



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017  
& ANSI/NC SL Z540-1-1994 & ANSI/NC SL Z540.3-2006

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CALIBRATION

Valid To: March 31, 2025

Certificate Number: 4296.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1, 8</sup>:

I. Dimensional

Parameter/Equipment	Range	CMC <sup>2, 4</sup> ( $\pm$ )	Comments
Calipers <sup>3</sup>	Up to 60 in	(300 + 4.5L) $\mu$ in	Gage blocks
Micrometers – Outside, Depth & Inside <sup>3</sup>	(0.105 to 1) in Up to 12 in Up to 36 in Up to 72 in	(17 + 7L) $\mu$ in (31 + 6.3L) $\mu$ in (58 + 7L) $\mu$ in (580 + 3.4L) $\mu$ in	Gage blocks
Anvil & Spindle Flatness – Measure <sup>3</sup>	Up to 60 $\mu$ in	5 $\mu$ in	Optical flat & monochromatic light
Height Gages <sup>3</sup>	Up to 40 in Up to 60 in	(120 + 5.7L) $\mu$ in (590 + 2.9L) $\mu$ in	Gage blocks

Parameter/Equipment	Range	CMC <sup>2, 4, 9</sup> (±)	Comments
Indicators <sup>3</sup>	Up to 1 in Up to 2 in Up to 10 in	46 μin 92 μin 590 μin	Gage blocks
Indicator – Amplifier	Up to 0.002 in	3 μin	Gage blocks
Gage Block Comparators <sup>3</sup>	Up to 0.0003 in Up to 0.001 in	2 μin 2.5 μin	Gage blocks
Master Comparators – Meter <sup>3</sup>	Up to 0.0002 in Up to 0.0004 in Up to 0.002 in Up to 0.004 in Up to 0.02 in	3.6 μin 6.2 μin 29 μin 58 μin 290 μin	Gage blocks
Height Master <sup>3</sup>			
Parallelism of Steps	Up to 0.001 in	15 μin	Gage blocks & amplifier
Micrometer Linearity	Up to 1 in	(17 + 6.9L) μin	
Step Height	Up to 4 in (4 to 24) in	(19 + 6.9L) μin (25 + 6.9L) μin	
Gage blocks			
Length	(0.01 to 4) in (5 to 20) in	(3.3 + 1.8L) μin (2.4 + 2.7L) μin	Gage blocks & comparator
Parallelism	(0.01 to 20) in	1.2 μin	Optical flat
Flatness	(0.01 to 20) in	3.2 μin	
Length Standards – Measure <sup>5</sup>	Up to 72 in	(120 + 6.6L) μin	Using gage blocks & amplifier
Ring Gages	(0.04 to 1) in (> 1 to 12) in	10 μin (7 + 3D) μin	Master comparator, gage blocks

Parameter/Equipment	Range	CMC <sup>2, 4, 9</sup> ( $\pm$ )	Comments
2D Length – Measure <sup>5</sup>  Light Probe High – Precision Wide – Field	Up to 3.54 in Up to 4.92 in Up to 7.87 in	(320 + 7L) $\mu$ in (79 + 6.9L) $\mu$ in (200 + 6.9L) $\mu$ in	Using Keyence IM-7020 vision system
Dimensional Measuring Systems <sup>3</sup>	0.02 in 0.1 in 0.1 in 0.2 in 0.8 in	13 $\mu$ in + 0.58R 17 $\mu$ in + 0.58R 6.4 $\mu$ in + 0.58R 7 $\mu$ in + 0.58R 23 $\mu$ in + 0.58R	Master gages  Steel pin gage Ceramic pin gage Ceramic gage block Ceramic gage block Ceramic ring gage
Thread Plug Gages (60°) –  Pitch Diameter  Major Diameter	(0.06 to 1) in (> 1 to 6) in  (0.06 to 1) in (> 1 to 6) in	(58 + 11D) $\mu$ in (60 + 9D) $\mu$ in  20 $\mu$ in (18 + 2D) $\mu$ in	P&W Supermicrometer <sup>TM</sup> , thread wires, gage blocks
P&W Supermicrometer <sup>TM3</sup> –  Spindle  Meter  Force	1 in  0.001 in  (2 to 16) ozf (16 to 40) ozf	15 $\mu$ in  10 $\mu$ in  0.56 ozf 2.9 ozf	Gage blocks    Force gage
Plug Gages	Up to 1 in (> 1 to 12) in	20 $\mu$ in (18 + 2D) $\mu$ in	P&W Supermicrometer <sup>TM</sup> , gage blocks, universal comparator
Adjustable Thread Ring Gages (60°) – Pitch Diameter <sup>3</sup>	Up to 6 in	(W) Set Plug Tolerance	Comparison to thread set plugs; tolerance of set plug is the stated CMC

