



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
& ANSI/NCSL Z540-1-1994

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CALIBRATION

Valid To: August 31, 2024

Certificate Number: 1892.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 8}:

I. Dimensional

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
Calipers ³ – OD Resolution 0.0005” ID Resolution 0.0005” Step Resolution 0.0005” Depth Resolution 0.0005”	Up to 8 in (8 to 60) in (60 to 80) in Up to 2 in Up to 2 in Up to 2 in	(290 + 0.48L) μin (290 + 0.83L) μin (6.2L) μin 0.0003 in 0.0003 in 0.0003 in	Gage blocks, gage block accessories
Gage Blocks	Up to 4 in (4 to 6) in (6 to 8) in (8 to 12) in	(3.4 + 1.4L) μin (1.7 + 3.0L) μin (20 + 0.12L) μin (28 + 0.12L) μin	LabMaster™, standard gage blocks
Height Gage	Up to 40 in	(110 + 1.6L) μin	Gage blocks

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
Height Master	Up to 36 in	(76 + 1.7L) μin	Gage blocks
Indicators ³	Up to 6 in	(29 + 0.87L) μin	Labmaster™, gage blocks, Supermicrometer™
Length Standards	Up to 12 in (12 to 40) in	(2.8 + 1.9L) μin (64 + 2.3L) μin	Labmaster™, gage blocks, electronic height gage, surface plate (standardization)
Micrometers ³			
ID Mics	Up to 8 in (8 to 16) in (16 to 24) in (24 to 32) in (32 to 40) in	(58 + 0.72L) μin (49 + 2.3L) μin (48 + 2.3L) μin (43 + 2.6L) μin (32 + 2.9L) μin	Gage blocks
OD Mics	Up to 8 in (8 to 16) in (16 to 24) in (24 to 32) in (32 to 40) in (40 to 48) in (48 to 56) in	(28 + 1.3L) μin (19 + 3.1L) μin (24 + 2.8L) μin (22 + 2.9L) μin (14 + 3.1L) μin (33 + 2.6L) μin (20 + 2.9L) μin	Gage blocks
Depth Mics	Up to 6 in (6 to 12) in	(29 + 1.1L) μin (8.8 + 4.4L) μin	Gage blocks, triangle base
Tri-Mics	(0.01 to 0.018) in (0.15 to 6) in	(37 + 0.025D) μin (120 + 4.04D) μin	Ring gages
V-Anvil Mics	Up to 2 in	(61 + 7.6L) μin	Plug gages
Pin Gauges/Plug Gages	(0.011 to 0.060) in (0.061 to 0.250) in (0.251 to 0.500) in (0.501 to 0.625) in (0.626 to 1.000) in (1.000 to 4.000) in	(4.8 + 2.2D) μin (4.4 + 8.0D) μin (5.1 + 0.1D) μin (2.1 + 9.3D) μin (5.6 + 3.0D) μin (4.0 + 3.6D) μin	LabMaster™

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Plain Ring Gage	(0.04 to 0.125) in (0.125 to 0.25) in (0.25 to 1) in (1 to 10) in	(13 + 8.4 <i>D</i>) μin (13 + 12.8 <i>D</i>) μin (9 + 17.2 <i>D</i>) μin (14 + 4.7 <i>D</i>) μin	LabMaster™
Thread Plug Gages – (Pitch and Major Diameter)	Up to 6 in: Pitch Diameter Major Diameter	(120 + 1.9 <i>D</i>) μin (21 + 1.3 <i>D</i>) μin	Supermicrometer™
Supermicrometer™	Up to 1 in	(6.8 + 6.7 <i>L</i>) μin	Gage bocks, force gage
Feeler Gages	Up to 0.25 in	(3.6 + 0.14 <i>L</i>) μin	Supermicrometer™, Labmaster™

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Oscilloscopes ³ – Square Wave Signal 10 Hz to 10 kHz 50Ω Impedance	(1 to 24.999) mV _{p-p} (25 to 109.999) mV _{p-p} (0.11 to 2.1999) V _{p-p} (2.2 to 6.6) V _{p-p}	0.10 mV _{p-p} 0.34 mV _{p-p} 0.0058 V _{p-p} 0.017 V _{p-p}	Fluke 5522A- SC1100
1MΩ Impedance	(1 to 24.999) mV _{p-p} (25 to 109.999) mV _{p-p} (0.11 to 2.1999) V _{p-p} (2.2 to 10.999) V _{p-p} (11 to 130) V _{p-p}	0.069 mV _{p-p} 0.16 mV _{p-p} 0.0024 V _{p-p} 0.012 V _{p-p} 0.15 V _{p-p}	Fluke 5522A- SC1100 time marker
Level Sine Wave Flatness – 50 kHz Ref	(25 to 109.999) mV _{p-p} (0.11 to 2.1999) V _{p-p} (2.2 to 6.6) V _{p-p}	0.34 mV _{p-p} 0.0058 V _{p-p} 0.017 V _{p-p}	Fluke 5522A- SC1100

