SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005 & ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3

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CALIBRATION

Valid To: September 30, 2019 Certificate Number: 1395.23

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

I. Dimensional

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Calipers[3]	Up to 40 in	(310 + 7.5*L*) µin	Gage block set
Micrometers[3]	Up to 36 in	(53 + 11*L*) µin	Gage block set, Optical flat
Linear Indicators – Digital and Analog[3]	50 µin Resolution 100 µin Resolution 0.001 in Resolution	(23 + 5.4*L*) µin (39 + 5.3*L*) µin (180 + 5.3*L*) µin	Gage blocks, Surface plate
Cylindrical Ring Gages	(0.04 to 1) in (>1 to 4) in (>4 to 12) in	(10 + 0.78*L*) µin (10 + 1.6*L*) µin (11 + 1.4*L*) µin	Pratt & Whitney SuperMic™, gage block set, comparison method
Cylindrical Plug Gages	Up to 12 in	(9 + 2.1*L*) µin	Pratt & Whitney SuperMic™, gage block set & master disks

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Threaded Plug Gages – (UN threads)			Pratt & Whitney Lab Master™ with:
Pitch (60° threads)	Up to 12 in, Pitch: (4 to 80) TPI	(70 + 4.2L) µin	Thread wires (English)
	(1 to 300) mm, Pitch: (0.3 to 4) mm	(1.8 + 0.043L) µm	Thread wires (Metric)
Major Diameter	Up to 12 in	(28 + 4.2L) µin	
Bore Gages, Inside Micrometers, Intramikes[3]	(0.081 to 6.0) in	(18 + 18L) µin	Gage blocks and ring gages
Granite Surface Plates[3] –			
Repeat Reading	Up to 36 x 48 in	41 µin	Repeat-O-Meter
Flatness	Up to 36 x 48 in	49 µin	Planakator (Moody Method)
Height Gages[3]	Up to 24 in	(320 + 4.2L) µin	Gage blocks, surface plate

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
DC Voltage – Generate[3]	Up to 330 mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (330 to 1000) V	16 µV/V + 1.4 µV 8.7 µV/V + 2 µV 10 µV/V + 16 µV 15 µV/V + 120 µV 14 µV/V + 1.2 mV	Fluke 5522A
DC Voltage – Measure[3]	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	6.9 µV/V + 0.45 µV 5.4 µV/V + 0.46 µV 5.4 µV/V + 0.94 µV 8 µV/V + 45 µV 8 µV/V + 0.23 mV*	HP 3458A opt 002 *Add 12 µV/V (Vin/1000)2 for inputs >100 V
DC Current – Clamp on Meters[3]	(20 to 150) A (150 to 1000) A	0.31 % 0.31 %	Fluke 5522A/SC1100 Fluke 5500A/Coil
DC Current –Generate[3]	(0 to 330) µA 330 µA to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20) A	0.012 % + 16 nA 79 µA/A + 39 nA 80 µA/A + 0.19 µA 79 µA/A + 1.9 µA 0.016 % + 31 µA 0.03 % + 37 µA 0.04 % + 0.39 mA 0.078 % + 0.65 mA	Fluke 5522A
DC Current – Measure[3]	Up to 100 nA (>0.1 to 1) µA (>1 to 10) µA (>10 to 100) µA (>0.1 to 1) mA (>1 to 10) mA (>10 to 100) mA (>0.1 to 1) A	0.015 % + 64 pA 39 µA/A + 64 pA 29 µA/A + 0.13 nA 28 µA/A + 1.1 nA 28 µA/A + 7.5 nA 28 µA/A + 75 nA 44 µA/A + 0.75 µA 0.013 % + 16 µA	HP 3458A opt 002

