



World Class Accreditation

The American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

WESTERN STATES CALIBRATION

Salt Lake City, UT

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 December 2009.



A handwritten signature in black ink, appearing to read "Peter Abney".

President & CEO
For the Accreditation Council
Certificate Number 2904.01
Valid to February 29, 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

WESTERN STATES CALIBRATION
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CALIBRATION

Valid To: February 29, 2012

Certificate Number: 2904.01

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	(0 to 6) in (6 to 72) in	440 μin (400 + 9.3L) μin	Gage blocks
Cylindrical Ring Gages	(0.04 to 1) in (1 to 14) in	14 μin 96 μin	Pratt & Whitney Labmaster, gage blocks
Dial Indicators	(0 to 1) in: 0.0005 in resolution 0.001 in resolution	340 μin 660 μin	Indicator tester
Test Indicators	(0 to 0.050) in: 0.00002 in resolution 0.00005 in resolution 0.0001 in resolution	14 μin 48 μin 74 μin	Indicator tester

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Indicator Tester –	(0 to 1) in 0.0001 in resolution	84 μin	Gage blocks, amplifier, lever gage head, surface plate
	(0 to 0.05) in 0.00001 in resolution	18 μin	
Height Masters	(0 to 24) in	140 μin	Gage blocks, amplifier, lever gage head, surface plate
Height Gages	(0 to 24) in: 0.001 in resolution 0.0001 in resolution	620 μin 170 μin	Check master, surface plate
Linear Measurements – Outside	(0.05 to 13) in	(9.3 + 6.7L) μin	Pratt & Whitney Labmaster, gage blocks
Micrometers – Outside Diameter	(0 to 6) in 0.00005 in resolution	(53 + 9.6L) μin	Gage blocks, optical flat
	(0 to 36) in 0.0001 in resolution	(67 + 17L) μin	
Depth	(0 to 12) in 0.0001 in resolution:	(66 + 7L) μin	Gage blocks, optical flat, surface plate
Pin/Plug Gages	(0 to 1) in	21 μin	Pratt & Whitney Labmaster, gage blocks
Thread Plug Gage – Plain and Truncated	(0 to 1.5) in / (4 to 80) TPI	27 μin 73 μin	Pratt & Whitney Supermike, thread wires
	(1.5 to 4) in / (4 to 80) TPI	29 μin 74 μin	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Thread Rings	(0 to 2) in	360 µin	Thread setting plugs
Thread Wires	(4 to 80) TPI	14 µin	Pratt & Whitney Labmaster
Surface Plates ³	Up to 60 in diagonal Repeat Reading Flatness	32 µin 120 µin	Repeat-o-meter Electronic levels

II. Electrical – DC/Low Frequency

Parameter/Range	Frequency	CMC ^{2,6} (±)	Comments
AC Current – Generate			
(32 to 330) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.23 % + 130 nA 0.18 % + 120 nA 0.15 % + 130 nA 0.38 % + 180 nA 0.93 % + 250 nA 1.9 % + 550 nA	Fluke 5520A
(0.33 to 3.3) mA	(10 to 20) Hz 20 to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.04 % + 25 µA 0.04 % + 17 µA 0.07 % + 17 µA 0.27 % + 18 µA 0.04 % + 17 µA	
(3.3 to 33) mA	(10 to 20) Hz 20 to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.04 % + 25 µA 0.04 % + 17 µA 0.07 % + 17 µA 0.27 % + 18 µA 0.04 % + 18 µA	
(33 to 330) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.21 % + 33 µA 0.11 % + 37 µA 0.05 % + 29 µA 0.11 % + 110 µA 0.23 % + 130 µA 0.47 % + 260 µA	

Parameter/Range	Frequency	CMC ^{2,6,7} (±)	Comments
AC Current – Generate (cont)			
(0.33 to 1.1) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.21 % + 150 µA 0.06 % + 150 µA 0.69 % + 1.3 mA 2.9 % + 6.6 mA	Fluke 5520A
(1.1 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.21 % + 0.30 mA 0.02 % + 6.9 mA 0.05 % + 1.3 mA 2.9 % + 7.8 mA	
(3 to 11) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	0.07 % + 3.5 mA 0.13 % + 2.4 mA 3.6 % + 5 mA	
(11 to 21) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	0.07 % + 48 mA 0.16 % + 11 mA 3.4 % + 30 mA	
AC Current – Measure, Fixed Points			
100 µA	10 Hz to 5 kHz	1.3 % + 170 nA	Wavetek 1281
1 mA	10 Hz to 5 kHz	0.11 % + 17 µA	
10 mA	10 Hz to 5 kHz	0.37 % + 1 µA	
100 mA	10 Hz to 5 kHz	0.02 % + 89 µA	
1 A	10 Hz to 5 kHz (1 to 5) kHz	0.08 % + 250 µA 0.24 % + 0.5 mA	
AC Voltage – Generate			
(1 to 33) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.041 % + 44.6 µV 63 µV/V + 24 µV 32 µV/V + 42 µV 0.11 % + 14 µV 0.37 % + 29 µV 0.9 % + 77 µV	Fluke 5520A