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2, 4, 7</sup> (±)	Comments
DC Voltage <sup>3</sup> – Generate	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	7.5 μV/V + 0.4 μV 5 μV/V + 0.7 μV 3.5 μV/V + 2.9 μV 3.5 μV/V + 4.3 μV 5 μV/V + 43 μV 6.5 μV/V + 440 μV	Fluke 5720A
DC Voltage <sup>3</sup> – Generate	(0 to 330) mV (0.33 to 3.3) V (3.3 to 33) V (33 to 330) V (330 to 1000) V	16 μV/V + 0.78 μV 9 μV/V + 1.6 μV 9 μV/V + 16 μV 14 μV/V + 120 μV 14 μV/V + 1.4 mV	Fluke 5522A
DC Voltage <sup>3</sup> – Measure	(0 to 200) mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1050) V  (0 to 10) kV	4.5 μV/V + 0.1 μV 3 μV/V + 0.42 μV 3 μV/V + 4.7 μV 4.5 μV/V + 43 μV 4.5 μV/V + 560 μV  0.36 % + 0.038 V	Fluke 8508A  Vitretek 4700
DC Current <sup>3</sup> – Generate	(0 to 220) μA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A (2.2 to 11) A	40 μA/A + 6 nA 35 μA/A + 7 nA 35 μA/A + 40 nA 45 μA/A + 0.7 μA 80 μA/A + 12 μA 360 μA/A + 480 μA	Fluke 5720A/5725A
DC Current <sup>3</sup> – Generate	(0 to 330) μA (0.33 to 3.3) mA (3.3 to 33) mA (33 to 330) mA (0.33 to 1.1) A (1.1 to 3) A (3 to 11) A (11 to 20.5) A  (20 to 100) A (100 to 300) A	120 μA/A + 0.016 μA 78 μA/A + 0.039 μA 78 μA/A + 0.19 μA 78 μA/A + 1.9 μA 160 μA/A + 31 μA 300 μA/A + 31 μA 390 μA/A + 390 μA 1 mA/A + 580 μA  0.058 % + 0.58R 0.12 % + 0.58R	Fluke 5522A  Guildline 9711, Fluke 8508A, & power supplies

Parameter/Equipment	Range	CMC <sup>2, 4, 7</sup> (±)	Comments
DC Current <sup>3</sup> – Measure	(0 to 200) µA (0.2 to 2) mA (2 to 20) mA (20 to 200) mA (0.2 to 2) A (2 to 20) A	12 µA/A + 0.41 nA 12 µA/A + 4 nA 13 µA/A + 40 nA 36 µA/A + 0.84 µA 170 µA/A + 16 µA 380 µA/A + 400 µA	Fluke 8508A
	(20 to 100) A (100 to 300) A	0.058 % + 0.58R 0.12 % + 0.58R	Guideline 9711, Fluke 8508A

Parameter/Range	Frequency	CMC <sup>2, 7</sup> (±)	Comments
AC Voltage <sup>3</sup> – Generate			
Up to 22 mV	(10 to 20) Hz	240 µV/V + 4 µV	Fluke 5720A/5725A
	(20 to 40) Hz	90 µV/V + 4 µV	
	(0.04 to 20) kHz	80 µV/V + 4 µV	
	(20 to 50) kHz	200 µV/V + 5 µV	
	(50 to 100) kHz	500 µV/V + 5 µV	
	(100 to 300) kHz	1.1 mV/V + 10 µV	
	(300 to 500) kHz (0.5 to 1) MHz	1.4 mV/V + 20 µV 2.7 mV/V + 20 µV	
(22 to 220) mV	(10 to 20) Hz	240 µV/V + 12 µV	Fluke 5720A/5725A
	(20 to 40) Hz	90 µV/V + 7 µV	
	(0.04 to 20) kHz	80 µV/V + 7 µV	
	(20 to 50) kHz	200 µV/V + 7 µV	
	(50 to 100) kHz	460 µV/V + 17 µV	
	(100 to 300) kHz	900 µV/V + 20 µV	
	(300 to 500) kHz (0.5 to 1) MHz	1.4 mV/V + 25 µV 2.7 mV/V + 45 µV	
(0.22 to 2.2) V	(10 to 20) Hz	240 µV/V + 41 µV	Fluke 5720A/5725A
	(20 to 40) Hz	90 µV/V + 16 µV	
	(0.04 to 20) kHz	45 µV/V + 9 µV	
	(20 to 50) kHz	75 µV/V + 10 µV	
	(50 to 100) kHz	110 µV/V + 30 µV	
	(100 to 300) kHz	420 µV/V + 80 µV	
	(300 to 500) kHz (0.5 to 1) MHz	0.1 mV/V + 200 µV 1.7 mV/V + 310 µV	

