The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Laboratory

A2LA has accredited

MICRO PRECISION CALIBRATION

San Diego, 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 August 2009.

President & CEO
For the Accreditation Council
Certificate Number 935.10
Valid to September 30, 2011

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: September 30, 2011 Certificate Number: 935.10

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

Parameter/Equipment	Range	Best Uncertainty[2,](±)	Comments
Conductivity[3] – Measure	111.3 mS 1015 µS 1408 µS	0.51 µS 0.51 µS 0.51 µS	Comparison to standard solutions
pH [3]– Measure	(4, 7, 10) pH unit	0.02 pH unit	Comparison to standard solutions

II. Dimensional

Parameter/Equipment	Range	Best Uncertainty[2, 6] (±)	Comments
Calipers & Height Gages [3]	(0.10 to 20) in	(56 µin + 0.6L) µin	Mitutoyo gage blocks and length rods

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Parameter/Equipment	Range	Best Uncertainty[2, 6] (±)	Comments
Micrometers[3] – Resolution: 100 µin 50 µin	 (0.10 to 12) in	 (54 + 3L) µin (28 + 2L) µin	 Mitutoyo gage blocks
Diameter, External Threads	(0.10 to 4.0) in (0.20 to 10.0) mm	(26 + 10L) µin (1.7 + 0.009L) µm	Supermicrometer and thread wires (three wire method)
Durometers[3] Type A	30 Duropoints 60 Duropoints 90 Duropoints	1 Duropoint	Mitutoyo Test Blocks

III. Electrical – DC/Low Frequency

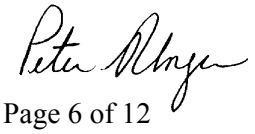
Parameter/Equipment	Range	Best Uncertainty[2, 4, 7] (±)	Comments
DC Voltage[3] – Generate	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	12 µV/V + 0.6 µV 12 µV/V + 1.0 µV 10 µV/V + 3.5 µV 12 µV/V + 6.5 µV 10 µV/V + 80 µV 13 µV/V + 500 µV	Fluke 5700A w/option 03
DC Voltage[3] – Measure	(0 to 100) mV 100 mV to 1V (1 to 10) V (10 to 100) V (100 to 1000) V	7 µV/V + 0.3 µV 7 µV/V + 0.3 µV 8 µV/V + 0.5 µV 11 µV/V + 30 µV 20 µV/V + 100 µV	HP 3458A
DC Current[3] – Generate	(0 to 2.2) mA (2.2 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 + 80 nA 60 µA/A + 0.8 uA 80 µA/A + 25 uA 0.06 % + 330 uA	Fluke 5700A w/option 03 Fluke 5500A

Parameter/Equipment	Range	Best Uncertainty[2, 4, 5, 7] (±)	Comments
DC Current[3] – Measure	(10 to 100) µA 100 µA to 10 mA (10 to 100) mA 100 mA to 1 A	26 µA/A + 5 µA 26 uA/A + 5 uA 60 µA/A + 5 µA 0.013 % + 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 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	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 % + 6 Ω 0.02 % + 6 Ω 0.016 % + 55 Ω 0.024 % + 55 Ω 0.02 % + 55 Ω 0.076 % + 550 Ω 0.012 % + 550 Ω 0.58 % + 5.5 kΩ 0.58 % + 17 Ω	Fluke 5500A
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 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

Parameter/Equipment	Range	Best Uncertainty[2, 4, 5, 7] (±)	Comments
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) nF (110 to 329.9) nF (0.33 to 1.09) µF (1.10 to 3.29) µF	3.3 % 1.7 % 0.93 % 0.69 % 0.64 % 0.40 % 0.40 % 0.40 % 0.51 %	Fluke 5500A
Electrical Calibration of Thermocouple Indicators[3] –			
Type E	-250 ºC to -100 ºC -100 ºC to 650 ºC 650 to 1000 ºC	0.5 ºC 0.16 ºC 0.21 ºC	Fluke 5500A
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	
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	

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
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 0.10 °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 0.10 °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 0.10 °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	
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	
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[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 1.6 % + 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] (±)	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

Parameter/Range	Frequency	Best Uncertainty[2, 4] (±)	Comments
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	