Parameter/Range[4]	Frequency	CMC[2, 5, 6] (±)	Comments
AC Current – Clamp-on Meter[3]			
(20 to 150) A	(60 to 400) Hz	0.32 %	Fluke 5522A
(150 to 1000) A	(60 to 400) Hz	0.31 %	Fluke 5500A/Coil
AC Voltage – Measure[3]			HP 3458A opt 002
(1 to 10) mV	(1 to 40) Hz	0.035 % + 3.5 µV	
	40 Hz to 1 kHz	0.023 % + 1.3 µV	
	(1 to 20) kHz	0.035 % + 1.3 µV	
	(20 to 50) kHz	0.012 % + 1.3 µV	
	(50 to 100) kHz	0.58 % + 1.3 µV	
	(100 to 300) kHz	4.6 % + 2.3 µV	
(10 to 100) mV	(1 to 40) Hz	89 µV/V + 4.6 µV	
	40 Hz to 1 kHz	89 µV/V + 2.3 µV	
	(1 to 20) kHz	0.017 % + 2.3 µV	
	(20 to 50) kHz	0.035 % + 2.3 µV	
	(50 to 100) kHz	0.093 % + 2.3 µV	
	(100 to 300) kHz	0.35 % + 12 µV	
	(0.3 to 1) MHz	1.2 % + 12 µV	
(0.1 to 1) V	(1 to 40) Hz	89 µV/V + 46 µV	
	40 Hz to 1 kHz	89 µV/V + 23 µV	
	(1 to 20) kHz	0.017 % + 23 µV	
	(20 to 50) kHz	0.035 % + 23 µV	
	(50 to 100) kHz	0.093 % + 23 µV	
	(100 to 300) kHz	0.35 % + 0.12 mV	
	(0.3 to 1) MHz	1.2 % + 0.12 mV	
(1 to 10) V	(1 to 40) Hz	89 µV/V + 0.47 mV	
	40 Hz to 1 kHz	89 µV/V + 0.23 mV	
	(1 to 20) kHz	0.017 % + 0.23 mV	
	(20 to 50) kHz	0.035 % + 0.23 mV	
	(50 to 100) kHz	0.093 % + 0.23 mV	
	(100 to 300) kHz	0.35 % + 1.2 mV	
	(0.3 to 1) MHz	1.2 % + 1.2 mV	

Parameter/Range[4]	Frequency	CMC[2, 5] (±)	Comments
AC Voltage – Measure[3] (cont)			
(10 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.023 % + 4.6 mV 0.023 % + 2.3 mV 0.023 % + 2.3 mV 0.041 % + 2.3 mV 0.14 % + 2.3 mV	HP 3458A opt 002
(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	0.046 % + 47 mV 0.046 % + 24 mV 0.069 % + 23 mV 0.14 % + 23 mV 0.35 % + 23 mV	
AC Voltage – Generate[3]			Fluke 5522A
(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	0.064 % + 4.7 µV 0.019 % + 4.7 µV 0.022 % + 4.7 µV 0.079 % + 4.7 µV 0.28 % + 9.3 µV 0.63 % + 39 µV	
(33 to 330) 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	0.024 % + 6.2 µV 0.012 % + 6.2 µV 0.013 % + 6.2 µV 0.028 % + 6.2 µV 0.062 % + 25 µV 0.16 % + 54 µV	

Parameter/Range[4]	Frequency	CMC[2, 5] (±)	Comments
AC Voltage – Generate[3] (cont)			
(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	0.024 % + 40 µV 0.012 % + 47 µV 0.015 % + 47 µV 0.024 % + 39 µV 0.055 % + 97 µV 0.19 % + 0.47 mV	Fluke 5522A
(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	0.024 % + 0.51 mV 0.012 % + 0.47 mV 0.019 % + 0.47 mV 0.028 % + 0.47 mV 0.07 % + 1.2 mV	
(33 to 330) V	(45 to 1000) Hz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.015 % + 1.8 mV 0.016 % + 4.7 mV 0.02 % + 4.7 mV 0.024 % + 4.7 mV 0.16 % + 39 mV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.024 % + 9.4 mV 0.02 % + 8.6 mV 0.024 % + 9 mV	
AC Current – Measure[3]			
(5 to 100) µA	45 Hz to 1 kHz	0.072 % + 0.035 µA	HP 3458A
(0.1 to 1) mA	(45 to 100) Hz 100 Hz to 5 kHz	0.070 % + 0.23 µA 0.037 % + 0.23 µA	
(1 to 10) mA	(45 to 100) Hz 100 Hz to 5 kHz	0.070 % + 2.3 µA 0.037 % + 2.3 µA	
(10 to 100) mA	(45 to 100) Hz 100 Hz to 5 kHz	0.070 % + 23 µA 0.037 % + 23 µA	
(0.1 to 1) A	(45 to 100) Hz 100 Hz to 5 kHz	0.093 % + 0.23 mA 0.12 % + 0.23 mA	

