SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1-1994

MICRO PRECISION CALIBRATION
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CALIBRATION

Valid To: July 31, 2011 Certificate Number: 935.09

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1]:

I. Dimensional

Parameter/Equipment	Range	Best Uncertainty[2, 6] (±)	Comments
Calipers & Height Gages[3]	(0.10 to 36) in (36 to 48) in	(56 µin + 0.6*L*) µin (1167 + 0.6L) µin	Mitutoyo gage blocks
Gage Blocks	(0 to 12) in	(5 + 0.6*L*) µin	Federal gage block comparator and master gage blocks
Surface Plates[3] Surface Repeatability	12 in to 30 ft	40 µin	Repeat-O-Meter (only valid in connection with flatness calibration)
Cylindrical Plug Gages	(0 to 12) in	(12 + 0.34*L*) µin	Sip measuring machine

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Parameter/Equipment	Range	Best Uncertainty[2, 6] (±)	Comments
Thread Plug Gages – Major Diameter Pitch Diameter	(0 to 12) in	(50 + 0.6*D*) µin	Sip measuring machine
Ring Gauges, Cylindrical & Tapered	(0.02 to 12) in	(11 + 1.5*L*) µin	Sip measuring machine
Indicators, Resolution – 0.00005 in 0.0001 in 0.001 in	 (0 to 1) in (0 to 2) in (0 to 8) in	 46 µin 92 µin 870 µin	Sip measuring machine
End Measuring Rods	(0 to 12) in	(5 + 0.6*L*) µin	Sip measuring machine
Pin Gages, Diameter	(0.02 to 2.00) in	75 µin	Sip measuring machine
Micrometers[3] – Length and Flatness, Resolution: 100 µin 50 µin	(0.10 to 12) in	(54 + 3*L*) µin (28 + 2*L*) µin	Mitutoyo gage blocks, optical flat, monochromic light source
Pitch Diameter, External Threads	(0.10 to 4.00) in	(26 + 10*L*) µin	Sip measuring machine

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	Best Uncertainty[2, 4, 5] (±)	Comments
DC Voltage – Generate[3]	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	11 µV/V + 0.6 µV 10 µV/V + 1.0 µV 11 µV/V + 3.5 µV 10 µV/V + 6.5 µV 11 µV/V + 80 µV 13 µV/V + 500 µV	Fluke 5700A w/option 03

Parameter/Equipment	Range	Best Uncertainty[2, 4, 5] (±)	Comments
DC Voltage – Measure[3]	(0 to 100) mV 100 mV to 1V (1 to 10) V (10 to 100) V (100 to 1000) V	13 µV/V + 3.0 µV 17 µV/V + 0.3 µV 13 µV/V + 0.5 µV 15 µV/V + 30 µV 27 µV/V + 100 µV	HP 3458A
DC Current – Generate[3]	(0 to 220) µA 220 µA to 22 mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A (11 to 20.5) A	50 µA/A + 8 nA 50 µA/A + 8 nA 50 µA/A + 80 nA 60 µA/A + 0.8 µA 80 µA/A + 25 µA 0.12 %	Fluke 5700A w/option 03 Fluke 5500A
DC Current – Measure[3]	Up to 100 nA 100 nA to 1 µA (1 to 10) µA (10 to 100) µA 100 µA to 10 mA (10 to 100) mA 100 mA to 1 A	35 µA/A + 400 µA 25 µA/A + 40 µA 25 µA/A + 10 µA 25 µA/A + 5 µA 25 µA/A + 5 µA 40 µA/A + 5 µA 0.012 % + 10 µA	HP 3458A
High DC Current[3]	(1 to 500) A	1.3 %	Fluke 5500A with current coil Hall Effect
Resistance – Generate[3]	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 0.33 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ 330 MΩ to 1.1 GΩ	0.12 % + 0.008 Ω 0.17 % 0.018 % 0.024 % 0.009 % + 0.06 Ω 0.024 % 0.009 % + 0.6 Ω 0.012 % 0.011 % + 6 Ω 0.013 % 0.015 % + 55 Ω 0.019 % 0.016 % 0.041 % 0.058 % 0.37 % 1.8 %	Fluke 5500A

