



World Class Accreditation

The American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

**MICRO PRECISION CALIBRATION, INC./
KIM LONG CALIBRATION, J.S.C**

Ho Chi Minh City, Vietnam

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 10th day of November 2009.



President & CEO

For the Accreditation Council
Certificate Number 0935.12
Valid to January 31, 2012

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

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CALIBRATION

Valid To: January 31, 2012

Certificate Number: 0935.12

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

I. Chemical Quantities

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|-------------------------------------|------------------------------|-------------------------------|----------------------------------|
| Conductivity ³ – Measure | 111 mS 1015 µS 1408 µS | 0.51 µS 0.51 µS 0.51 µS | Comparison to standard solutions |
| pH-Measure ³ | (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 ³ | (0.10 to 12) in | (56 µin + 0.6L) µin | Gage blocks |

| Parameter/Equipment | Range | CMC ^{2,6} (±) | Comments |
|---|-----------------------------------|----------------------------------|---|
| Surface Plates ³ – Repeatability | (12 x 12 to 72 x 144) in | 40 μin | Repeat-o-meter |
| Thread Plug Gages – Major Diameter Pitch Diameter | (0 to 8) in | (50 + 0.6D) μin | Pratt & Whitney Supermic |
| Indicators ³ | (0.1 to 4) in | 1.2R | Gage blocks |
| Mic / Length standards | (0 to 8) in | (5 + 0.6L) μin | Pratt & Whitney Supermic |
| Pin Gages, Diameter | (0.02 to 2.00) in | 75 μin | Pratt & Whitney Supermic |
| Micrometers – Length and Flatness ³ Resolution: 1000 μin 100 μin | (0.10 to 12) in (0.10 to 4) in | (55 + 15L) μin (34 + 15L) μin | Gage blocks, optical flat, monochromic light source |

III. Electrical – DC/Low Frequency

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|-----------------------|---|--|-------------|
| DC Voltage – Generate | Up to 10 mV (10 to 100) mV 100 mV to 100 V (100 to 1000) V | 0.0034 % of rdg + 16 μV 0.0036 % of rdg + 16 μV 0.0036 % of rdg + 22 μV 0.0038 % of rdg + 30 μV | Datron 4700 |

| Parameter/Equipment | Range | CMC ^{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 $\mu\text{V}/\text{V}$ + 3.0 μV 17 $\mu\text{V}/\text{V}$ + 0.3 μV 13 $\mu\text{V}/\text{V}$ + 0.5 μV 15 $\mu\text{V}/\text{V}$ + 30 μV 27 $\mu\text{V}/\text{V}$ + 100 μV | HP 3458A |
| DC Current – Generate ³ | (10 to 100) μA 100 μA to 100 mA 100 ma to 1 A | 0.013 % of rdg 0.013 % of rdg 0.10 % of rdg | Datron 4700 |
| 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 $\mu\text{A}/\text{A}$ + 400 μA 25 $\mu\text{A}/\text{A}$ + 40 μA 25 $\mu\text{A}/\text{A}$ + 10 μA 25 $\mu\text{A}/\text{A}$ + 5 μA 25 $\mu\text{A}/\text{A}$ + 5 μA 40 $\mu\text{A}/\text{A}$ + 5 μA 0.012 % + 10 μA | HP 3458A |
| High DC Current ³ | (1 to 50) A (1 to 500) A | 0.12 % of rdg 1.3 % | Shunt monitored with multimeter 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) 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 0.33 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 | 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 % + 17 k Ω | Fluke 5500A |

| Parameter/Equipment | Range | CMC ^{2,5} (±) | Comments |
|--|--|--|-------------|
| Resistance – Generate, Fixed Points ³ | 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ | 40 μΩ/Ω 40 μΩ/Ω 30 μΩ/Ω 35 μΩ/Ω 60 μΩ/Ω 100 μΩ/Ω | Datron 4700 |
| 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 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 | 3.3 % 1.7 % 0.93 % 0.69 % 0.64 % 0.40 % 0.40 % 0.40 % 0.51 % | Fluke 5500A |
| Inductance – Generate ³ Fixed Points | 1.0 mH 10 mH 100 mH 1 H | 0.059 % of rdg 0.06 % of rdg 0.062 % of rdg 0.082 % of rdg | Genrad 1482 |

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|--|---|---|-------------|
| Electrical Calibration of Thermocouple Indicators ³ – | | | |
| Type E | -250 °C to -100 °C -100 °C to 650 °C 650 to 1000 °C | 0.5 °C 0.16 °C 0.21 °C | Fluke 5500A |
| Type J | -210 °C to -100 °C -100 °C to 760 °C 760 °C to 1200 °C | 0.27 °C 0.17 °C 0.23 °C | |
| Type K | -200 °C to -100 °C -100 °C to 120 °C 120 °C to 1000 °C 1000 °C to 1372 °C | 0.33 °C 0.18 °C 0.26 °C 0.04 °C | |
| Type S | 0 °C to 250 °C 250 °C to 1400 °C 1400 °C to 1767 °C | 0.47 °C 0.37 °C 0.46 °C | |
| Type T | -250 °C to -150 °C -150 °C to 0 °C 0 °C to 400 °C | 0.63 °C 0.24 °C 0.16 °C | |
| 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 | |