Parameter/Range[4]	Frequency	CMC[2, 5] (±)	Comments
AC Current – Generate[3]			
(29 to 330) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1.0 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.16 % + 80 nA 0.12 % + 80 nA 0.1 % + 80 nA 0.23 % + 0.12 µA 0.62 % + 0.16 µA 1.3 % + 0.32 µA	Fluke 5522A
(0.33 to 3.3) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1.0 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.16 % + 0.12 µA 0.1 % + 0.12 µA 0.08 % + 0.12 µA 0.16 % + 0.16 µA 0.41 % + 0.24 µA 0.8 % + 0.48 µA	
(3.3 to 33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1.0 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.14 % + 1.6 µA 0.071 % + 1.6 µA 0.034 % + 1.6 µA 0.064 % + 1.6 µA 0.17 % + 2.4 µA 0.32 % + 3.2 µA	
(33 to 330) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1.0 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.14 % + 16 µA 0.071 % + 16 µA 0.034 % + 16 µA 0.079 % + 40 µA 0.16 % + 78 µA 0.32 % + 0.16 mA	
(0.33 to 1.1) A	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1.0 kHz (1 to 5) kHz (5 to 10) kHz	0.14 % + 78 µA 0.039 % + 78 µA 0.039 % + 78 µA 0.47 % + 0.78 mA 2.0 % + 4 mA	
(1.1 to 3) A	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1.0 kHz (1 to 5) kHz (5 to 10) kHz	0.14 % + 78 µA 0.15 % + 78 µA 0.055 % + 78 µA 0.47 % + 0.78 mA 2.0 % + 4 mA	
(3 to 11) A	45 Hz to 1.0 kHz (1 to 5) kHz	0.083 % + 1.6 mA 2.4 % + 1.6 mA	

Parameter/Range[4]	Frequency	CMC[2, 5] (±)	Comments
AC Current – Generate[3] (cont)			
(11 to 20.5) A	45 Hz to 1.0 kHz (1 to 5) kHz	0.12 % + 4 mA 2.4 % + 4 mA	Fluke 5522A

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Electrical Simulation of Thermocouple Indicators and Indicating Systems[3] –			
Type E	-270 ºC to -200 ºC >-200 ºC to 0 ºC >0 ºC to 600 ºC >600 ºC to 1000 ºC	0.12 ºC 0.057 ºC 0.07 ºC 0.1 ºC	Fluke 5522A Vdc output mode with external thermocouple reference probes and zero point calibrator.
Type J	-210 ºC to -100 ºC >-100 ºC to 900 ºC >900 ºC to 1200 ºC	0.06 ºC 0.09 ºC 0.12 ºC	
Type K	-270 ºC to -200 ºC >-200 ºC to -100 ºC >-100 ºC to 600 ºC >600 ºC to 1000 ºC >1000 °C to 1372 °C	0.17 ºC 0.066 ºC 0.077 ºC 0.11 ºC 0.16 ºC	
Type T	-270 ºC to -200 ºC >-200 ºC to 0 ºC >0 ºC to 400 ºC	0.14 ºC 0.07 ºC 0.058 ºC	

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Oscilloscopes[3] –			
Level Sine Amp 50 kHz Reference	5 mV to 5.5 $V_{(p-p)}$	3.4 % to 300 µV	Fluke 5522A/SC1100
Level Sine Flatness 5 mV to 5.5 V Relative to 50 kHz Reference	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to1100) MHz	3.2 % + 100 µV 3.4 % + 100 µV 4.3 % + 100 µV 4.3 % + 100 µV	
Vertical Gain DC Into 50 Ω Into 1 MΩ	 (0 to 6.6) V (0 to 130) V	 0.20 % + 40 µV 0.27 % + 40 µV	
Square Wave 1 MΩ, 100 Hz 50 Ω, 1 kHz	 1 mV to 150 $V_{(p-p)}$ 1 mV to 6.6 $V_{(p-p)}$	 0.16 % + 40 µV 0.21 % + 40 µV	
Time Marker Output Into 50 Ω	1 ns to 10 ms 10 ns to 50 ms 50 ms to 5 s	0.071 % 0.032 % 0.032 %	
Pulse Rise Time 5mV to 2.5 $V_{(p-p)}$	≤300 ps ≤350 ps	11 ps 11 ps	

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
DC Resistance – Generate[3]	(0 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 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 (0.11 to 1.1) GΩ	32 µΩ/Ω + 0.78 mΩ 24 µΩ/Ω + 1.2 mΩ 22 µΩ/Ω + 1.1 mΩ 22 µΩ/Ω + 1.6 mΩ 22 µΩ/Ω + 1.6 mΩ 22 µΩ/Ω + 16 mΩ 22 µΩ/Ω + 16 mΩ 22 µΩ/Ω + 0.16 Ω 22 µΩ/Ω + 0.16 Ω 28 µΩ/Ω + 1.6 Ω 28 µΩ/Ω + 1.6 Ω 52 µΩ/Ω + 24 Ω 0.011 % + 40 Ω 0.021 % + 2 kΩ 0.041 % + 2.7 kΩ 0.24 % + 80 kΩ 1.2 % + 0.39 MΩ	Fluke 5522A
DC Resistance – Measure[3]	(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 1.0) GΩ	19 µΩ/Ω + 85 µΩ 16 µΩ/Ω + 0.82 mΩ 14 µΩ/Ω + 0.82 mΩ 14 µΩ/Ω + 8.2 mΩ 14 µΩ/Ω + 83 mΩ 20 µΩ/Ω + 2.7 Ω 62 µΩ/Ω + 0.12 kΩ 0.059 % + 3.7 kΩ 0.58 % + 0.26 MΩ	Agilent/HP 3458A OPT-2 within ± 5 °C of T_{CAL} with AutoCal