Parameter/Range	Frequency	CMC <sup>2, 7</sup> ( $\pm$ )	Comments
AC Voltage <sup>3</sup> – Generate (cont)			
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	240 $\mu$ V/V + 400 $\mu$ V 90 $\mu$ V/V + 150 $\mu$ V 45 $\mu$ V/V + 150 $\mu$ V 75 $\mu$ V/V + 100 $\mu$ V 100 $\mu$ V/V + 200 $\mu$ V 270 $\mu$ V/V + 600 $\mu$ V 1 mV/V + 2 mV 1.5 mV/V + 3.2 mV	Fluke 5720A/5725A
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	240 $\mu$ V/V + 4 mV 90 $\mu$ V/V + 2 mV 52 $\mu$ V/V + 0.7 mV 80 $\mu$ V/V + 1 mV 150 $\mu$ V/V + 2.5 mV 900 $\mu$ V/V + 16 mV 4.4 mV/V + 40 mV 8 mV/V + 80 mV	Max voltage is subject to 2.2 x 10e7 V-Hz
(220 to 250) V	(15 to 50) Hz (0.05 to 1) kHz	300 $\mu$ V/V + 16 mV 70 $\mu$ V/V + 4 mV	
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	600 $\mu$ V/V + 12 mV 2.3 mV/V + 45 mV	
(220 to 1100) V	(0.04 to 1) kHz (1 to 20) kHz (20 to 30) kHz	90 $\mu$ V/V + 5 mV 170 $\mu$ V/V + 7.2 mV 600 $\mu$ V/V + 11 mV	

Parameter/Range	Frequency	CMC <sup>2, 7</sup> ( $\pm$ )	Comments
AC Voltage <sup>3</sup> – Generate (cont)			
(1 to 33) mV	(10 to 45) Hz (0.045 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	620 $\mu$ V/V + 4.8 $\mu$ V 120 $\mu$ V/V + 4.7 $\mu$ V 160 $\mu$ V/V + 4.7 $\mu$ V 0.78 mV/V + 4.7 $\mu$ V 2.7 mV/V + 9.3 $\mu$ V 6.2 mV/V + 39 $\mu$ V	Fluke 5522A
(33 to 330) mV	(10 to 45) Hz (0.045 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	230 $\mu$ V/V + 6.2 $\mu$ V 110 $\mu$ V/V + 6.2 $\mu$ V 120 $\mu$ V/V + 6.2 $\mu$ V 270 $\mu$ V/V + 6.3 $\mu$ V 620 $\mu$ V/V + 25 $\mu$ V 1.6 mV/V + 54 $\mu$ V	
(0.33 to 3.3) V	(10 to 45) Hz (0.045 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	230 $\mu$ V/V + 39 $\mu$ V 120 $\mu$ V/V + 47 $\mu$ V 150 $\mu$ V/V + 47 $\mu$ V 230 $\mu$ V/V + 40 $\mu$ V 540 $\mu$ V/V + 97 $\mu$ V 1.9 mV/V + 470 $\mu$ V	
(3.3 to 33) V	(10 to 45) Hz (0.045 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	230 $\mu$ V/V + 510 $\mu$ V 120 $\mu$ V/V + 470 $\mu$ V 190 $\mu$ V/V + 470 $\mu$ V 270 $\mu$ V/V + 470 $\mu$ V 700 $\mu$ V/V + 1.2 mV	
(33 to 330) V	(0.045 to 1) kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	150 $\mu$ V/V + 4.8 mV 160 $\mu$ V/V + 4.7 mV 190 $\mu$ V/V + 4.7 mV 230 $\mu$ V/V + 4.7 mV 1.6 mV/V + 39 mV	
(330 to 1020) V	(0.045 to 1) kHz (1 to 5) kHz (5 to 10) kHz	230 $\mu$ V/V + 9.5 mV 190 $\mu$ V/V + 8.2 mV 230 $\mu$ V/V + 8.8 mV	

