



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, 2013

Certificate Number: 0935.11

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Dimensional

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Calipers & Height Gages ³	(0.1 to 24) in	(56 + 0.6L) μin	Mitutoyo gage blocks
Cylindrical Plug and Pin Gages	(0 to 12) in	(12 + 0.34L) μin	Universal measuring machine (UMM) and gage blocks
Thread Plug Gage – Major Diameter Pitch Diameter	(0 to 12) in (0.1 to 4) in	(5 + 0.6L) μin (66 + 10L) μin	UMM UMM w/thread wires
Micrometers ³	(0.1 to 12) in	(54 + 3L) μin (28 + 2L) μin	Gage blocks
Pitch Diameter, External Threads	(0.1 to 4) in	(26 + 10L) μin	Universal measuring machine (UMM) and thread wires

Parameter/Equipment	Range	CMC ² (±)	Comments
Indicators	(0 to 1) in (0 to 2) in (0 to 8) in	46 µin 92 µin 870 µin	Universal Measuring Machine (UMM), gage blocks

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 5, 6} (±)	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
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

Parameter/Equipment	Range	CMC ^{2,5,6} (\pm)	Comments
Resistance ³ – Generate	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) k Ω (1.1 to 3.3) k Ω (3.3 to 11) k Ω (11 to 33) k Ω (33 to 110) k Ω (110 to 330) k Ω 330 k Ω to 1.1 M Ω (1.1 to 3.3) M Ω (3.3 to 11) M Ω (11 to 33) M Ω (33 to 110) M Ω (110 to 330) M Ω 330 M Ω to 1.1 G Ω	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 k Ω 0.58 % + 5.5 k Ω 2 %	Fluke 5500A
Resistance ³ – Generate Fixed Points	1 Ω 10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω 100 M Ω	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 k Ω 100 k Ω to 1 M Ω (1 to 10) M Ω (10 to 100) M Ω 100 M Ω to 1 G Ω	19 parts in 10 ⁶ + 0.06 m Ω 13 parts in 10 ⁶ + 0.6 m Ω 10 parts in 10 ⁶ + 0.6 m Ω 15 parts in 10 ⁶ + 2.4 Ω 59 parts in 10 ⁶ + 120 Ω 0.058 % + 1.2 k Ω 1.8 % + 10 k Ω	HP 3458A
Electrical Calibration of Thermocouple Indicators ³ – Type E	-250 $^{\circ}$ C to -100 $^{\circ}$ C -100 $^{\circ}$ C to 650 $^{\circ}$ C 650 $^{\circ}$ C to 1000 $^{\circ}$ C	0.56 $^{\circ}$ C 0.54 $^{\circ}$ C 0.53 $^{\circ}$ C	Fluke 5500A

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouple Indicators ³ (cont) –			
Type J	-210 °C to -100 °C -100 °C to 760 °C 760 °C to 1200 °C	0.48 °C 0.45 °C 0.43 °C	Fluke 5500A
Type K	-200 °C to -100 °C -100 °C to 120 °C 120 °C to 1000 °C 1000 °C to 1372 °C	0.48 °C 0.44 °C 0.46 °C 0.47 °C	
Type S	0 °C to 250 °C 250 °C to 1400 °C 1400 °C to 1767 °C	0.48 °C 0.47 °C 0.54 °C	
Type T	-250 °C to -150 °C -150 °C to 0 °C 0 °C to 400 °C	0.56 °C 0.52 °C 0.58 °C	
Electrical Calibration of RTD Indicating Systems ³ –			
Pt 395, 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	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of RTD Indicating Systems ³ (cont) –			
Pt 385, 200 Ω	-200 °C to 100 °C 100 °C to 260 °C 260 °C to 600 °C 600 °C to 630 °C	0.05 °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	CMC ^{2,5} (±)	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	

Parameter/Range	Frequency	CMC ^{2,5,6} (±)	Comments
AC Voltage ³ (cont) – Generate			
(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	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 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	

Parameter/Range	Frequency	CMC ^{2, 5, 6} (\pm)	Comments
AC Current ³ – Generate (1 to 220) μ A 220 μ A 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 μ A 100 μ A to 100 mA 100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % + 0.03 μ A 0.18 % + 0.03 μ A 0.078 % + 0.03 μ A 0.46 % + 20 μ A 0.17 % + 20 μ A 0.073 % + 20 μ A 0.042 % + 20 μ A 0.46 % + 200 μ A 0.19 % + 200 μ A 0.1 % + 200 μ A 0.12 % + 200 μ A	HP 3458A
Capacitance ³ – Generate (0.19 to 3.3) nF (3.3 to 330) nF 330 nF to 3.3 μ F (3.3 to 33) μ F (33 to 330) μ F (330 μ F 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 μ F 0.45 % + 3 μ F 0.75 % + 30 μ F 1.1 % + 100 μ F	Fluke 5500A

III. Mechanical

Parameter/Equipment	Range	CMC ² (\pm)	Comments
Pressure ³	(-15 to 30) psi	0.18 % of Full Scale	Druck pressure calibrator

Parameter/Equipment	Range	CMC ^{2,7} (±)	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	0.25 g 0.3 lb	Verification w/class 1 weights Class F weights
Mass	Up to 500 mg Up to 500 g	2.0 mg 3.2 mg	Single substitution NIST handbook 44 using class 1 weights

IV. Thermodynamics

Parameter/Equipment	Range	CMC 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	PRT and Agilent 3458A

V. Time and Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency – Measure Fixed Point	10 MHz Up to 26.5 GHz	1 x 10 ⁻¹¹ Hz 1 x 10 ⁻¹¹ Hz	HP 58503A driven by GPS and HP 5343A

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

² Calibration and Measurement Capability (CMC) 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 or nearly ideal measuring equipment. Calibration and Measurement Capabilities represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC 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 actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found 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 actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

⁴ In the statement of CMC, 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. CMCs 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. CMCs 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.

⁷ In the statement of CMC, the value is defined as the percentage of reading, unless otherwise noted.



World Class Accreditation

The American Association for Laboratory 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 28th day of October 2011.





Peter Abney

President & CEO
For the Accreditation Council
Certificate Number 935.11
Valid to October 31, 2013

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