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|--|---|---|-------------|
| Electrical Calibration of RTD Indicating Systems ³ – (cont) | | | |
| 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 | Fluke 5500A |
| 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 | CMC ² (±) | Comments |
|---------------------------------------|--|---|-------------|
| AC Voltage – Generate ³ | | | |
| (1 to 100) mV | (10 to 30) Hz 30Hz to 20 kHz (20 to 100) kHz (0.1 to 1) MHz | 0.1 % of rdg + 15 μV rng 0.02 % of rdg + 15 μV rng 0.05 % of rdg + 25 μV rng 0.33 % of rdg + 30 μV rng | Datron 4700 |
| (1 to 10) V | (10 to 30) Hz 30Hz to 20 kHz (20 to 100) kHz (0.1 to 1) MHz | 0.1 % of rdg + 0.010 % rng 0.02 % of rdg + 0.006 % rng 0.05 % of rdg + 0.009 % rng 0.35 % of rdg | |

| Parameter/Range | Frequency | CMC ^{2,5} (±) | Comments |
|---------------------------------------|--|--|---|
| AC Voltage – Generate ³ | | | |
| (100) V | (10 to 30) Hz 30 Hz to 20 kHz (20 to 100) kHz | 0.1 % of rdg + 0.010 % rng 0.02 % of rdg + 0.006 % rng 0.05 % of rdg + 0.009 % rng | Datron 4700 |
| (1000) V | (45 to 330) Hz 300 Hz to 10 kHz (10 to 33) kHz | 0.046 % of rdg 0.038 % of rdg 0.048 % of rdg | |
| 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 (1 to 20) kHz | 0.05 % + 40 mV 0.05 % + 20 mV 0.07 % + 20 mV | HP 3458A, synchronous sub- sampled mode |
| (1 to 20) kV | (20 to 50) kHz (50 to 100) kHz | 0.14 % + 20 mV 0.35 % + 20 mV | |

| Parameter/Range | Frequency | CMC ^{2,5} (±) | Comments |
|--|---|---|--|
| AC Current – Generate ³ 10 µA 100 µA 1 mA 10 mA 100 mA 1 A | 1 kHz | 0.076 % of rdg 0.015 % of rdg 0.014 % of rdg 0.013 % of rdg 0.014 % of rdg 0.015 % of rdg | Datron 4700 |
| AC Current – Measure ³ Up to 100 µA 100 µA to 100 mA 100 mA to 1 A (1 to 500) 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 (50 to 70) Hz | 0.46 % + 0.03 µA 0.18 % + 0.03 µA 0.078 % + 0.03 µA 0.46 % + 20 µA 0.17 % + 20 µA 0.073 % + 20 µA 0.042 % + 20 µA 0.46 % + 200 µA 0.19 % + 200 µA 0.10 % + 200 µA 0.12 % + 200 µA 0.32 % | HP 3458A Fluke 5500 with Fluke coil |

IV. Mechanical

| Parameter/Equipment | Range ⁷ | CMC ² (±) | Comments |
|----------------------------------|--|---|---|
| Torque ³ – Measure | (0 to 100) in·oz (0 to 100) in·lb (0 to 100) ft·lb | 0.78 % of rdg 0.67 % of rdg 0.71 % of rdg | Mountz torque system |
| Scales and Balances ³ | 1 mg to 30 kg (10 to 1000) lb | 1.0 LSVD | Class 1 & F weights LSVD = least significant value digit |

| Parameter/Equipment | Range ⁷ | CMC ² (±) | Comments |
|---------------------|--------------------|----------------------|----------------------|
| Mass | (1 to 500) mg | 2 µg | Class 1 with balance |
| | 1 g | 3 µg | Class 1 with balance |
| | 2 g | 4 µg | |
| | 5 g | 5 µg | |
| | 10 g | 8 µg | |
| | 20 g | 10 µg | |
| | 50 g | 23 µg | |
| | 100 g | 36 µg | |
| | 200 g | 44 µg | |
| | 10 kg | 3 mg | Class 4 with balance |
| Pressure | (-15 to 30) psi | 0.10 % of rdg | Heise PTE-1 |
| | Up to 1000 psi | 0.09 % of rdg | |
| | Up to 10000 psi | 0.10 % of rdg | |

V. Thermodynamics

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|---|-----------------|----------------------|--------------------------|
| Humidity – Measuring Equipment ³ | 11 % RH | 1.6 % RH | Saturated salt solutions |
| | 33 % RH | 1.7 % RH | |
| | 75.4 % RH | 1.5 % RH | |
| | 97 % RH | 2 % RH | |
| Temperature – Measuring Equipment | (-20 to 500) °C | 0.33 °C | SPRT Rosemont 162c |

VI. Time & Frequency

| Parameter/Equipment | Range ⁷ | CMC ² (±) | Comments |
|---------------------------------|--------------------|--|----------------|
| Frequency – Measuring Equipment | 1 MHz 10 MHz | 5×10^{-12} Hz 5×10^{-12} Hz | HP 58503A, GPS |

- 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. In the statement of CMC, R is the numerical value of the resolution of the device in microinches. Pitch diameter is measured by the three-wire method.
- ⁷ Where ranges are not specified, the CMC stated is for the cardinal points only.