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

MICRO PRECISION CALIBRATION DE MEXICO
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CALIBRATION

Valid To: January 31, 2013 Certificate Number: 0935.03

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

I. Chemical Quantities

Parameter/Equipment	Range	CMC[2] (±)	Comments
Conductivity – Measure	(111 to 1285) mS (1015 to 1408) µS	0.51 µS 0.51 µS	Comparison to standard solutions
pH – Measure	(4, 7, 10) pH unit	0.02 pH unit	Comparison to standard solutions

II. Dimensional

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Calipers & Height Gages	(0.10 to 24) in	(56 + 0.6*L*) µin/in	Grade ASME 0
Optical Comparators and Visual Systems	Up to 200 mm	210 µm	Glass scale and gage blocks

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Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Micrometers	(0.10 to 12) in	(32 + 0.6*L*) µin/in	Grade ASME 0
Surface Plates Repeatability (Flatness Only)	(12 × 12) in to (72 x 144) in	50 µin	Repeat-o-meter
Pitch Diameter, External Threads	(0.10 to 4.00) in	(61 + 1.2*L*) µin	Supermicrometer and thread wires (three wire method)

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4, 5, 7] (±)	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	12 µV/V + 0.6 µV 12 µV/V + 1.0 µV 11 µV/V + 3.5 µV 12 µV/V + 6.5 µV 13 µV/V + 80 µV 13 µV/V + 500 µV	Fluke 5700A w/option 03
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 + 3.0 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
High Voltage	(1 to 20) kV	0.07 % + 4 V	Vitrek 4600A
DC Current[3] – Generate	(0 to 220) mA 220 mA to 22 mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A	40 µA/A + 8 nA 40 µA/A + 8 nA 44 µ A/A + 80 nA 47µ A/A + 0.8 µA 57µ A/A + 25 µA	Fluke 5700A w/option 03
	(11 to 20.5) A	0.12 %	Fluke 5500A
High Current	(1 to 500) A	0.90 %	Fluke 5500 w/Fluke coil

Parameter/Equipment	Range	CMC[2, 4, 5, 7] (±)	Comments
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 (1 to 10) A (1 to 100) A (100 to 300) A	35 µA/A + 400 µA 25 µA/A + 40 µA 25 µA/A + 10 µA 25 µA/A + 5 µA 25 uA/A + 5 µA 40 µA/A + 5 µA 0.012 % + 10 µA 0.12 % 0.12 % 0.12 %	HP 3458A Shunt monitored w/multimeter
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 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 100 MΩ to 1 GΩ	0.12 % + 0.008 Ω 0.17 % 0.02 % 0.02 % 90 µΩ/Ω + 0.06 Ω 0.02 % 90 µΩ/Ω + 0.6 Ω 0.1 % 0.011 % + 6 Ω 0.1 % 0.015 % + 55 Ω 0.02 % 0.02 % 0.04 % 0.06 % 0.37 % 1.8 % 0.57 %	Fluke 5500A HRRS-B decade resistance
Fixed Points	1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ	0.01 % 39 µΩ/Ω 24 µΩ/Ω 18 µΩ/Ω 17 µΩ/Ω 19 µΩ/Ω 27 µΩ/Ω 54 µΩ/Ω 0.02 %	Fluke 5700A w/option 03

Parameter/Equipment	Range	CMC[2, 4, 5, 7] (±)	Comments
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 μΩ/Ω + 0.06 mΩ 15 μΩ/Ω + 0.6 mΩ 13 μΩ/Ω + 0.6 mΩ 18 μΩ/Ω + 2.4 Ω 59 μΩ/Ω + 120 Ω 0.058 % + 1.2 kΩ 1.8 % + 10 kΩ	HP 3458A
Capacitance[3] – Generate	(0.33 to 0.49) nF (0.50 to 1.09) nF (1.10 to 3.29) nF (3.30 to 10.9) nF (11.0 to 32.9) nF (33 to 109.9) μF (110 to 329.9) μF (0.33 to 1.09) μF (1.10 to 3.29) μF (1 to 10) μF	3.3 % 1.4 % 0.73 % 0.51 % 0.54 % 0.32 % 0.32 % 0.29 % 0.37 % 0.1 %	Fluke 5500A HPCS-Z-A capacitance decade box
Inductance – Generate Fixed Points	 1.0 mH 10 mH 100 mH 1 H	 0.06 % 0.06 % 0.06 % 0.08 %	 Genrad 1482
Electrical Calibration of Thermocouple Indicators[3] – Type E Type J Type K	 -250 ºC to -100 ºC -100 ºC to 650 ºC 650 ºC to 1000 ºC -210 ºC to -100 ºC -100 ºC to 760 ºC 760 ºC to 1200 ºC -200 ºC to -100 ºC -100 ºC to 120 ºC 120 ºC to 1000 ºC 1000 ºC to 1372 ºC	 0.5 ºC 0.16 ºC 0.21 ºC 0.27 ºC 0.17 ºC 0.23 ºC 0.33 ºC 0.18 ºC 0.26 ºC 0.04 ºC	 Fluke 5500A

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Calibration of Thermocouple Indicators[3] – (cont)			
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	Fluke 5500A
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 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 0.10 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 0.10 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 0.10 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	0.04 ºC 0.05 ºC 0.14 ºC 0.16 ºC	
Pt 385, 500 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	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Calibration of RTD Indicating Systems[3] – (cont)			
PtNi 385, 100 Ω	-80 ºC to 100 ºC 100 ºC to 260 ºC	0.08 ºC 0.14 ºC	Fluke 5500A
Cu 427, 10 Ω	-100 ºC to 260 ºC	0.3 ºC	

