The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Laboratory

A2LA has accredited

MICRO PRECISION CALIBRATION, INC.

Garden Grove, CA

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 31st day of July 2009.

President & CEO
For the Accreditation Council
Certificate Number 935.11
Valid to October 31, 2011
Revised: August 3, 2009

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

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

MICRO PRECISION CALIBRATION
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CALIBRATION

Valid To: October 31, 2011 Certificate Number: 935.11

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, 4] (±)	Comments
Calipers & Height Gages[3]	(0.1 to 24) in	(56 + 0.6*L*) µin	Mitutoyo gage blocks
Optical Comparators and Visual Systems	Up to 200 mm	130 µm	Mitutoyo gage blocks
Gage Blocks – Length Only	(0 to 12) in	(56 + 0.6*L*) µin	P & W labmaster, master gage blocks
Cylindrical Plug Gages	(0 to 12) in	(12 + 0.34*L*) µin	P & W labmaster, master gage blocks
Thread Plug Gage – Major Diameter Pitch Diameter	(0 to 12) in	(5 + 0.6*L*) µin	P & W labmaster
Ring Gage – Cylindrical, Tapered	(0.02 to 12) in	(11 + 1.5*L*) µin	P & W labmaster

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Parameter/Equipment	Range	Best Uncertainty[2, 4] (±)	Comments
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	P & W labmaster, master gage blocks
End Measuring Rods	(0 to 12) in	(5 + 0.6*L*) µin	P & W labmaster, master gage blocks
Pin Gage – Diameter	(0.02 to 2) in	75 µin	P & W labmaster, master gage blocks
Micrometers [3]– Resolution: 100 µin 50 µin	 (0.1 to 12) in	 (54 + 3*L*) µin (28 + 2*L*) µin	Mitutoyo gage blocks
Pitch Diameter, External Threads	(0.1 to 4) in	(26 + 10*L*) µin	Supermicrometer and thread wires (three wire method)

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	Best Uncertainty[2, 5] (±)	Comments
DC Voltage[3] – Generate	(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 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

Parameter/Equipment	Range	Best Uncertainty[2, 4, 5, 6] (±)	Comments
DC Voltage[3] – Measure	(0 to 100) mV 100 mV to 1V (1 to 10) V (10 to 100) V (100 to 1000) V	13 µV/V + 3 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[3] – Generate	(0 to 220) µA 220 µA to 22 mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) 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	Fluke 5700A
DC Current[3] – Measure	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
Resistance[3] – Generate	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 330 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 0.53 % + 0.015 Ω 0.02 % + 0.015 Ω 0.014 % + 0.015 Ω 0.017 % + 0.06 Ω 0.013 % + 0.06 Ω 0.017 % + 0.6 Ω 0.013 % + 0.6 Ω 0.02 % + 6 Ω 0.016 % + 6 Ω 0.024 % + 55 Ω 0.02 % + 55 Ω 0.076 % + 550 Ω 0.12 % + 550 Ω 0.58 % + 5.5 kΩ 0.58 % + 5.5 kΩ 2 %	Fluke 5500A

Parameter/Equipment	Range	Best Uncertainty[2, 4, 5, 6] (±)	Comments
Resistance[3] – Generate Fixed Points	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[3] – Measure	(0 to 10) Ω (10 to 100) Ω 100 Ω to 100 kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	19 parts in 10^6 + 0.06 mΩ 13 parts in 10^6 + 0.6 mΩ 10 parts in 10^6 + 0.6 mΩ 15 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
Electrical Calibration of Thermocouple Indicators[3] –			
Type E	-250 ºC to -100 ºC -100 ºC to 650 ºC 650 ºC to 1000 ºC	0.56 ºC 0.54 ºC 0.53 ºC	Fluke 5500A
Type J	-210 ºC to -100 ºC -100 ºC to 760 ºC 760 ºC to 1200 ºC	0.48 ºC 0.45 ºC 0.43 ºC	
Type K	-200 ºC to -100 ºC -100 ºC to 120 ºC 120 ºC to 1000 ºC 1000 ºC to 1372 ºC	0.48 ºC 0.44 ºC 0.46 ºC 0.47 ºC	
Type S	0 ºC to 250 ºC 250 ºC to 1400 ºC 1400 ºC to 1767 ºC	0.48 ºC 0.47 ºC 0.54 ºC	
Type T	-250 ºC to -150 ºC -150 ºC to 0 ºC 0 ºC to 400 ºC	0.56 ºC 0.52 ºC 0.58 ºC	

Parameter/Equipment	Range	Best Uncertainty[2, 5] (±)	Comments
Electrical Calibration of RTD Indicating Systems[3] –			
Pt 395, 100 Ω	-200 ºC to 0 ºC 0 ºC to 100 ºC 100 ºC to 400 ºC 400 ºC to 630 ºC 630 ºC to 800 ºC	0.05 ºC 0.07 ºC 0.1 ºC 0.12 ºC 0.23 ºC	Fluke 5500A
Pt 3926, 100 Ω	-200 ºC to 0 ºC 0 ºC to 100 ºC 100 ºC to 400 ºC 400 ºC to 630 ºC	0.05 ºC 0.07 ºC 0.1 ºC 0.12 ºC	
Pt 3916, 100 Ω	-200 ºC to -190 ºC -190 ºC to 0 ºC 0 ºC to 300 ºC 300 ºC to 600 ºC 600 ºC to 630 ºC	0.25 ºC 0.05 ºC 0.08 ºC 0.1 ºC 0.23 ºC	
Pt 385, 200 Ω	-200 ºC to 100 ºC 100 ºC to 260 ºC 260 ºC to 600 ºC 600 ºC to 630 ºC	0.05 ºC 0.06 ºC 0.09 ºC 0.11 ºC	
Pt 385, 1 kΩ	-200 ºC to 100 ºC 100 ºC to 260 ºC 260 ºC to 600 ºC 600 ºC to 630 ºC	0.03 ºC 0.05 ºC 0.07 ºC 0.23 ºC	
PtNi 385, 100 Ω	-80 ºC to 100 ºC 100 ºC to 260 ºC	0.08 ºC 0.14 ºC	
Cu 427, 10 Ω	-100 ºC to 260 ºC	0.3 ºC	