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Capacitance – Generate[3]	(0.19 to 0.3999) nF (0.4 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.9999) nF (11 to 32.9999) nF (33 to 109.9999) nF (110 to 329.999) nF (0.33 to 1.09999) µF (1.1 to 3.29999) µF (3.3 to 10.9999) µF (11 to 32.9999) µF (33 to 109.999) µF (110 to 329.999) µF (0.33 to 1.09999) mF (1.1 to 3.2999) mF (3.3 to 10.9999) mF (11 to 32.9999) mF (33 to 110) mF	0.44 % + 8.1 pF 0.39 % + 8.1 pF 0.39 % + 8.1 pF 0.20 % + 8.1 pF 0.20 % + 78 pF 0.20 % + 80 pF 0.20 % + 0.23 nF 0.20 % + 0.78 nF 0.20 % + 2.3 nF 0.20 % + 23 nF 0.31 % + 23 nF 0.35 % + 78 nF 0.35 % + 0.23 µF 0.35 % + 0.78 µF 0.35 % + 2.3 µF 0.35 % + 7.8 µF 0.58 % + 23 µF 0.85 % + 78 µF	Fluke 5522A

III Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2] (±)	Comments
RF Power – Measure[3] (-30 to 20) dBm	 Up to 4.2 GHz,	 0.36 dBm	 HP 8482A and power meter

IV. Mechanical

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Force - Measuring Equipment[3] Tension	 Up to 50 lbf	 0.01 % + 0.58*R*	 Class F weights

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Scales & Balances – Fixed Points[3, 7]	10.0 mg 100.0 mg 1000.0 mg 10.0 g 100.0 g 1000.0 g 10.0 kg	5 µg + 0.58*R* 5 µg + 0.58*R* 5.3 µg + 0.58*R* 53 µg + 0.58*R* 0.22 mg + 0.58*R* 3.5 mg + 0.58*R* 0.42 g + 0.58*R*	Class 1 weight sets
Torque Wrenches[3]	(1 to 10) in·lbf (10 to 100) in·lbf	0.77 % + 0.58*R* 0.77 % + 0.58*R*	Mountz MP-10 Hios H-100
Speed – Measure[3] (Rotational)	(0 to 99.999) rpm (100 to 999.99) rpm (1000 to 9999.9) rpm (10000 to 99999) rpm	0.016 rpm + 0.58*R* 0.19 rpm + 0.58*R* 1.6 rpm + 0.58*R* 13 rpm + 0.58*R*	Tachometer

V. Thermodynamics

Parameter/Equipment	Range	CMC[2] (±)	Comments
Temperature –Measure and Measurement Equipment	(-30 to 250) °C	0.079 °C	Fluke 5627A PRT Agilent 34420A
Humidity – Measure[3]	(0 to 100) % RH	3.2 % RH	Onset ZW-003

VI. Time & Frequency

Parameter/Equipment	Range[4]	CMC[2, 6] (±)	Comments
Frequency – Measuring Equipment	0.01 Hz to 2 MHz	(2.5 µHz/Hz +5 µHz) + 0.58*R*	Fluke 5522A

[1] This laboratory offers commercial and field calibration services.

[2] Calibration and Measurement Capability Uncertainty (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. CMCs 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] Where ranges are not specified, the CMC stated is for the cardinal points only.

[5] The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a percent or fraction of the reading plus a fixed floor specification.

[6] In the statement of CMC, L is the numerical value of the nominal length of the device measured in inches; D is the numerical value for the diameter of the device in inches, R is the numerical value of the resolution of the device. In the statement of CMC, the value is defined as the percentage of reading.

[7] In the statement of CMC, decade or cardinal values shown. Other values can be obtained using substitution method with uncertainty increased by a multiple for each substitution.

Accredited Laboratory

A2LA has accredited

SIMCO ELECTRONICS

Athlone, IRELAND

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/NCSLI Z540-1-1994 and the requirements of ANSI/NCSLI Z540.3-2006 and R205 – Specific Requirements: Calibration Laboratory Accreditation Program. 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 6th day of January 2017.

President and CEO
For the Accreditation Council
Certificate Number 1395.23
Valid to September 30, 2019
Revised September 27, 2017

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