Parameter/Range	Frequency	CMC ^{2, 6} (±)	Comments
Oscilloscope3 – (cont)			
Level Sine Wave Flatness –			
Up to 600 MHz	(1 to 24.999) mV _{p-p} (25 to 109.999) mV _{p-p} (0.11 to 2.1999) V _{p-p} (2.2 to 10.999) V _{p-p} (11 to 130) V _{p-p}	0.069 mV _{p-p} 0.16 mV _{p-p} 0.0024 V _{p-p} 0.012 V _{p-p} 0.15 V _{p-p}	Fluke 5522A- SC1100
600 MHz to 1.1 GHz	Up to 10 mV @ 50 kHz (10 to 40) mV @ 50 kHz (40 to 400) mV @ 50kHz (0.4 to 1.3) V @ 50 kHz (1.3 to 5.5) V @ 50 kHz	0.5 mV 0.7 mV 4.3 mV 0.02 V 0.1 V	
Amplitude Time Markers: (5-2-1 Sequence) Into a 50Ω Load	50 kHz to 100 MHz Up to 10 mV (10 to 40) mV (40 to 400) mV (0.4 to 1.3) V (1.3 to 5.5) V	0.25 mV 0.55 mV 4.6 mV 0.015 V 0.075 V	
Rise Time: 10 mV to 2.5 V	(100 to 300) MHz Up to 10 mV (10 to 40) mV (40 to 400) mV (0.4 to 1.3) V (1.3 to 5.5) V	0.3 mV 0.7 mV 6.1 mV 0.021 V 0.1 V	
	(300 to 600) MHz Up to 10 mV (10 to 40) mV (40 to 400) mV (0.4 to 1.3) V (1.3 to 5.5) V	0.5 mV 1.3 mV 4.3 mV 0.041 V 0.2 V	
	(600 to 1100) MHz Up to 10 mV (10 to 40) mV (40 to 400) mV (0.4 to 1.3) V	0.6 mV 1.6 mV 15 mV 0.05 V	

Parameter/Equipment	Range	CMC ^{2, 6} (\pm)	Comments
Oscilloscope ³ – (cont) Rise Time: 10 mV to 2.5 V	(1 to 2) ns (5 to 100) ns 100 ns to 20 ms 50 ms to 5 s 1 ns to 1 ms	0.0009 ns 0.0041 ns + 0.0006 ns/ns 0.0042 ms 0.0041 ns + 0.007 s/s 350 ps	Fluke 5522A-SC1100
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	9.5 μ V/V + 0.4 μ V 5.9 μ V/V + 0.7 μ V 4.1 μ V/V + 2.5 μ V 4.1 μ V/V + 4 μ V 5.9 μ V/V + 40 μ V 7.6 μ V/V + 0.4 mV	Fluke 5730A
DC Voltage ³ – Measure	(0 to 200) mV 200 mV to 2 V (2 to 20) V (20 to 200) V (200 to 1000) V	7.5 μ V/V + 0.1 μ V 6.6 μ V/V + 0.4 μ V 3.5 μ V/V + 4 μ V 5.3 μ V/V + 40 μ V 5.2 μ V/V + 0.4 mV	Fluke 8508A
DC Current ³ – Generate	(0 to 220) μ V 220 μ V to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A	48 μ A/A + 6 nA 42 μ A/A + 7 nA 42 μ A/A + 40 nA 53 μ A/A + 0.7 μ A 0.12 mA/A + 12 μ A 0.42 mA/A + 0.48 mA	Fluke 5730A
Clamp-On Only ³	(11 to 20) A (16.5 to 149.999) A (150 to 1025) A	0.82 mA/A + 0.75 mA 0.39 % + 15 mA 0.48 % + 50 mA	Fluke 5522A Fluke 5522A w/ 5500A coil
DC Current ³ – Measure	(0 to 200) μ A 200 μ A to 2 mA (2 to 20) mA (20 to 200) mA 200 mA to 2 A (2 to 20) A	14 μ A/A + 0.4 nA 14 μ A/A + 4 nA 15 μ A/A + 40 nA 43 μ A/A + 0.8 μ A 0.2 mA/A + 1.6 μ A 0.44 mA/A + 200 μ A	Fluke 8508A