Parameter/Range	Frequency	Best Uncertainty[2, 4, 5] (±)	Comments
AC Voltage[3] – Generate			
(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	
(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 0.27 % + 190 mV	
(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	

Parameter/Range	Frequency	Best Uncertainty[2, 4, 5, 6] (±)	Comments
AC Voltage[3] – Measure			
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 (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.05 % + 40 mV 0.05 % + 20 mV 0.07 % + 20 mV 0.14 % + 20 mV 0.35 % + 20 mV	
AC Current[3] – Generate			
40 Hz to 1 kHz	(1 to 220) µA 220 µA to 22 mA (22 to 220) mA 220 mA to 2.2 A	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

Parameter/Range	Frequency	Best Uncertainty[2, 4, 5, 6] (±)	Comments
AC Current[3] (cont.) – Measure			
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	HP 3458A
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	
Capacitance[3] – Generate			
(0.19 to 3.3) nF (3.3 to 330) nF 330 nF to 3.3 µF (3.3 to 33) µF (33 to 330) µF (330 µF to 3.3 mF (3.3 to 33) mF (33 to 110) mF	50 Hz to 1 kHz 50 Hz to 300 Hz 	0.5 % + 0.01 nF 0.25 % + 0.3 nF 0.25 % + 3 nF 0.4 % + 30 nF 0.45 % + 0.3 µF 0.45 % + 3 µF 0.75 % + 30 µF 1.1 % + 100 µF	Fluke 5500A

III. Electrical – RF/Microwave

Parameter/Range	Frequency	Best Uncertainty[2] (±)	Comments
RF Tuned Power[3] – Generate, Connector Type N, (0 to -100) dB	Up to 1.3 GHz Up to 26.5 GHz	0.4 dB 0.72 dB	HP 8902A, w/HP11722A, HP 11792A
RF Absolute Power[3] – Generate Connector Type N			
50 MHz to 26.5 GHz	(-30 to -20) dB (-20 to 10) dB (10 to 20) dB	0.06 dB 0.068 dB 1.2 dB	E4419B, 8484A, 8481A, 8487A

Parameter/Range	Frequency	Best Uncertainty[2, 4] (±)	Comments
Amplitude Modulation[3] – Measure			
Rate: 150 kHz to 10 MHz Depth: (5 to 99) %	50 Hz to 10 kHz 20 Hz to 100 kHz	4 % 4.6 %	HP 8902A
Rate: 10 MHz to 1.3 GHz Depth: (5 to 99) %	50 Hz to 50 kHz 20 Hz to 100 kHz	3.6 % 4.6 %	
Frequency Modulation – Measure[3]			
Rate: 250 kHz to 10 MHz Dev: ≤ 40 kHz	20 Hz to 10 kHz	3.1 %	HP 8902A
Rate: 10 MHz to 1.3 GHz Dev: ≤ 400 kHz	20 Hz to 200 kHz 50 Hz to 100 kHz	7.7 % 1.6 %	
Phase Modulation[3] – Measure			
Rate: 10 MHz to 1.3 GHz	200 Hz to 20 kHz	7 %	HP 8902A

IV. Mechanical

Parameter/Equipment	Range	Best Uncertainty[2, 4] (±)	Comments
Pressure[3]	(-15 to 30) psi Up to 1000 psi Up to 10 000 psi	0.1 % 0.09 % 0.1 %	Druck pressure calibrator
Volume – Volumetric Glassware	(0 to 250) mL (250 to 600) mL (600 to 1000) mL	0.12 mL 0.21 mL 0.31 mL	Gravimetric, electronic balance and weights

Parameter/Equipment	Range	Best Uncertainty[2, 4] (±)	Comments
Torque[3]	(16 to 160) in·oz. (0 to 100) in·lb (50 to 500) ft·lb	0.77 % 0.65 % 0.61 %	Torque system
Scales and Balances[3]	1 mg to 30 kg (10 to 600) lb	1 LSVD 0.3 lb	Verification with class 1 weights Class F weights
Mass	Up to 500 mg Up to 500 g Up to 15 kg	0.018 % 0.024 % 0.3 %	Double substitution NIST handbook 44 using Class 1 weights Class 1/Class F weights

V. Thermodynamics

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Humidity – Measuring Equipment	11 % RH 75.4 % RH 97 % RH	1.6 % RH 1.5 % RH 2 % RH	Standard salt solutions
Temperature – Measuring Equipment	(0 to 300) °C	0.33 °C	Jofra calibrator

VI. Time and Frequency

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Frequency – Measure Fixed Point	10 MHz Up to 26.5 GHz	1×10^{-11} Hz 1×10^{-11} Hz	Trembel GPS HP53132A driven by 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] In the statement of best uncertainty, the value is defined as the percentage of reading and L is the numerical value of the nominal length of the device measured in inches.

[5] The measurands stated are generated with the Fluke 5500A, and 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.

[6] 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.