Parameter/Range	Frequency	CMC <sup>2, 7</sup> ( $\pm$ )	Comments
AC Voltage <sup>3</sup> – Measure			
Up to 200 mV	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz (0.1 to 2) kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	160 $\mu$ V/V + 14 $\mu$ V 130 $\mu$ V/V + 4 $\mu$ V 110 $\mu$ V/V + 4 $\mu$ V 110 $\mu$ V/V + 2 $\mu$ V 110 $\mu$ V/V + 4 $\mu$ V 310 $\mu$ V/V + 8 $\mu$ V 710 $\mu$ V/V + 20 $\mu$ V	Fluke 8508A
(0.2 to 2) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz (0.1 to 2) kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	140 $\mu$ V/V + 120 $\mu$ V 110 $\mu$ V/V + 21 $\mu$ V 85 $\mu$ V/V + 20 $\mu$ V 65 $\mu$ V/V + 20 $\mu$ V 85 $\mu$ V/V + 20 $\mu$ V 210 $\mu$ V/V + 40 $\mu$ V 510 $\mu$ V/V + 200 $\mu$ V 0.3 % + 2 mV 1 % + 20 mV	
(2 to 20) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz (0.1 to 2) kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	140 $\mu$ V/V + 1.2 mV 110 $\mu$ V/V + 0.2 mV 85 $\mu$ V/V + 0.2 mV 65 $\mu$ V/V + 0.2 mV 85 $\mu$ V/V + 0.2 mV 210 $\mu$ V/V + 0.4 mV 510 $\mu$ V/V + 2 mV 0.3 % + 20 mV 1 % + 200 mV	
(20 to 200) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz (0.1 to 2) kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	140 $\mu$ V/V + 12 mV 110 $\mu$ V/V + 2 mV 85 $\mu$ V/V + 2 mV 65 $\mu$ V/V + 2 mV 85 $\mu$ V/V + 2 mV 210 $\mu$ V/V + 4 mV 510 $\mu$ V/V + 20 mV 0.3 % + 200 mV 1 % + 2 V	



Parameter/Range	Frequency	CMC <sup>2, 7</sup> (±)	Comments
AC Voltage <sup>3</sup> – Measure (cont)			
(200 to 1050) V	(1 to 10) Hz (10 to 40) Hz (0.04 to 10) kHz (10 to 30) kHz (30 to 100) kHz	140 µV/V + 70 mV 110 µV/V + 20 mV 95 µV/V + 20 mV 210 µV/V + 40 mV 510 µV/V + 200 mV	Fluke 8508A
(0 to 10) kV	(0.1 to 200) Hz (200 to 450) Hz (450 to 600) Hz	0.14 % + 0.12 V 0.46 % + 0.12 V 0.87 % + 0.12 V	Vitrek 4700
AC Current <sup>3</sup> – Generate			
Up to 220 µA	(10 to 20) Hz (20 to 40) Hz (0.04 to 1) kHz (1 to 5) kHz (5 to 10) kHz	250 µA/A + 17 nA 160 µA/A + 10 nA 120 µA/A + 8 nA 280 µA/A + 12 nA 1.1 mA/A + 65 nA	Fluke 5720A/5725A
(0.22 to 2.2) mA	(10 to 20) Hz (20 to 40) Hz (0.04 to 1) kHz (1 to 5) kHz (5 to 10) kHz	250 µA/A + 42 nA 160 µA/A + 36 nA 120 µA/A + 35 nA 200 µA/A + 110 nA 1.1 mA/A + 650 nA	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz (0.04 to 1) kHz (1 to 5) kHz (5 to 10) kHz	250 µA/A + 410 nA 160 µA/A + 360 nA 120 µA/A + 350 nA 200 µA/A + 550 nA 1.1 mA/A + 5 µA	
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz (0.04 to 1) kHz (1 to 5) kHz (5 to 10) kHz	250 µA/A + 4.7 µA 160 µA/A + 3.6 µA 120 µA/A + 2.5 µA 200 µA/A + 3.5 µA 1.1 mA/A + 10 µA	
(0.22 to 2.2) A	(0.02 to 1) kHz (1 to 5) kHz (5 to 10) kHz	260 µA/A + 35 µA 450 µA/A + 80 µA 7 mA/A + 160 µA	