Parameter/Equipment	Range	Best Uncertainty[2, 4, 5] (±)	Comments
Resistance (cont.) – Generate, Fixed Points[3]	1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ	0.013 % 39 parts in 10^6 24 parts in 10^6 18 parts in 10^6 17 parts in 10^6 19 parts in 10^6 27 parts in 10^6 54 parts in 10^6 0.016 %	Fluke 5700A w/option 03
Resistance – Measure[3]	(0 to 10) Ω (10 to 100) Ω 100 Ω to 100 kΩ 100 k Ω to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	19 parts in 10^6 + 0.06 mΩ 15 parts in 10^6 + 0.6 mΩ 13 parts in 10^6 + 0.6 mΩ 18 parts in 10^6 + 2.4 Ω 59 parts in 10^6 + 120 Ω 0.058 % + 1.2 kΩ 1.8 % + 10 kΩ	HP 3458A
Capacitance – Generate[3]	(0.33 to 10.999) nF (11 to 109.99) nF (110 to 329.99) nF (0.33 to 1.0999) µF (1.1 to 3.2999) µF (3.3 to 10.999) µF (11 to 32.999) µF (33 to 109.99) µF (110 to 329.99) µF (330 to 1.1) mF	0.5 % + 0.01 nF 0.25 % + 0.1 nF 0.25 % + 0.3 nF 0.25 % + 1 nF 0.35 % + 3 nF 0.35 % + 10 nF 0.40 % + 30 nF 0.50 % + 100 nF 0.70 % + 300 nF 1 % + 300 nF	Fluke 5500A
Inductance – Generate [3] Fixed Points	 1.0 mH 100 mH 1 H	 0.059 % rdg 0.062 % rdg 0.082 % rdg	 Genrad 1482
Electrical Calibration of Thermocouple Indicators[3] – Type E	 -250 ºC to -100 ºC -100 ºC to 650 ºC 650 ºC to 1000 ºC	 0.5 ºC 0.16 ºC 0.21 ºC	 Fluke 5500A

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Electrical Calibration of Thermocouple Indicators (cont.)[3] –			
Type J	-210 ºC to -100 ºC -100 ºC to 760 ºC 760 ºC to 1200 ºC	0.27 ºC 0.17 ºC 0.23 ºC	Fluke 5500A
Type K	-200 ºC to -100 ºC -100 ºC to 120 ºC 120 ºC to 1000 ºC 1000 ºC to 1372 ºC	0.33 ºC 0.18 ºC 0.26 ºC 0.04 ºC	
Type S	0 ºC to 250 ºC 250 ºC to 1400 ºC 1400 ºC to 1767 ºC	0.47 ºC 0.37 ºC 0.46 ºC	
Type T	-250 ºC to -150 ºC -150 ºC to 0 ºC 0 ºC to 400 ºC	0.63 ºC 0.24 ºC 0.16 ºC	
Electrical Calibration of RTD Indicating Systems[3] –			
Pt 385, 100 Ω	-200 °C to 0 °C 0 °C to 100 °C 100 °C to 400 °C 400 °C to 630 °C 630 °C to 800 °C	0.05 °C 0.07 °C 0.1 °C 0.12 °C 0.23 °C	Fluke 5500A
Pt 3926, 100 Ω	-200 °C to 0 °C 0 °C to 100 °C 100 °C to 400 °C 400 °C to 630 °C	0.05 °C 0.07 °C 0.1 °C 0.12 °C	
Pt 3916, 100 Ω	-200 °C to -190 °C -190 °C to 0 °C 0 °C to 300 °C 300 °C to 600 °C 600 °C to 630 °C	0.25 °C 0.05 °C 0.08 °C 0.1 °C 0.23 °C	
Pt 385, 200 Ω	-200 °C to 100 °C 100 °C to 260 °C 260 °C to 600 °C 600 °C to 630 °C	0.04 °C 0.05 °C 0.14 °C 0.16 °C	

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Electrical Calibration of RTD Indicating Systems (cont.)[3] –			
Pt 385, 500 Ω	-200 °C to 100 °C 100 °C to 260 °C 260 °C to 600 °C 600 °C to 630 °C	0.05 °C 0.06 °C 0.09 °C 0.11 °C	Fluke 5500A
Pt 385, 1 kΩ	-200 °C to 100 °C 100 °C to 260 °C 260 °C to 600 °C 600 °C to 630 °C	0.03 °C 0.05 °C 0.07 °C 0.23 °C	
PtNi 385, 100 Ω	-80 °C to 100 °C 100 °C to 260 °C	0.08 °C 0.14 °C	
Cu 427, 10 Ω	-100 °C to 260 °C	0.3 °C	