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Resistance ³ – Generate, Fixed Points	0 Ω 1 Ω 1.9 Ω 10.0 Ω 19.0 Ω 100 Ω 190 Ω 1.0 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1.0 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	46 μΩ 0.11 mΩ 0.11 mΩ 1.3 mΩ 0.27 mΩ 1.2 mΩ 1.2 mΩ 9.8 mΩ 9.8 mΩ 0.1 Ω 0.1 Ω 1.3 Ω 1.3 Ω 24 Ω 25 Ω 0.52 kΩ 0.58 kΩ 13 kΩ	Fluke 5730A
Resistance ³ – Measure	(0 to 2) Ω (2 to 20) Ω (20 to 200) Ω 200 Ω to 2 kΩ (2 to 20) kΩ (20 to 200) kΩ 200 kΩ to 2 MΩ (2 to 20) MΩ (20 to 200) MΩ 200 MΩ to 2 GΩ (2 to 20) GΩ	17 μΩ/Ω + 4 μΩ 11 μΩ/Ω + 14 Ω 9.8 μΩ/Ω + 50 mΩ 13 μΩ/Ω + 0.5 mΩ 10 μΩ/Ω + 5 mΩ 8.8 μΩ/Ω + 50 mΩ 11 μΩ/Ω + 1 Ω 18 μΩ/Ω + 100 Ω 58 μΩ/Ω + 10 kΩ 1.0 mΩ/Ω + 1 MΩ 0.14 % + 10 MΩ	Fluke 8508A

Parameter/Range	Frequency	CMC ^{2, 6} (±)	Comments
AC Voltage ³ – Generate (0 to 2.2) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	1.0 mV/V + 4 μV 0.98 mV/V + 4 μV 0.91 mV/V + 4 μV 0.78 mV/V + 4 μV 0.78 mV/V + 5 μV 1.3 mV/V + 10 μV 1.8 mV/V + 20 μV 3.4 mV/V + 20 μV	Fluke 5730A

Parameter/Range	Frequency	CMC ^{2, 6} (±)	Comments
AC Voltage ³ – Generate (cont)			
(2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	1.4 mV/V + 4 μV 0.20 mV/V + 4 μV 0.30 mV/V + 46 μV 0.30 mV/V + 4 μV 0.60 mV/V + 5 μV 1.2 mV/V + 10 μV 1.6 mV/V + 20 μV 3.1 mV/V + 20 μV	Fluke 5730A
(22 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 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.30 mV/V + 12 μV 0.10 mV/V + 7 μV 0.081 mV/V + 7 μV 0.23 mV/V + 7 μV 0.50 mV/V + 17 μV 1.0 mV/V + 20 μV 1.6 mV/V + 25 μV 3.1 mV/V + 45 μV	
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 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.85 mV/V + 40 μV 0.82 mV/V + 15 μV 0.82 mV/V + 8 μV 0.82 mV/V + 10 μV 0.82 mV/V + 30 μV 0.92 mV/V + 80 μV 1.3 mV/V + 200 μV 1.9 mV/V + 300 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 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.86 mV/V + 400 μV 0.82 mV/V + 150 μV 0.82 mV/V + 50 μV 0.82 mV/V + 100 μV 0.82 mV/V + 200 μV 0.86 mV/V + 600 μV 2.3 mV/V + 2 mV 1.9 mV/V + 3.2 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 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.86 mV/V + 4 mV 0.82 mV/V + 1.5 mV 0.82 mV/V + 0.6 mV 0.82 mV/V + 1 mV 0.84 mV/V + 2.5 mV 1.3 mV/V + 16 mV 4.5 mV/V + 40 mV 8.0 mV/V + 80 mV	

Parameter/Range	Frequency	CMC ^{2, 6} (±)	Comments
AC Voltage ³ – Generate (cont) (220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.29 mV/V + 16 μV 67 μV/V + 3.5 μV	Fluke 5730A
AC Voltage ³ – Measure Up to 199.99 mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.40 mV/V + 4 μV 0.26 mV/V + 4 μV 0.26 mV/V + 4 μV 0.36 mV/V + 4 μV 0.68 mV/V + 5 μV 1.4 mV/V + 10 μV 2.2 mV/V + 20 μV 3.4 mV/V + 20 μV	Fluke 5790A
200 mV to 1.9999 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.27 mV/V + 12 μV 0.11 mV/V + 7 μV 0.10 mV/V + 7 μV 0.21 mV/V + 7 μV 0.50 mV/V + 17 μV 0.90 mV/V + 20 μV 1.4 mV/V + 25 μV 2.7 mV/V + 45 μV	
(2 to 19.999) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.44 mV/V + 40 μV 0.38 mV/V + 150 μV 0.37 mV/V + 8 μV 0.38 mV/V + 10 μV 0.39 mV/V + 30 μV 0.56 mV/V + 80 μV 1.0 mV/V + 200 μV 1.7 mV/V + 300 μV	
(20 to 199.99) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.88 mV/V + 400 μV 0.76 mV/V + 150 μV 0.75 mV/V + 50 μV 0.76 mV/V + 100 μV 0.77 mV/V + 200 μV 0.93 mV/V + 600 μV 2.1 mV/V + 2 mV 3.1 mV/V + 3.2 mV	

