 inH <sub>2</sub> O .0003 psi/psi + 0.027 psi	Dead Weight Tester
	1 000 psi to 2 000 psi	2.4 psi	Digital Pressure Calibrator
	2 000 psi to 5 000 psi	4.3 psi	
	5 000 psi to 10 000 psi	6.8 psi	

**Mass – Vacuum**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Vacuum <sup>2,4</sup>	0 to 29.9 inHg	0.09 inHg	Digital Vacuum Calibrator

**Mass – Torque**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Torque <sup>2</sup>	5 lbf-in to 3000 lbf-in	0.28 lbf-in + 0.003 lbf-in/ lbf-in	Comparisons performed with a Digital Torque Calibrator

**Mass – Force**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Force Gauges (Tension Only)	10 g to 1 000 g 1 kg to 10 kg 0.5 lbs to 100 lbs 50 lbs to 400 lbs	0.2 g 1.5 g 0.03 lb 0.27 lb	ASTM Class 2/NIST Class S Weights NIST Class Q and Class F weights

**Electricity and Magnetism – Voltage**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
DC Volts- Source <sup>1,2,3</sup>	0 mV to 220 mV	11 μV/V + 0.9 μV	Comparisons performed with a Multifunction Calibrator and DMM
	220 mV to 22 V	10 μV/V + 1.3 μV	
	2.2 V to 22 V	11 μV/V + 8 μV	
	22 V to 220 V	11 μV/V + 100 μV	
	220 V to 1 100 V	13 μV/V + 670 μV	
DC Volts- Measure <sup>1,2,3</sup>	100 μV to 100 mV	13 μV/V + 0.6 μV	Comparisons performed with a 8 ½ Digit Multimeter
	100 mV to 1 V	10 μV/V + 0.5 μV	
	1 V to 10 V	9 μV/V + 3 μV	
	10 V to 100 V	13 μV/V + 55 μV	
	100 V to 1.1 kV	13 μV/V + 440 μV	
	1.1 kV to 30 kV	0.15% of reading	Comparison performed with High Voltage Meter

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
AC Volts – Source <sup>1, 2, 3</sup>  0.1 mV to 2.2 mV	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	700 $\mu$ V/V + 6 $\mu$ V 280 $\mu$ V/V + 6 $\mu$ V 140 $\mu$ V/V + 6 $\mu$ V 480 $\mu$ V/V + 6 $\mu$ V 1.1 mV/V + 9 $\mu$ V 1.5 mV/V + 18 $\mu$ V 2.2 mV/V + 35 $\mu$ V	Comparisons performed with a Multifunction Calibrator and DMM
2.2 mV to 22 mV	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	700 $\mu$ V/V + 7 $\mu$ V 280 $\mu$ V/V + 7 $\mu$ V 150 $\mu$ V/V + 7 $\mu$ V 475 $\mu$ V/V + 7 $\mu$ V 1 mV/V + 9 $\mu$ V 1.5 mV/V + 17 $\mu$ V 2 mV/V + 35 $\mu$ V	
22 mV to 220 mV	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	700 $\mu$ V/V + 19 $\mu$ V 290 $\mu$ V/V + 11 $\mu$ V 290 $\mu$ V/V + 11 $\mu$ V 150 $\mu$ V/V + 11 $\mu$ V 1 mV/V + 30 $\mu$ V 2 mV/V + 46 $\mu$ V 2 mV/V + 47 $\mu$ V	
220 mV to 2.2 V	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	700 $\mu$ V/V + 120 $\mu$ V 210 $\mu$ V/V + 35 $\mu$ V 110 $\mu$ V/V + 6 $\mu$ V 170 $\mu$ V/V + 22 $\mu$ V 325 $\mu$ V/V + 100 $\mu$ V 560 $\mu$ V/V + 170 $\mu$ V 3 mV/V + 1.1 mV	
2.2 V to 22 V	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 100 kHz to 300k Hz 300 kHz to 500 kHz 500 kHz to 1 MHz	700 $\mu$ V/V + 1 mV 210 $\mu$ V/V + 340 $\mu$ V 100 $\mu$ V/V + 80 $\mu$ V 160 $\mu$ V/V + 230 $\mu$ V 330 $\mu$ V/V + 1 mV 700 $\mu$ V/V + 2 mV 1.6 mV/V + 6 mV	
22 V to 220 V	10 Hz to 20 Hz 40 Hz to 20 kHz	700 $\mu$ V/V + 12 mV 100 $\mu$ V/V + 1.2 mV	
220V to 1 100 V	50 Hz to 1kHz	105 $\mu$ V/V + 5 mV	
AC Volts – Measure <sup>1, 2, 3</sup>  100 $\mu$ V to 10 mV	40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz	335 $\mu$ V/V + 6.6 $\mu$ V 235 $\mu$ V/V + 6 $\mu$ V 360 $\mu$ V/V + 6 $\mu$ V 5.6 mV/V + 3.6 $\mu$ V 46 mV/V + 3.9 $\mu$ V	