Parameter/Range	Frequency	CMC <sup>2, 7</sup> (±)	Comments
AC Current <sup>3</sup> – Generate (cont)  (2.2 to 11) A	(0.04 to 1) kHz (1 to 5) kHz (5 to 10) kHz	460 μA/A + 180 μA 950 μA/A + 390 μA 3.6 mA/A + 750 μA	Fluke 5720A/5725A
AC Current <sup>3</sup> – Generate  (29 to 330) μA  (0.33 to 3.3) mA  (3.3 to 33) mA  (33 to 330) mA	(10 to 20) Hz (20 to 45) Hz (0.045 to 1) kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz  (10 to 20) Hz (20 to 45) Hz (0.045 to 1) kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz  (10 to 20) Hz (20 to 45) Hz (0.045 to 1) kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz  (10 to 20) Hz (20 to 45) Hz (0.045 to 1) kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.16 % + 0.078 μA 0.12 % + 0.078 μA 0.097 % + 0.078 μA 0.23 % + 0.12 μA 0.62 % + 0.16 μA 1.2 % + 0.31 μA  0.16 % + 0.12 μA 0.097 % + 0.12 μA 0.078 % + 0.12 μA 0.16 % + 0.16 μA 0.39 % + 0.23 μA 0.78 % + 0.47 μA  0.14 % + 1.6 μA 0.07 % + 1.6 μA 0.031 % + 1.6 μA 0.062 % + 1.6 μA 0.16 % + 2.3 μA 0.31 % + 3.1 μA  0.14 % + 16 μA 0.07 % + 16 μA 0.031 % + 16 μA 0.078 % + 39 μA 0.16 % + 78 μA 0.31 % + 160 μA	Fluke 5522A

Parameter/Range	Frequency	CMC <sup>2, 7</sup> (±)	Comments
AC Current <sup>3</sup> – Generate (cont)			
(0.33 to 3) A	(10 to 45) Hz (0.045 to 1) kHz (1 to 5) kHz (5 to 10) kHz	0.14 % + 78 µA 0.047 % + 78 µA 0.47 % + 0.78 mA 1.9 % + 3.9 mA	Fluke 5522A
(3 to 11) A	(45 to 100) Hz (0.1 to 1) kHz (1 to 5) kHz	0.047 % + 1.6 mA 0.078 % + 1.6 mA 2.3 % + 1.6 mA	
(11 to 20.5) A	(45 to 100) Hz (0.1 to 1) kHz (1 to 5) kHz	0.093 % + 3.9 mA 0.12 % + 3.9 mA 2.3 % + 3.9 mA	
AC Current <sup>3</sup> – Measure			
Up to 200 µA	(1 to 10) Hz (0.01 to 10) kHz (10 to 30) kHz (30 to 100) kHz	480 µA/A + 0.021 µA 480 µA/A + 0.02 µA 650 µA/A + 0.02 µA 0.4 % + 0.02 µA	Fluke 8508A
(0.2 to 2) mA	(1 to 10) Hz (0.01 to 10) kHz (10 to 30) kHz (30 to 100) kHz	290 µA/A + 0.2 µA 280 µA/A + 0.2 µA 650 µA/A + 0.2 µA 0.4 % + 0.2 µA	
(2 to 20) mA	(1 to 10) Hz (0.01 to 10) kHz (10 to 30) kHz (30 to 100) kHz	290 µA/A + 2 µA 280 µA/A + 2 µA 650 µA/A + 2 µA 0.4 % + 2 µA	
(20 to 200) mA	(1 to 10) Hz (0.01 to 10) kHz (10 to 30) kHz	290 µA/A + 20 µA 250 µA/A + 20 µA 600 µA/A + 20 µA	