Parameter/Range	Frequency	CMC[2, 4, 7] (±)	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	0.05 % + 8 mV 0.016 % + 2.5 mV 80 µV/V + 0.8 mV	
(22 to 220) V	(20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz	0.022 % + 3.5 mV 0.05 % + 8 mV 1.6 % + 190 mV	
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.06 % + 11 mV 0.23 % 45 mV	

Parameter/Range	Frequency	CMC[2, 4, 5, 7] (±)	Comments
AC Voltage[3] – Generate (cont)			
(220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.04 % + 16 mV 90 µV/V + 4 mV	Fluke 5700A w/option 03
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	
High Voltage (1 to 20) kV	(50 to 70) Hz	0.32 %	Vitrek 4600A
AC Current[3] – Generate			
(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

Parameter/Range	Frequency	CMC[2, 4, 5, 7] (±)	Comments
AC Current[3] – Generate (cont.)			
(1 to 500) A	(50 to 70) Hz	1.8 %	Fluke 5500 w/Fluke coil
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 0.10 % + 200 µA 0.12 % + 200 µA	

IV. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2] (±)	Comments
RF Tuned Power – Measure			
0 dB, Reference (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	Up to 18 GHz	Reference 0.06 dB 0.08 dB 0.11 dB 0.14 dB 0.2 dB 0.31 dB 0.34 dB 0.4 dB	HP 8902A, HP 11722A, HP 11793A

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
RF Absolute Power – Generate (-30 to -20) dB (-20 to 10) dB (10 to 20) dB	50 MHz to 18 GHz	0.06 dB 0.068 dB 1.2 dB	HP 537B, 8484A, 8482A
Amplitude Modulation – Measure Rate: 150 kHz to 10 MHz Depth: (5 to 99) % Rate: 10 MHz to 1.3 GHz Depth: (5 to 99) %	 50 Hz to 10 kHz 20 Hz to 10 kHz 50 Hz to 10 kHz 20 Hz to 10 kHz	 2 % + 1 digit 3 % + 1 digit 1 % + 1 digit 3 % + 1 digit	HP 8902A
Frequency Modulation – Measure Rate: 250 kHz to 10 MHz Dev: ≤ 40 kHz Rate: 10 MHz to 1.3 GHz Dev: ≤ 400 kHz	 50 Hz to 10 kHz 50 Hz to 100 kHz 20 Hz to 200 kHz	 2 % + 1 digit 1 % + 1 digit 5 % + 1 digit	HP 8902A
Phase Modulation – Generate Rate: 10 MHz to 1.3 GHz	 200 Hz to 20 kHz	 3.5 % + 1 digit	HP 8902A

V. Fluid Quantities

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Viscosity – @ 25 ºC	(17 to 2000) cst (1990 to 200 400) cP	0.68 % 0.52 %	Cannon series N viscosity standards

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Flow – Air	(30 to 5000) ml/min	1.3 %	Bios flow system with flow cells, Bios DC-LC-1
	(2000 to 9500) ml/min	2.2 %	Bios CC-MC-1
	(5000 to 50 000) ml/min	1.7 %	Bios DC-HC-1

VI. Mechanical

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Indirect Verification of Rockwell Hardness Testers[3]	HRC: 24.61 53.35 61.26 HRB: 44.10 65.37 90.82	 1.3 HRC 1.3 HRC 1.3 HRC 1.6 HRB 1.4 HRB 1.3 HRB	ASTM E18-08B
Pressure – Measure	(-15 to + 15) psig Up to 1000 psig Up to 10 000 psig	0.1 % of 0.1 % of 0.1 % of	Fluke 744 w/various pressure modules
Torque	(0 to 400) in·oz (0 to 5) in·lb (0 to 400) in·lb (0 to 250) ft·lb (250 to 600) ft·lb	0.83 % 0.92 % 0.7 % 0.66 % 0.68 %	DCI torque system
Tension & Compression	Up to 10 000 lb	0.073 % of Full Scale	Load cell comparison

Parameter/Equipment	Range	CMC[2] (±)	Comments
Scales & Balances	(0 to 400) g (0 to 10) kg (10 to 50) kg (50 to 100) kg (100 to 1000) kg	0.57 mg 4.0 g 8.0 g 17 g 0.13 kg	NIST handbook 44 using class 1 weights NIST handbook 44 using class F weights

VII. Optical Quantities

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Fiber Optics – Measure 1310 nm 1550 nm	(6 to -60) dB	 4.9 % 4.9 %	 EXFO optical calibration system

VIII. Thermodynamics

Parameter/Equipment	Range	CMC[2] (±)	Comments
Humidity – Measuring Equipment	11 % RH 33 % RH 75.4 % RH 97 % RH	1.6 % RH 1.7 % RH 1.5 % RH 2 % RH	Saturated salt solutions
Temperature – Measuring Equipment	(0 to 300) °C	0.17 °C	Hart 9100
Temperature – Measure	(-20 to 200) °C	0.05 °C	DP 97

[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] 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. 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.

[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. 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.

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

[7] In the statement of CMC, the value is defined as the percentage of reading.

The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Laboratory

A2LA has accredited

MICRO PRECISION CALIBRATION DE MEXICO

Guadalajara, Mexico

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 25th day of July 2011.

President & CEO
For the Accreditation Council
Certificate Number 935.03
Valid to January 31, 2013

0935For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.