Parameter/Range	Frequency	CMC ^{2, 6} (\pm)	Comments
AC Voltage ³ – Measure (cont) (200 to 1050) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.88 mV/V + 400 μ V 0.76 mV/V + 150 μ V 0.75 mV/V + 50 μ V 0.76 mV/V + 100 μ V 0.77 mV/V + 200 μ V 0.93 mV/V + 600 μ V 2.1 mV/V + 600 μ V 2.7 mV/V + 45 μ V	Fluke 5790A
AC Current ³ – Generate Up to 220 μ A 220 μ A to 2.2 mA (2.2 to 22) mA (22 to 220) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 20) Hz (20 to 40) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 20) Hz (20 to 40) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.36 mA/A + 16 nA 0.21 mA/A + 10 nA 0.14 mA/A + 8 nA 0.33 mA/A + 12 nA 1.3 mA/A + 65 nA 0.36 mA/A + 40 nA 0.20 mA/A + 35 nA 0.14 mA/A + 35 nA 0.23 mA/A + 0.11 μ A 1.3 mA/A + 0.65 μ A 0.35 mA/A + 0.40 μ A 0.21 mA/A + 0.35 μ A 0.14 mA/A + 0.35 μ A 0.23 mA/A + 0.55 μ A 1.3 mA/A + 5.0 μ A 0.37 mA/A + 4.0 μ A 0.72 mA/A + 3.5 μ A 0.14 mA/A + 3.5 μ A 0.23 mA/A + 3.5 μ A 1.3 mA/A + 10 μ A	Fluke 5730A

Parameter/Range	Frequency	CMC ^{2, 6} (\pm)	Comments
AC Current ³ – Generate (cont)			
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.30 mA/A + 35 μ A 0.53 mA/A + 80 μ A 8.1 mA/A + 0.16 mA	Fluke 5730A
Clamp-on Only ³ (16.5 to 149.999) A	(45 to 65) Hz (65 to 440) Hz	0.42 % + 25 mA 0.95 % + 27 mA	Fluke 5522A w/ 5500A coil
(150 to 1025) A	(45 to 65) Hz (65 to 440) Hz	0.42 % + 90 mA 0.94 % + 0.1 A	
AC Current ³ – Measure			
(0 to 200) μ A	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	1.0 mA/A + 20 nA 0.55 mA/A + 20 nA 0.075 mA/A + 20 nA	Fluke 8508A
200 μ A to 2 mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.62 mA/A + 0.20 μ A 0.33 mA/A + 0.20 μ A 0.75 mA/A + 0.20 μ A	
(2 to 20) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.89 mA/A + 2.0 μ A 0.32 mA/A + 2.0 μ A 0.75 mA/A + 2.0 μ A	
(20 to 200) mA	10 Hz to 10 kHz	0.29 mA/A + 20 μ A	
200 mA to 2 A	10 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.69 mA/A + 0.20 mA 0.82 mA/A + 0.20 mA 3.5 mA/A + 0.20 mA	
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	0.93 mA/A + 2.0 mA 2.9 mA/A + 2.0 mA	

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
AC High Voltage – Measure (50 to 60) Hz	(1 to 10) kV (10 to 35) kV (35 to 100) kV	0.25 V + 4.6 mV/V 0.25 V + 4.8 mV/V 4.9 V + 4.9 mV/V	Vitrek 4700
DC High Voltage – Measure	(1 to 10) kV (10 to 35) kV (35 to 100) kV	0.18 + 0.49 mV/V 0.18 + 0.72 mV/V 0.96 + 1.2 mV/V	Vitrek 4700 with HVL100