Parameter/Range	Frequency	CMC ^{2,6,7} (±)	Comments
AC Voltage – Generate (cont)			
(33 to 330) mV	(10 to 45) Hz 45 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.011 % + 45 μV 0.017 % + 13 μV 0.042 % + 14 μV 0.094 % + 40 μV 0.23 % + 110 μV	Fluke 5520A
(0.33 to 3.3) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.03 % + 420 μV 0.02 % + 95 μV 0.03 % + 89 μV 0.04 % + 120 μV 0.09 % + 200 μV 0.01% + 1.1 mV	
(3.3 to 33) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.03 % + 4.2 mV 0.02 % + 1 mV 0.03 % + 900 μV 0.04 % + 4 mV 0.2 % + 3.8 mV	
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.03 % + 7.2 mV 0.03 % + 11 mV 0.04 % + 10 mV 0.04 % + 26 mV 0.22 % + 110 mV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.04 % + 55 mV 0.03 % + 30 mV 0.04 % + 30 mV	
AC Voltage – Measure			
(0 to 100) mV	(10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.011 % + 8.5 μV 60 μV/V + 14 μV 50 μV/V + 13 μV 60 μV/V + 12 μV 0.028 % + 13 μV 0.076 % + 17 μV	Wavetek 1281

Parameter/Range	Frequency	CMC ^{2,7} (±)	Comments
AC Voltage – Measure (cont)			
(0.1 to 1) V	(10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	45 μV/V + 200 μV 45 μV/V + 120 μV 0.019 % + 7.8 μV 95 μV/V + 16 μV 0.024 % + 24 μV	Wavetek 1281
(1 to 10) V	(10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	67 μV/V + 1.1 mV 15 μV/V + 230 μV 0.012 % + 120 μV 6.7 μV/V + 220 μV 4.5 μV/V + 460 μV 12 μV/V + 1.8 mV 0.4 % + 12 mV 1.2 % + 120 mV	
(10 to 100) V	(10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	45 μV/V + 16 mV 56 μV/V + 11 mV 0.014 % + 1 mV 98 μV/V + 1.3 mV 0.022 % + 3.8 mV 0.058 % + 13 mV 0.4 % + 120 mV 13 μV/V + 1.2 V	
(100 to 1000) V	40 Hz to 30 kHz (30 to 100) kHz	0.04 % + 55 mV 0.05 % + 310 mV	

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
DC Current – Generate	(0 to 329.999) μA (0 to 3.29999) mA (0 to 32.9999) mA (0 to 329.999) mA (0 to 1.09999) A (1.1 to 2.99999) A (0 to 10.0000) A (11 to 20.5) A	100 μA/A + 77 nA 63 μA 170 μA 31 μA/A + 130 μA 12 mA 130 mA 130 mA 130 mA	Fluke 5520A

Parameter/Equipment	Range	CMC ^{2, 6, 7} (\pm)	Comments
DC Current – Measure	(0 to 100.0000) μ A (0.1 to 1.000000) mA (1 to 10.00000) mA (10 to 100.0000) mA (0.1 to 1.000000) A	78 μ A/A + 5.2 nA 0.011 % + 13 nA 0.011 % + 170 nA 0.011 % + 1.9 μ A 0.022 % + 28 μ A	Wavetek 1281
DC Volts – Generate	(0 to 329.9999) mV (0 to 3.299999) V (0 to 32.99999) V (30 to 329.9999) V (100 to 1000.000) V	32 μ V 8.2 μ V/V + 21 μ V 12 μ V/V + 110 μ V 0.01 μ V/V + 2 mV 0.54 μ V/V + 5.2 mV	Fluke 5520A
DC Volts – Measure	(0 to 1.0000000) V (1 to 10.000000) V (10 to 100.00000) V (100 to 1000.000) V	0.2 μ V/V + 1.4 μ V 4.5 μ V/V + 33 μ V 11 μ V/V + 130 μ V 0.01 μ V/V + 2 mV	Wavetek 1281
Resistance – Generate	(0 to 10.9999) Ω (11 to 32.999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω 330 Ω to 1.099999 k Ω (1.1 to 3.299999) k Ω (3.3 to 10.99999) k Ω (11 to 32.99999) k Ω (33 to 109.9999) k Ω (110 to 329.9999) k Ω 330 k Ω to 1.099999 M Ω (1.1 to 3.299999) M Ω (3.3 to 10.99999) M Ω (11 to 32.99999) M Ω (33 to 109.9999) M Ω (110 to 329.9999) M Ω (330 to 1100) M Ω	28 $\mu\Omega/\Omega$ + 0.0018 Ω 32 $\mu\Omega/\Omega$ + 0.0023 Ω 30 $\mu\Omega/\Omega$ + 0.0022 Ω 34 $\mu\Omega/\Omega$ + 0.0031 Ω 32 $\mu\Omega/\Omega$ + 0.0048 Ω 19 $\mu\Omega/\Omega$ + 0.12 Ω 30 $\mu\Omega/\Omega$ + 0.072 Ω 42 $\mu\Omega/\Omega$ + 0.035 Ω 19 Ω 36 $\mu\Omega/\Omega$ + 3.2 Ω 13 $\mu\Omega/\Omega$ + 68 Ω 60 $\mu\Omega/\Omega$ + 85 Ω 0.011 % + 960 Ω 0.03 % + 4.3 k Ω 0.01 % + 18 k Ω 0.36 % + 130 k Ω 1.8 % + 580 k Ω	Fluke 5520A