Parameter/Range	Frequency	CMC <sup>2, 4, 7</sup> (±)	Comments
AC Current <sup>3</sup> – Measure (cont)			
(0.2 to 2) A	(0.01 to 2) kHz (2 to 10) kHz (10 to 30) kHz	600 μA/A + 200 μA 710 μA/A + 200 μA 0.3 % + 200 μA	Fluke 8508A
(2 to 20) A	(0.01 to 2) kHz (2 to 10) kHz	800 μA/A + 2 mA 0.25 % + 2 mA	
(20 to 100) A	(0.1 to 1000) Hz	0.13 A + 0.58R	Valhalla 2575A & 8508A

Parameter/Equipment	Range	CMC <sup>2, 7</sup> (±)	Comments
Resistance <sup>3</sup> – Measure	(0 to 2) Ω (2 to 20) Ω (20 to 200) Ω (0.2 to 2) kΩ (2 to 20) kΩ (20 to 200) kΩ (0.2 to 2) MΩ (2 to 20) MΩ (20 to 200) MΩ (0.2 to 2) GΩ (2 to 20) GΩ	15 μΩ/Ω + 4 μΩ 9 μΩ/Ω + 14 μΩ 7.5 μΩ/Ω + 51 μΩ 7.5 μΩ/Ω + 510 μΩ 7.5 μΩ/Ω + 5 mΩ 7.5 μΩ/Ω + 52 mΩ 8.5 μΩ/Ω + 530 mΩ 15 μΩ/Ω + 10 Ω 60 μΩ/Ω + 100 Ω 530 μΩ/Ω + 1 kΩ 530 μΩ/Ω + 10 kΩ	Fluke 8508A

Parameter/Equipment	Range	CMC <sup>2, 4, 7</sup> ( $\pm$ )	Comments	
Resistance <sup>3</sup> – Generate, Fixed Points	(1, 1.9) $\Omega$	95 $\mu\Omega/\Omega$ + 0.2 $\mu\Omega$	Fluke 5720A	
	(10, 19) $\Omega$	23 $\mu\Omega/\Omega$ + 1.5 $\mu\Omega$		
	(100, 190) $\Omega$	10 $\mu\Omega/\Omega$ + 11 $\mu\Omega$		
	(1, 1.9) k $\Omega$	9 $\mu\Omega/\Omega$ + 120 $\mu\Omega$		
	(10, 19) k $\Omega$	9 $\mu\Omega/\Omega$ + 1.5 m $\Omega$		
	(100, 190) k $\Omega$	11 $\mu\Omega/\Omega$ + 15 m $\Omega$		
	1 M $\Omega$	20 $\mu\Omega/\Omega$ + 180 m $\Omega$		
	1.9 M $\Omega$	21 $\mu\Omega/\Omega$ + 140 m $\Omega$		
	10 M $\Omega$	40 $\mu\Omega/\Omega$ + 580 m $\Omega$		
	19 M $\Omega$	47 $\mu\Omega/\Omega$ + 1.1 $\Omega$		
	100 M $\Omega$	100 $\mu\Omega/\Omega$ + 15 $\Omega$		
	10 M $\Omega$	0.16 % + 0.58R		Keithley 5155
	100 M $\Omega$	0.16 % + 0.58R		
	1 G $\Omega$	0.16 % + 0.58R		
	10 G $\Omega$	0.17 % + 0.58R		
	100 G $\Omega$	0.23 % + 0.58R		
1 T $\Omega$	4.9 % + 0.58R			
Resistance <sup>3</sup> – Generate	(0 to 11) $\Omega$	31 $\mu\Omega/\Omega$ + 0.78 m $\Omega$	Fluke 5522A	
	(11 to 33) $\Omega$	23 $\mu\Omega/\Omega$ + 1.2 m $\Omega$		
	(33 to 110) $\Omega$	22 $\mu\Omega/\Omega$ + 1.1 m $\Omega$		
	(110 to 330) $\Omega$	22 $\mu\Omega/\Omega$ + 1.6 m $\Omega$		
	(0.33 to 1.1) k $\Omega$	22 $\mu\Omega/\Omega$ + 2.2 m $\Omega$		
	(1.1 to 3.3) k $\Omega$	22 $\mu\Omega/\Omega$ + 16 m $\Omega$		
	(3.3 to 11) k $\Omega$	22 $\mu\Omega/\Omega$ + 16 m $\Omega$		
	(11 to 33) k $\Omega$	22 $\mu\Omega/\Omega$ + 160 m $\Omega$		
	(33 to 110) k $\Omega$	22 $\mu\Omega/\Omega$ + 160 m $\Omega$		
	(110 to 330) k $\Omega$	25 $\mu\Omega/\Omega$ + 1.6 $\Omega$		
	(0.33 to 1.1) M $\Omega$	25 $\mu\Omega/\Omega$ + 1.7 $\Omega$		
	(1.1 to 3.3) M $\Omega$	47 $\mu\Omega/\Omega$ + 24 $\Omega$		
	(3.3 to 11) M $\Omega$	100 $\mu\Omega/\Omega$ + 39 $\Omega$		
	(11 to 33) M $\Omega$	200 $\mu\Omega/\Omega$ + 2 k $\Omega$		
	(33 to 110) M $\Omega$	390 $\mu\Omega/\Omega$ + 2 k $\Omega$		
(110 to 330) M $\Omega$	2.3 m $\Omega/\Omega$ + 78 k $\Omega$			
(330 to 1100) M $\Omega$	12 m $\Omega/\Omega$ + 390 k $\Omega$			