Parameter/Range	Frequency	CMC ^{2, 5, 6} (±)	Comments
AC Flatness – Measure (220 to 700) mV	(10 to 30) Hz (30 to 120) Hz (0.12 to 1.2) kHz (1.2 to 120) kHz (120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz	0.1 % 0.03 % 0.03 % 0.04 % 0.04 % 0.06 % 0.06 % 0.14 % 0.27 %	Fluke 5790A
700 mV to 2.2 V	(10 to 30) Hz (30 to 120) Hz (0.12 to 1.2) kHz (1.2 to 120) kHz (120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz	0.1 % 0.04 % 0.04 % 0.03 % 0.03 % 0.06 % 0.07 % 0.1 % 0.2 %	
(2.2 to 7) V	(10 to 30) Hz (30 to 120) Hz (0.12 to 1.2) kHz (1.2 to 120) kHz (120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz	0.1 % 0.04 % 0.04 % 0.04 % 0.04 % 0.05 % 0.06 % 0.1 % 0.2 %	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouple Indicators ³ – Generate & Measure			
Type E	(-270 to 0) °C (0 to 600) °C (600 to 1000) °C	0.032 °C 0.035 °C 0.039 °C	Fluke 5730A. Fluke Ice Point 9101, Fluke 8508A
Type J	(-210 to -0) °C (0 to 600) °C (600 to 1200) °C	0.069 °C 0.038 °C 0.044 °C	
Type K	(-200 to 0) °C (0 to 600) °C (600 to 1372) °C	0.091 °C 0.045 °C 0.063 °C	
Type N	(-200 to 0) °C (0 to 600) °C (600 to 1300) °C	0.15 °C 0.057 °C 0.057 °C	
Type R	(0 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.27 °C 0.14 °C 0.13 °C	
Type S	(0 to 500) °C (500 to 1000) °C (1000 to 1767) °C	0.27 °C 0.18 °C 0.13 °C	
Type T	(-250 to 0) °C (0 to 120) °C (120 to 400) °C	0.21 °C 0.042 °C 0.038 °C	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of RTD Indicators ³ – Generate & Measure			
Pt 385, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.05 °C 0.07 °C 0.09 °C 0.10 °C 0.12 °C 0.23 °C	Fluke 5522A, Fluke 8508A
Pt 3926, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.05 °C 0.07 °C 0.09 °C 0.10 °C 0.12 °C	
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.25 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.10 °C 0.23 °C	
Pt 385, 200 Ω	(-200 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.04 °C 0.05 °C 0.12 °C 0.13 °C 0.14 °C 0.16 °C	
Pt 385, 500 Ω	(-200 to -80) °C (-80 to 100) °C (100 to 260) °C (260 to 400) °C (400 to 600) °C (600 to 630) °C	0.04 °C 0.05 °C 0.06 °C 0.08 °C 0.09 °C 0.11 °C	

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Electrical Calibration of RTD Indicators ³ (cont) – Generate & Measure			
Pt 385, 1000 Ω	(-200 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 600) °C (600 to 630) °C	0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.23 °C	Fluke 5522A, Fluke 8508A
PtNi 385, 120 Ω	(-80 to 100) °C (100 to 260) °C	0.08 °C 0.14 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.3 °C	

Parameter/Range	Frequency	CMC ^{2, 6} (±)	Comments
Distortion – Measure			
(-75 to 0) dB Dist	10 Hz to 500 kHz	0.74 dB	U8903A
(-99.99 to 0) dB Dist	9 kHz to 30 MHz	1.2 dB	E4440A
Capacitance – Generate			
(220 to 399.9) pF	10 Hz to 10 kHz	12 pF	Fluke 5522A
(0.4 to 1.0999) nF	10 Hz to 10 kHz	0.015 nF	
(1.1 to 3.2999) nF	10 Hz to 3 kHz	0.035 nF	
(3.3 to 10.999) nF	10 Hz to 1 kHz	0.035 nF	
(11 to 32.999) nF	10 Hz to 1 kHz	0.085 nF	
(33 to 109.999) nF	10 Hz to 1 kHz	0.26 nF	
(110 to 329.999) nF	10 Hz to 1 kHz	0.78 nF	
(0.33 to 1.1) μF	(10 to 600) Hz	0.0035 μF	
(1.1 to 3.3) μF	(10 to 300) Hz	0.011 μF	
(3.3 to 11) μF	(10 to 150) Hz	0.035 μF	
(11 to 33) μF	(10 to 120) Hz	0.15 μF	
(33 to 110) μF	(10 to 80) Hz	0.55 μF	
(110 to 330) μF	DC to 50 Hz	2.4 μF	
(0.33 to 1.1) mF	DC to 20 Hz	0.0055 mF	
(1.1 to 3.3) mF	DC to 6 Hz	0.017 mF	
(3.3 to 11) mF	DC to 2 Hz	0.055 mF	
(11 to 33) mF	DC to 0.6 Hz	0.26 mF	
(33 to 110) mF	DC to 0.2 Hz	1.2 mF	