Parameter/Equipment	Range	CMC ^{2,5,7} (±)	Comments
Resistance – Measure	(0 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ	0.0013 Ω 6.7 μΩ/Ω + 0.0014 Ω 11 μΩ/Ω + 0.0019 Ω 11 μΩ/Ω + 0.019 Ω 12 μΩ/Ω + 0.12 Ω 3.4 μΩ/Ω + 69 Ω 1.2 kΩ 0.024 % + 24 k Ω 78 MΩ	Wavetek 1281
Electrical Simulation of Thermocouples –			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.85 °C 0.64 °C 0.01 % + 0.52 °C 0.01 % + 0.61 °C 0.01 % + 0.55 °C	Fluke 5520A
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 760) °C	1.1 °C 0.48 °C 0.12 °C	
Type K	(-200 to -100) °C (-100 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.33 °C 0.31 °C 0.32 °C 0.31 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.01 % + 0.31 °C 0.32 °C 0.01 % + 0.22 °C 0.01 % + 0.22 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.01 % + 0.31 °C 0.32 °C 0.23 °C 0.01 % + 0.17 °C	
Type T	(-250 to 120) °C (120 to 400) °C	0.11 °C 0.01 % + 0.11 °C	

III. Mechanical

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
Force – Measuring Equipment	(0 to 300) lbf	0.032 % + 0.036 g	Class F weights, Class S-1 weights
Gage Pressure – Measuring Equipment, Fixed Points	2 psi 50 psi 100 psi 200 psi 300 psi 400 psi 500 psi 1000 psi 2000 psi 4000 psi 6000 psi 8000 psi 10 000 psi	2.0 % 0.08 % 0.02 % 0.02 % 0.02 % 0.02 % 0.02 % 0.02 % 0.02 % 0.02 % 0.02 % 0.01 % 0.02 %	Pressurements Limited W2200-3-P dead weight tester
Indirect Verification of Hardness Testers ³	HRBW: Low Middle High HRC: Low Middle High	 0.76 HRBW 0.75 HRBW 0.69 HRBW 0.63 HRC 0.64 HRC 0.61 HRC	ASTM E18
Scales ³	(0 to 300) lb	0.032 % + 0.035 g	Class F weights, Class S-1 weights
Torque – Measure	4 in·lb to 100 ft·lb	0.17 %	Digital torque load cells
Torque – Measuring Equipment	4 in·lb to 100 ft·lb	0.07 %	Calibration arms & weights

IV. Thermodynamics

Parameter/Equipment	Range	CMC ² (±)	Comments
Temperature – Measure	(0 to 100) °C	0.058 °C	Hart Scientific black stack w/ 1925-A thermistor probe
Temperature – Measuring Equipment	(0 to 100) °C	0.058 °C	Hart Scientific black stack

V. Time & Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency Reference	10 MHz	8.7 x 10 ⁻⁹ Hz/Hz	LORAN-C FS700
Frequency – Measure, Fixed Frequency	1 MHz 100 MHz 200 MHz 225 MHz	1.2 x 10 ⁻⁷ Hz/Hz 1.2 x 10 ⁻⁹ Hz/Hz 6 x 10 ⁻¹⁰ Hz/Hz 4.8 x 10 ⁻¹⁰ Hz/Hz	LORAN-C FS700 w/ HP 53132A

¹ This laboratory offers commercial 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, L is the numerical value of the nominal length of the device measured in inches.

⁵ In the statement of CMC, percentages are to be read as percent of reading, unless noted otherwise.

⁶ The measurands stated are generated with the Fluke 5520A 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.

⁷ The measurands stated are measured with the Wavetek 1281. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. CMCs are expressed as either output or as a fraction of the reading plus one-year floor specifications where defined.