Parameter/Range	Frequency	Best Uncertainty[2, 4] (±)	Comments
AC Voltage – Generate[3]			
(0 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz	0.055 %+ 13 µV 0.021 % + 8 µV 0.011 % + 8 µV 0.037 % + 8 µV 0.085 % + 25 µV 0.34 % + 80 µV	Fluke 5700A w/option 03
220 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz	0.05 % + 80 µV 0.016 % + 25 µV 75 µV/V + 6 µV 0.012 % + 16 µV 0.025 % + 70 µV 0.22 % + 850 µV	
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz	0.05 % + 0.8 mV 0.016 % + 0.25 mV 75 µV/V + 0.06 mV 0.012 % + 0.16 mV 0.025 % + 0.35 mV 0.34 % + 8.5 mV	

Parameter/Range	Frequency	Best Uncertainty[2, 4, 5] (±)	Comments
AC Voltage (cont.) – Generate[3]			
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz	0.05 % + 8 mV 0.016 % + 2.5 mV 80 µV/V + 0.8 mV 0.022 % + 3.5 mV 0.05 % + 8 mV 1.6 % + 190 mV	Fluke 5700A w/option 03
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.06 % + 11 mV 0.23 % 45 mV	
(220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.04 % + 16 mV 90 µV/V + 4 mV	
AC Voltage – Measure[3]			
Up to 10 mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.03 % + 3 µV 0.02 % + 2 µV 0.03 % + 2 µV 0.12 % + 2 µV 0.58 % + 2 µV 4.6 % + 2 µV	HP 3458A, synchronous sub-sampled mode
10 mV to 10 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz	80 µV/V + 0.4 mV 80 µV/V + 0.2 mV 0.02 % + 0.2 mV 0.03 % + 0.2 mV 0.09 % + 0.2 mV 0.35 % + 1 mV 1.2 % + 1 mV 1.7 % + 1 mV	
(10 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.02 % + 4 mV 0.02 % + 2 mV 0.04 % + 2 mV 0.14 % + 2 mV 0.46 % + 10 mV 1.7 % + 10 mV	
(100 to 1000) V	(1 to 40) Hz 40 Hz to 1 kHz	0.05 % + 40 mV 0.05 % + 20 mV	
(1 to 20) kV	(1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.07 % + 20 mV 0.14 % + 20 mV 0.35 % + 20 mV	

Parameter/Range	Frequency	Best Uncertainty[2, 4, 5] (±)	Comments
AC Current– Generate[3]			
(1 to 220) µA 220 µA to 22 mA (22 to 220) mA 220 mA to 2.2 A	40 Hz to 1 kHz	0.09 % 0.024 % 0.026 % 0.093 %	Fluke 5700A w/option 03
AC Current [3]– Measure			
Up to 100 µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz	0.46 % + 0.03 µA 0.18 % + 0.03 µA 0.078 % + 0.03 µA	HP 3458A
100 µA to 100 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % + 20 µA 0.17 % + 20 µA 0.073 % + 20 µA 0.042 % + 20 µA	
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % + 200 µA 0.19 % + 200 µA 0.1 % + 200 µA 0.12 % + 200 µA	
(1 to 500) A	(50 to 70) Hz	0.32 %	Fluke 5500 with Fluke coil

III. Electrical – RF/Microwave

Parameter/Range	Frequency	Best Uncertainty[2] (±)	Comments
RF Tuned Power Relative – Measure[3]			
(-0.0 to -3) dB (-3 to -10) dB (-10 to -40) dB (-40 to -50) db (-50 to -80) dB (-80 to -90) dB (-90 to -110) dB (-110 to -127) dB	2.5 MHz (18 to 26.5)	0.02 dB 0.02 dB 0.08 dB 0.14 dB 0.2 dB 0.26 dB 0.3 dB 0.4 dB	HP 8902A, HP11722A,