Parameter/Range	Frequency	CMC ^{2, 6} (\pm)	Comments
Capacitance – Generate, Fixed Points 1 pF 10 pF 100 pF 1000 pF 0.01 μ F 0.10 μ F 1.0 μ F	1 kHz 1 kHz 1 kHz 1 kHz 1 kHz 1 kHz 1 kHz	0.0012 pF 0.012 pF 0.12 pF 1.2 pF 0.000 74 μ F 0.000 82 μ F 0.0015 μ F	HP 16380A and HP 16380C standard capacitor sets
Capacitance – Measure 10 pF 100 pF 1000 pF 0.1 μ F 10 μ F	120 Hz to 300 kHz 120 Hz to 300 kHz 120 Hz to 300 kHz 120 Hz to 100 kHz 120 Hz to 100 kHz	0.028 pF 0.19 pF 1.2 pF 0.000 61 μ F 0.093 μ F	Agilent E4980A

III. Electrical RF/Microwave

Parameter/Equipment	Range	CMC ^{2, 4, 7} (\pm)	Comments
RF Attenuation – Tuned RF Power Measurement	100 kHz to 10 MHz 10 MHz to 3.05 GHz (3.05 to 6.6) GHz (6.6 to 13.2) GHz (13.2 to 19.2) GHz (19.2 to 26.5) GHz	0.89 dBm 0.2 dBm 0.2 dBm 0.2 dBm 0.2 dBm 0.2 dBm	SP 8902A with 11722A N5531S MMR System
RF Power – Source	(20 to 24) dBm (0.01 to 100) kHz (0.1 to 125) MHz (14 to 20) dBm (0.01 to 100) kHz (0.1 to 125) MHz (125 to 300) MHz (0.3 to 1.4) GHz (-17 to 14) dBm (0.01 to 100) kHz (0.1 to 125) MHz (125 to 300) MHz (0.3 to 1.4) GHz (1.4 to 4.0) GHz	0.06 dB 0.06 dB 0.04 dB 0.06 dB 0.09 dB 0.23 dB 0.04 dB 0.06 dB 0.09 dB 0.23 dB 0.35 dB	Fluke 96270A reference source with leveling head output

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
RF Attenuation – Tuned RF Power Measurement	(-48 to -17) dBm (0.01 to 100) kHz (0.1 to 125) MHz (125 to 300) MHz (0.3 to 1.4) GHz (1.4 to 3.0) GHz (3.0 to 4.0) GHz (-74 to -48) dBm (0.1 to 10) MHz (10 to 125) MHz (125 to 300) MHz (0.3 to 1.4) GHz (1.4 to 4.0) GHz (-84 to -74) dBm (0.1 to 10) MHz (10 to 125) MHz (125 to 300) MHz (0.3 to 1.4) GHz (1.4 to 4.0) GHz (-94 to -84) dBm (0.1 to 10) MHz (10 to 125) MHz (125 to 300) MHz (0.3 to 3.0) GHz (-94 to -124) dB (10 to 125) MHz (125 to 300) MHz (0.3 to 1.4) GHz (1.4 to 3.0) GHz	0.04 dB 0.06 dB 0.09 dB 0.25 dB 0.40 dB 0.59 dB 0.23 dB 0.11 dB 0.11 dB 0.46 dB 0.57 dB 0.60 dB 0.10 dB 0.34 dB 0.57 dB 1.2 dB 0.60 dB 0.40 dB 0.60 dB 1.2 dB 0.80 dB 1.8 dB 1.8 dB 1.8 dB	SP 8902A with 11722A N5531S MMR system
RF Power – Measuring Equipment	(-120 to 16) dBm (2.4 to 8.0) GHz (8.0 to 12.0) GHz (12.0 to 18.0) GHz (18.0 to 22.0) GHz (22.0 to 26.5) GHz	0.8 dB 0.8 dB 0.8 dB 0.8 dB 0.8 dB	Fluke 96270A reference source with 11667B splitter
RF Power – Measure	(+20 to -30) dBm DC to 30 MHz (+20 to -10) dBm 30 MHz to 2.0 GHz (2 to 4.2) GHz (4.2 to 18) GHz (18 to 26.5) GHz	0.52 dBm + 1 digit 0.23 dBm 0.23 dBm 0.32 dBm 0.45 dBm	8902A with 11722A N5531S MMR system with N5532B