VI. Electrical – RF/Microwave

Parameter/Range	Frequency	Best Uncertainty[2] (±)	Comments
RF Tuned Power – Generate			HP 8902A, HP11722A,
(0 to -100) dB	Up to 1.3 GHz Up to 18 GHz	0.40 dB 0.72 dB	
RF Absolute Power – Generate			
100 kHz to 50 GHz	(-70 to -20) dB (-20 to 10) dB (10 to 20) dB	0.19 dB 0.068 dB 1.2 dB	HP 438B, 8484A, 8482A 8487A, 8487D
Phase Modulation – Generate			
Rate: 10 MHz to 1.3 GHz	200 Hz to 20 kHz	3.5 % + 1 digit of rdg	HP 8902A

Parameter/Range	Frequency	Best Uncertainty[2, 7] (±)	Comments
Amplitude Modulation – Measure			
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			
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	
Reflection $S_{11}/_{22}$ Measure 30 kHz to 6 GHz	(0.56 to 1) lin	(± 0.0059 to ±0.021) lin (±0.61 to ± 1.5) deg	HP8751A, HP 87512C, HP85052B, Calibration Kit And Network Analyzer
	(0.32 to 0.56) lin	(± 0.0045 to ±0.014) lin (±0.61 to ± 2.0) deg	
	(0.1 to 0.32) lin	(± 0.0027 to ±0.010) lin (±1.0 to ± 4.1) deg	
	(0.032 to 0.1) lin	(± 0.0021 to ±0.0068) lin (±1.7 to ± 11) deg	
	(0.01 to 0.032) lin	(± 0.0018 to ±0.059) lin (±3.9 to ± 180) deg	
	(0 to 0.001) lin	< ± 0.0055 lin ± 180 deg	

Parameter/Equipment	Range	Best Uncertainty[2, 7] (±)	Comments
Transmission $S_{11}/_{22}$ Measure 30 kHz to 6 GHz	(0 to 12) dB (12 to 30) dB (30 to 40) dB (40 to 50) dB (50 to 60) dB (60 to 70) dB (70 to 80) dB (80 to 100) dB	(± 0.059 to ±0.11) dB (±0.39 to ± 0.91) deg (± 0.074 to ±0.11) dB (±0.69 to ± 0.93) deg (± 0.080 to ±0.010) dB (±1.0 to ± 4.1) deg (± 0.081 to ±0.13) dB (±0.75 to ± 1.0) deg (± 0.088 to ±0.23) dB (±0.78 to ± 1.6) deg (± 0.13 to ±0.60) dB (±1.0 to ± 4.1) deg (± 0.34 to ±1.7) dB (±2.3 to ± 13) deg (± 0.99 to ±10) dB (±7.0 to ± 180) deg	HP8751A, HP 87512C, HP85056D, Calibration Kit And Network Analyzer

V. Mechanical

Parameter/Equipment	Range	Best Uncertainty[2, 7] (±)	Comments
Pressure[3] – Measure	(-15 to 30) psi Up to 300 psi Up to 15 000 psi	0.098 % 0.85 % 0.92 %	Druck Calibrator Dead Weight Tester
Torque[3] – Measure	(0 to 100) in·oz. (0 to 100) in·lb. (0 to 100) ft·lb. (Up to 1000) ft.lb	0.83 % 0.92 % 0.7 % 0.68 %	Norbar Torque System CDI Torque System

Parameter/Equipment	Range	Best Uncertainty[2, 7] (±)	Comments
Mass	(5 to 500) mg (0 to 500) g Up to 600 lb	1.2 mg 1.2 g 0.3 %	NIST handbook 44 using class 1 weights NIST handbook 44 using class F weights
Accelerometers Frequency Response	 5 Hz to 10 Hz 10 Hz to 10 kHz	 6 % of FS. 3.6 % of FS.	 Vibration calibration system, standard accelerometers

VI. Thermodynamics

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Humidity – Measuring Equipment	11 % RH 33 % RH 75 % RH	1.6 % RH 1.7 % RH 1.5 % RH	Saturated salt solutions
Temperature – Measuring Equipment	(-25 to 600) ºC	0.33 ºC	Hart 1560 Black Stack, Minco PRT
Temperature – Measure	(-40 to 200) °C	0.33 °C	Hart 1560 Black Stack, Minco PRT

VII. Time & Frequency

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Frequency – Measuring Equipment	10 MHz	1 parts in 10^{-11}	HP 58503 GPS
Frequency[3] – Measure	1 Hz to 50 GHz	1 parts in 10^{-9}	GPS, 3325A, 83650B, 53132A

[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. Pitch diameter is measured by the three-wire method.

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