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
10 mV to 100 mV	40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 MHz to 2 MHz	136 $\mu\text{V/V} + 9 \mu\text{V}$ 134 $\mu\text{V/V} + 8.4 \mu\text{V}$ 173 $\mu\text{V/V} + 8.2 \mu\text{V}$ 350 $\mu\text{V/V} + 7.5 \mu\text{V}$ 920 $\mu\text{V/V} + 5.8 \mu\text{V}$ 3 mV/V + 15 $\mu\text{V}$ 11 mV/V + 64 $\mu\text{V}$	
100 mV to 1 V	40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 MHz to 2 MHz	100 $\mu\text{V/V} + 48 \mu\text{V}$ 95 $\mu\text{V/V} + 24 \mu\text{V}$ 170 $\mu\text{V/V} + 24 \mu\text{V}$ 360 $\mu\text{V/V} + 26 \mu\text{V}$ 930 $\mu\text{V/V} + 25 \mu\text{V}$ 3 mV/V + 130 $\mu\text{V}$ 10 mV/V + 230 $\mu\text{V}$	
1 V to 10 V	40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 MHz to 2 MHz	100 $\mu\text{V/V} + 480 \mu\text{V}$ 95 $\mu\text{V/V} + 240 \mu\text{V}$ 170 $\mu\text{V/V} + 240 \mu\text{V}$ 360 $\mu\text{V/V} + 260 \mu\text{V}$ 1 mV/V + 250 $\mu\text{V}$ 3 mV/V + 1.3 mV 11 mV/V + 2.2 mV	
10 V to 100 V	40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz	0.25 mV/V + 5 mV 0.24 mV/V + 2.4 mV 0.24 mV/V + 2.5 mV 0.42 mV/V + 2.3 mV 1.4 mV/V + 2.3 mV	
100 V to 1 000 V	40 Hz to 1kHz	0.50 mV/V + 25 mV	
1kV to 30kV	40 Hz to 1 kHz	1.2% of reading	

**Electricity and Magnetism – Resistance**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Resistance - Source <sup>2</sup>	1 Ω, 1.9 Ω,	260 μΩ	Comparisons performed with a Multifunction Calibrator and DMM
	10 Ω	410 μΩ	
	19 Ω	710 μΩ	
	100 Ω	2.4 mΩ	
	190 Ω	4.8 mΩ	
	1 kΩ	19 mΩ	
	1.9 kΩ	38 mΩ	
	10 kΩ	180 mΩ	
	19 kΩ	430 mΩ	
	100 kΩ	1.8 Ω	
	190 kΩ	4 Ω	
	1 MΩ	31 Ω	
	1.9 MΩ	58 Ω	
	10 MΩ	550 Ω	
19 MΩ	1.2 kΩ		
100 MΩ	15 kΩ		
Resistance –Measure <sup>1,2,3</sup>	0.1 Ω to 10 Ω	18 μΩ/Ω + 62 μΩ	Comparisons performed with a 8 ½ Digit Multimeter
	10 Ω to 100 Ω	16 μΩ/Ω + 570 μΩ	
	100 Ω to 1 kΩ	14 μΩ/Ω + 520 μΩ	
	1 kΩ to 10 kΩ	13 μΩ/Ω + 540 μΩ	
	10 kΩ to 100 kΩ	14 μΩ/Ω + 56 mΩ	
	100 KΩ to 1 MΩ	20 μΩ/Ω + 2.2 Ω	
	1 MΩ to 10 MΩ	61 μΩ/Ω + 110 Ω	
	10 MΩ to 100 MΩ	600 μΩ/Ω + 2.1 kΩ	