Parameter/Equipment	Range	CMC ^{2, 5, 7} (±)	Comments
Power Reference Measure	1 mW, 50 MHz	1.2 %	N432A, HP 3458A, HP 478A-H55 thermistor mount
Amplitude Modulation – Measure			
100 kHz to 10 MHz	Rate: 50 Hz to 10 kHz Depth: (5 to 99) %	2.3 % + 1 digit	8902A Measuring Receiver
10 MHz to 3 GHz	Rate: 50 Hz to 100kHz Depth: (20 to 99) % Depth: (5 to 20) %	0.58 % 2.9 %	N5531S MMR System with N5532B
(3 to 26.5) GHz	Rate: 50 Hz to 100kHz Depth: (20 to 99) % Depth: (5 to 20) %	1.7 % 5.2 %	
Frequency Modulation – Measure			
Rate: (0.02 to 10) kHz	≤ 40kHz _{peak} (0.25 to 10) MHz	1.2 % Deviation	N5531S MMR System with N5532B
Rate: (0.05 to 200) kHz	≤ 400kHz _{peak} (0.01 to 26.5) GHz	1.2 % Deviation	
Phase Modulation – Measure			
100 kHz to 6.6 GHz	> 0.7 Rad (> 0.3 to 0.7) Rad	1.6 % Deviation 3.7 % Deviation	N5531S MMR system with N5532B
(6.6 to 13.2) GHz	> 2.0 Rad (> 0.6 to 2.0) Rad	1.3 % Deviation 3.5 % Deviation	
(13.2 to 26.5) GHz	> 4.0 Rad (> 1.2 to 4.0) Rad	1.2 % Deviation 3.5 % Deviation	

IV. Mechanical

Parameter/Equipment	Range	CMC ^{2, 5, 7} (±)	Comments
Pressure – Measure and Measuring Equipment			
Pneumatic	(-2.2 to 2.2) psig (0 to 15) psig	0.000 12 psi 0.0004 psi	Fluke PPC3 pressure calibrator
	(-14.7 to 60) psig Up to 200 psig Up to 500 psig Up to 1 000 psig	0.0090 psi 0.024 psi 0.060 psi 0.13 psi	Mensor CPC 6000
Hydraulic	(0 to 34) inHg (50 to 10 000) psi (0 to 30 000) psi	0.012 inHg 0.0093 % 35 PSIG + 3 μPSIG/PSIG	Deadweight tester Additel DT672
Pressure – Measure and Measuring Equipment ³			
Hydraulic	(5 to 10 000) psig	0.12 %	Deadweight tester
Pneumatic	Up to 1 psig Up to 5 psig Up to 30 psig Up to 100 psig Up to 300 psig Up to 1000 psig Up to 5000 psig	0.0012 psi 0.04 psi 0.018 psi 0.12 psi 0.17 psi 0.59 psi 4.7 psi	Fluke modules
Scales & Balances ³			
Linearity	0.01 mg to 42 g (43 to 210) g 210 g to 5.1 kg (5.1 to 30) kg	0.00021 g 0.00025 g 0.028 g 0.028 g	Class 00, Class 0 and Class 1 weights
Repeatability	0.01 mg to 42 g (43 to 210) g 210 g to 5.1 kg (5.1 to 30) kg	0.000 028 g 0.000 14 g 0.019 g 0.00026 kg	
Scales & Balances ³	(0 to 1500) lb	0.0058 lb + 0.0004 lbs/lbs	Class F weights

Parameter/Equipment	Range	CMC ^{2, 5, 7} (±)	Comments
Mass – Measure	0.01 mg to 42 g (43 to 210) g	0.000 03 g + 0.36 µg/g 0.000 15 g + 0.08 µg/g	Analytical balances
	210 g to 6 kg (6 to 30) kg	0.018 g + 1.9 µg/g 0.17 g + 0.8 mg/g	Top loading balances
Torque – Measure	0.5 ozf·in to 2000 lbf·ft	0.3 %	Torque transducers
	(500 to 5000) lbf·ft	0.5 %	Norbar Transducer
Torque ³ – Measure	5 lbf·in to 600 lbf·ft	0.35 %	Torque transducers
Torque Transducers	(0.5 to 400) ozf·in (4 to 150) lbf·in (150 to 400) lbf·in (10 to 2000) lbf·ft	0.05 % 0.05 % 0.06 % 0.05 %	Torque arms, Class F weights
Force Measurement ³	(1 to 10) lbf (10 to 100) lbf (100 to 500) lbf (500 to 1000) lbf (1000 to 5000) lbf (5000 to 10 000) lbf (10 000 to 50 000) lbf (50 000 to 500 000) lbf	0.0058 lbf + 15 µlbf/lbf 0.0058 lbf + 34 µlbf/lbf 0.053 lbf + 58 µlbf/lbf 0.57 lbf + 20 µlbf/lbf 5.8 lbf + 33 µlbf/lbf 12 lbf + 24 µlbf/lbf 57 lbf + 74 µlbf/lbf 210 lbf + 620 µlbf/lbf	Load cells, Class F, Class 1 weights
Force – Measure and Measuring Equipment			
Compression	(1 to 1000) lbf (65 to 6500) lbf (6500 to 50 000) lbf	0.12 % 0.98 lbf 7.3 lbf	Class F weights Proving rings
Tension	(1 to 1000) lbf (65 to 6500) lbf (500 to 50 000) lbf	0.12 % 0.98 lbf 7.3 lbf	Class F weights Proving rings