Parameter/Range	Frequency	Best Uncertainty[2] (±)	Comments
RF Power[3] –			
Absolute RF, Measure (-30 to -20 dBm	(50 MHz to 50 GHz)	0.06 dBm	HP 438A, 8484A, 8482A
(10 to 20) dBm	(50 MHz to 50 GHz)	1.2 dB	8485A, 8487A
Amplitude Modulation – Measure[3]			
Rate: 150 kHz to 10 MHz Depth: (5 to 99) %	50 Hz to 10 kHz 20 Hz to 10 kHz	2 % + 1 digit of rdg 3 % + 1 digit of rdg	HP 8902A
Rate: 10 MHz to 1.3 GHz Depth: (5 to 99) %	50 Hz to 10 kHz 20 Hz to 10 kHz	1 % + 1 digit of rdg 3 % + 1 digit of rdg	
Frequency Modulation – Measure[3]			
Rate: 250 kHz to 10 MHz Dev: ≤ 40 kHz	50 Hz to 10 kHz	2 % + 1 digit of rdg	HP 8902A
Rate: 10 MHz to 1.3 GHz Dev: ≤ 400 kHz	50 Hz to 100 kHz 20 Hz to 200 kHz	1 % + 1 digit of rdg 5 % + 1 digit of rdg	

IV. Mechanical

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Torque[3] – Measure	(0 to 400) in·oz (0 to 50) in·lb (0 to 150) in-lb (0 to 400) in·lb (0 to 600) ft·lb	0.83 % of rdg 0.92 % of rdg 0.7 % of rdg 0.66 % of rdg 0.68 % of rdg	CDI torque system
Scales and Balances[3]	1mg to 30 kg (10 to 1000) lb	1.0 LSVD 300 mg	Verification with class 1 Class F weights

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Mass –	(1 to 500) mg	2 µg	Class 1 with balance
Fixed Points	1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g	3 µg 4 µg 5 µg 8 µg 10 µg 23 µg 36 µg 44 µg	Class 1 with balance
	10 kg	3 mg	Class 4 with balance
Pressure – Measure[3]	(-15 to 100) psi Up to 1000 psi Up to 10 000 psi	0.1 % of rdg 0.09 % of rdg 0.15 % of rdg	Heise PTE-1 Fluke 700P08 Heise HQS-2-B-I-G

V. Thermodynamics

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Humidity – Measuring Equipment[3]	11 % RH 33 % RH 75 % RH 97 % RH	1.6 % RH of rdg 1.7 % RH of rdg 1.5 % RH of rdg 2 % RH of rdg	Saturated salt solutions
Temperature – Measuring Equipment	(-20 to 600) ºC	0.53 ºC	SPRT and Hart 9105 calibrator

VI. Time & Frequency

Parameter/Equipment	Range	Best Uncertainty[2,] (±)	Comments
Frequency – Measuring Equipment	10 MHz	5×10^{-12} Hz	HP 58503A, GPS

[1] This laboratory offers commercial calibration service and field calibration service.

[2] "Best Uncertainty" is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards of nearly ideal measuring equipment. Best uncertainties represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The best uncertainty of a specific calibration performed by the laboratory may be greater than the best uncertainty due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

[3] Field calibration service is available for this calibration and this laboratory meets A2LA *R104 – General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. Please note the uncertainties achievable on a customer's site can normally be expected to be larger than the Best Measurement Capabilities (BMC) that the accredited laboratory has been assigned as Best Uncertainty on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the calibration uncertainty being larger than the BMC.

[4] The measurands stated are generated with the Fluke 5500A, Fluke 5700A series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. Best measurement uncertainties are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.

[5] The measurands stated are measured with the HP 3458A series of instruments. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. Best measurement uncertainties are expressed as either a specific value that covers the full range or as a combination of the fraction of the reading/output plus a range specification.

[6] In the statement of best uncertainty, L is the numerical value of the nominal length of the device measured in inches. D is the numerical value of the nominal diameter of the device measured in inches. Pitch diameter is measured by the three-wire method.

The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Laboratory

A2LA has accredited

MICRO PRECISION CALIBRATION, INC.

Tampa, FL

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 2nd day of June 2009.

President & CEO
For the Accreditation Council
Certificate Number 935.09
Valid to July 31, 2011

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.