**Electricity and Magnetism – Current**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
DC Current - Source <sup>1,2,3</sup>	22 μA to 220 μA	70 μA/A + 0.01 μA	Comparisons performed with a Multifunction Calibrator and DMM
	220 μA to 2.2 mA	69 μA/A + 0.01 μA	
	2.2 mA to 22 mA	70 μA/A + 0.1 μA	
	22 mA to 220 mA	81 μA/A + 1 μA	
	220 mA to 2.2 A	110 μA/A + 36μA	
	2.2 A to 10 A	0.7mA/A + 0.4 mA	
DC Current – Measure <sup>1,2,3</sup>	10 μA to 100 μA	20 μA/A + 2 nA	Comparisons performed with a Multifunction Calibrator and DMM
	100 μA to 1 mA	21 μA/A + 11 nA	
	1 mA to 10 mA	21 μA/A + 110 nA	
	10 mA to 100 mA	38 μA/A + 1 μA	
	100 mA to 1 A	122 μA/A + 20 μA	
AC Current - Source <sup>2,3</sup>	22 μA to 220 μA	480 μA/A + 0.03 μA 800 μA/A + 0.06 μA 2 mA/A + 0.1 μA	Comparisons performed with a Multifunction Calibrator and DMM
	220 μA to 2.2 mA	220 μA/A + 0.04 μA 814 μA/A + 0.6 μA 2 mA/A + 1.2 μA	
	2.2 mA to 22 mA	500 μA/A + 0.43 μA 815 μA/A + 6 μA 2 μA/A + 12 μA	

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
22 mA to 220 mA	40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	240 $\mu$ A/A + 4 $\mu$ A 815 $\mu$ A/A + 60 $\mu$ A 2 mA/A + 120 $\mu$ A	
220 mA to 2.2 A	40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	900 $\mu$ A/A + 44 $\mu$ A 1 mA/A + 110 $\mu$ A 1.2 mA/A + 230 $\mu$ A	
2.2 A to 10A	40 Hz to 1kHz	1.6 mA/A	
AC Current – Measure <sup>1,2,3</sup> 10 $\mu$ A to 100 $\mu$ A	20 Hz to 45 Hz 45 Hz to 1 kHz	5 mA/A + 35 nA 715 $\mu$ A/A + 35 nA	Comparisons performed with a multifunction Calibrator
100 $\mu$ A to 1 mA	20 Hz to 45 Hz 45 Hz to 1 kHz	5 mA/A + 0.3 $\mu$ A 0.40 mA/A + 0.2 $\mu$ A	
1 mA to 10 mA	20 Hz to 45 Hz 45 Hz to 1 kHz	5 mA/A + 2 $\mu$ A 0.4 mA/A + 2 $\mu$ A	
10 mA to 100 mA	10 Hz to 20 Hz 45 Hz to 1 kHz	0.41 mA/A + 22 $\mu$ A 0.40 mA/A + 20 $\mu$ A	
100 mA to 1 A	20 Hz to 45 Hz 45 Hz to 1 kHz	4 mA/A + 0.2 mA 1 mA/A + 0.2 mA	

**Electricity and Magnetism – Capacitance**

Calibration Parameter/Equipment	Range	Best Measurement Capability (+/-) <sup>2</sup>	Remarks
Capacitance <sup>2,3</sup> Source	0.33 nF to 11 nF 11 nF to 110 nF 330 nF to 1.1 $\mu$ F 3.3 $\mu$ F to 11 $\mu$ F 33 $\mu$ F to 110 $\mu$ F 330 $\mu$ F to 1.1 mF	5 mF/F + 0.02 nF 2 mF/F + 0.2 nF 2 mF/F + 2.2 nF 4 mF/F + 16 nF 6 mF/F + 130 nF 12 mF/F + 530 nF	Comparisons performed with a Multifunction Calibrator and LCR Meter
Measure	4 pF to 25 $\mu$ F	600 $\mu$ F/F	Comparisons performed with a Digital RLC Meter

**Electricity and Magnetism – Inductance**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Inductance – Measure / Source <sup>2</sup>	1 mH to 65 H	300 $\mu$ H/H	Comparisons performed with a Digital RLC Meter

**Electricity and Magnetism – Electrical Temperature Simulation**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
RTD – Pt 385 Simulate <sup>1,2,4</sup>	-200 $^{\circ}$ C to 0 $^{\circ}$ C 100 $^{\circ}$ C to 630 $^{\circ}$ C 630 $^{\circ}$ C to 800 $^{\circ}$ C	0.06 $^{\circ}$ C 0.08 $^{\circ}$ C 0.27 $^{\circ}$ C	Comparisons performed with a Multifunction Calibrator and electronic thermometer