V. Thermodynamics

Parameter/Equipment	Range	CMC ^{2,5,7} (±)	Comments
Thermometers ³	(-80 to -20) °C (-20 to 100) °C (100 to 400) °C (400 to 650) °C	0.012 °C 0.015 °C 0.038 °C 0.040 °C	Liquid bath Dry block/PRT
Infrared Thermometers – Measuring Equipment	(-15 to 120) °C (100 to 200) °C (200 to 350) °C (350 to 500) °C	0.7 °C 0.73 °C 1.0 °C 1.7 °C	Fluke 4180/4181
Ovens ³ – Temperature Only	(0 to 900) °C	1.4 °C	Fluke 1586 RTD Thermocouple
Temp/Humidity Indicators – Relative Humidity Temperature	(10 to 95) RH (0 to 50) °C	0.65 % 0.20 °C	Thunder Scientific 2500
Temperature – Measure	(-80 to < 0) °C 0 °C (> 0 to 200) °C (> 200 to 400) °C (400 to 650) °C	0.084 °C 0.019 °C 0.040 °C 0.053 °C 0.067 °C	Fluke 1502A with 5628 PRT
Relative Humidity – Measure ³	(13 to 73) % RH @ 25°C (10 to 90) % RH	0.65 % RH 0.65 % RH	RH Systems 473 chilled mirror
Temperature Uniformity Survey ³ J-Type Thermocouples K-Type Thermocouples	Range: (0 to 1200) °F Range: (0 to 1850) °F	2.3 + 0.0029 °F/°F 2.2 + 0.0035 °F/°F	IAW AMS2750

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
System Accuracy Test ³	Range: (0 to 1850) °F	2.2 °F + 0.0035 °F/°F	IAW AMS2750
Nuclear Density Gauges, Fixed Points – Density ³	111.0 lb/ft ³ 138.8 lb/ft ³ 168.3 lb/ft ³	1.2 lb/ft ³ 1.6 lb/ft ³ 1.9 lb/ft ³	Density block
Nuclear Density Gauges, Fixed Points – Moisture ³	Up to 35 lb/ft ³	1.3 lb/ft ³	Moisture blocks

VI. Time & Frequency

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Stopwatches/Timers ³	Up to 30 days	0.037 s/day	Timometer
Tachometer ³ – Non-contact	(0 to 100 000) RPM	0.062 RPM + 0.000 0056 RPM/RPM	Function generator and LED strobe.
Contact	(0 to 1500) RPM	0.13 RPM + 0.001 40 RPM/RPM	Reference tachometer comparison
Frequency – Measure ³	(0 to 200) MHz 50 MHz to 26.5 GHz	1.2 parts in 10 ⁷ Hz/Hz 1.2 parts in 10 ⁷ Hz/Hz	Agilent 53151A Agilent 53132A
Frequency – Measuring Equipment Time base	10 MHz	3.4 parts in 10 ⁹ MHz	Agilent 33120A, 4410A GPS
Frequency – Source	10 MHz	6 parts in 10 ¹⁰ Hz/Hz	4410A GPS frequency standard
	DC to 4 GHz (4 to 26.5) GHz	5.8 parts in 10 ⁸ Hz/Hz 5.8 parts in 10 ⁸ Hz/Hz	Fluke 96270A w/leveling head and microwave output

- ¹ This laboratory offers commercial calibration service and field calibration service.
- 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. 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 values of the nominal length of the device measured in inches, and D is the diameter of the device in inches
- ⁵ In the statement of CMC, a % denotes a percent of reading unless otherwise noted.
- ⁶ The measurands stated are generated using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure the measurand in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a fraction/percentage of the reading plus a fixed floor specification.
- ⁷ The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter
- ⁸ This scope meets A2LA's *P112 Flexible Scope Policy*.



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Presented this 10th day of August 2022.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1892.01
Valid to August 31, 2024
Revised December 30, 2022

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