**Electricity and Magnetism / Time and Frequency – Oscilloscopes**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Oscilloscopes <sup>1,2,3</sup>			FLUKE 5500A/SC300
Time Markers	2 nS to 1 μS 2 μS to 5 S	12 mS/S 12 mS/S	
DC Voltage Source <sup>1</sup> Oscilloscopes into 50 ohms	0 to 2.2 V	3 mV/V + 0.12 mV	
DC Voltage Source <sup>1</sup> Oscilloscopes Into 1M ohms	0 to 33 V	3 mV/V + 0.12 mV	
Square Wave, Source <sup>1</sup> Oscilloscopes into 50 ohms	1.8 mV to 2.2 Vp-p	3 mV/V + 0.12 mV	
Square Wave, Source <sup>1</sup> Oscilloscopes into 1M ohms	1.8 mV to 105 Vp-p	3 mV/V + 0.12 mV	
Leveled Sine Wave <sup>1</sup> Amplitude 50 kHz (reference)	5 mV to 5.5V	23 mV/V + 0.24 mV	
Leveled Sine Wave <sup>1</sup> Amplitude 50 kHz to 100 MHz	5 mV to 5.5 V	41 mV/V + 0.35 mV	
Leveled Sine Wave <sup>1</sup> Amplitude 100 MHz to 300 MHz	5 mV to 3 V	50 mV/V + 0.35 mV	
Leveled Sine Wave Flatness <sup>1</sup> Relative to 50 kHz 50 kHz to 100 MHz	5mV to 5.5V	18 mV/V + 0.13 mV	
Leveled Sine Wave Flatness <sup>1</sup> Relative to 50 kHz 100 MHz to 300 MHz	5 mV to 3 V	27 mV/V + 0.16 mV	
Level Sine Wave <sup>1</sup> Frequency	50 kHz to 300 MHz	29 Hz/MHz	
Leading Edge Risetime <sup>1</sup>	1 kHz to 1 MHz	1.2 nsec	

**Time and Frequency – Frequency / Period**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Frequency Stability <sup>2</sup>	10 MHz	2.5 x 10 <sup>-7</sup> MHz	Comparisons performed with a Multifunction Frequency Counter
Frequency Measure	1 mHz to 1.3 GHz	2 x 10 <sup>-6</sup> MHz	Measurement made with a Frequency Counter
Frequency Source	1 mHz to 1.05 GHz	2 x 10 <sup>-6</sup> MHz	Frequencies generated by Signal Generator/Level Generator monitored by a counter

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Stopwatch	Up to 24 hrs	0.03 sec/day	Compared against Function Generator/Counter
Process Timers	Up to 24 hrs	0.6 sec/day	Certified Stopwatch

**Thermodynamic – Thermocouples**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Thermocouple Simulation <sup>1,2,4</sup> Type J	-210 °C to -100 °C -100 °C to -30 °C -30 °C to 150 °C 150 °C to 760 °C 760 °C to 1200 °C	0.32 °C 0.19 °C 0.16 °C 0.2 °C 0.27 °C	Comparisons performed with a Multifunction Calibrator and Electronic Thermometer
K	-200 °C to -100 °C -100 °C to 120 °C 120 °C to 1000 °C 1000 °C to 1372 °C	0.38 °C 0.19 °C 0.30 °C 0.46 °C	
R	0 °C to 250 °C 250 °C to 1000 °C 1000 °C to 1767 °C	0.66 °C 0.41 °C 0.47 °C	
T	-250 °C to -150 °C -150 °C to 0 °C 0 °C to 400 °C	0.73 °C 0.28 °C 0.19 °C	

**Thermodynamic – Thermodynamic Devices (all)**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Thermodynamic <sup>2,4</sup> Measure/Source	-35 °C to 400 °C	0.04 °C	Comparisons performed with a 7 ½ Digit Multimeter and SPRT Thermometer Calibration Bath and Dry well
Humidity <sup>2,4</sup> Measure	20 % RH to 90 % RH	1.6 % RH	Vaisala HM70
Simulation	33.1 % RH to 75.5 %RH	1.6 % RH	Vaisala HM70

**Amount of Substance – Chemical – Conductivity and pH**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Conductivity – Source <sup>1,2,4</sup>	1000 μS/cm	23 μS/cm	Conductivity Solutions
	10 mS/cm	0.6 mS/cm	
	100 mS/cm	2.5 mS/cm	
pH <sup>2,3,4</sup>	4 pH to 10 pH	0.07 pH	pH Solutions

**Notes:**

- 1) Laboratory offers calibration services at the laboratory's own facilities and at the client or other agreed upon facilities.
- 2) Best uncertainties represent expanded uncertainties at approximately the 95% confidence level using a coverage factor of k=2.
- 3) Uncertainties stated as floor plus fractional part of reading
- 4) Uncertainty value applies to entire range identified for these measurements.

Approved by:  Date: May 22, 2009

R. Douglas Leonard Jr.  
Chief Technical Officer