Parameter/Range	Frequency	CMC <sup>2,7</sup> (±)	Comments
Capacitance <sup>3</sup> – Generate			
(0.19 to 1.1) nF	10 Hz to 10 kHz	0.39 % + 0.0081 nF	Fluke 5522A                *Excludes 0.7 mF
(1.1 to 3.3) nF	10 Hz to 3 kHz	0.39 % + 0.0078 nF	
(3.3 to 11) nF	10 Hz to 1 kHz	0.19 % + 0.0078 nF	
(11 to 110) nF	10 Hz to 1 kHz	0.19 % + 0.078 nF	
(110 to 330) nF	10 Hz to 1 kHz	0.19 % + 0.23 nF	
(0.33 to 1.1) μF	(10 to 600) Hz	0.19 % + 0.83 nF	
(1.1 to 3.3) μF	(10 to 300) Hz	0.19 % + 2.3 nF	
(3.3 to 11) μF	(10 to 150) Hz	0.19 % + 7.8 nF	
(11 to 33) μF	(10 to 120) Hz	0.31 % + 23 nF	
(33 to 110) μF	(10 to 80) Hz	0.35 % + 78 nF	
(110 to 330) μF	(0 to 50) Hz	0.35 % + 230 nF	
(0.33 to 1.1) mF	(0 to 20) Hz	0.35 % + 0.78 μF	
(1.1 to 3.3) mF	(0 to 6) Hz	0.35 % + 2.3 μF	
(3.3 to 11) mF	(0 to 2) Hz	0.35 % + 12 μF	
(11 to 33) mF	(0 to 0.6) Hz	0.58 % + 23 μF	
(33 to 110) mF	(0 to 0.2) Hz	0.85 % + 82 μF	

Parameter/Equipment	Range	CMC <sup>2, 4, 7</sup> (±)	Comments
Electrical Simulation of Thermocouple Indicators & Indicating Systems <sup>3</sup> –			
Type E	(-270 to -245) °C (-245 to -195) °C (-195 to -155) °C (-155 to -90) °C (-90 to 15) °C (15 to 890) °C (890 to 1000) °C	1.4 °C 0.21 °C 0.12 °C 0.097 °C 0.083 °C 0.071 °C 0.082 °C	Ectron Corporation 1140A
Type J	(-210 to -180) °C (-180 to -120) °C (-120 to -50) °C (-50 to 990) °C (990 to 1200) °C	0.14 °C 0.12 °C 0.094 °C 0.083 °C 0.082 °C	
Type K	(-270 to -255) °C (-255 to -195) °C (-195 to -115) °C (-115 to -55) °C (-55 to 1000) °C	2.5 °C 0.81 °C 0.14 °C 0.11 °C 0.087 °C	
Type T	(-270 to -255) °C (-255 to -240) °C (-240 to -210) °C (-210 to -150) °C (-150 to -40) °C (-40 to 100) °C (100 to 400) °C	2.1 °C 0.57 °C 0.35 °C 0.21 °C 0.14 °C 0.094 °C 0.083 °C	
Waveform – Measure <sup>3</sup>			
Voltage	(0 to 100) V	0.12 % + 0.82R	Tektronix TDS3054B
Frequency	Up to 500 MHz	0.24 % + 0.82R	
Rise Time	Up to 500 MHz	0.81 ns + 0.82R	

Parameter/Frequency	Range/Frequency	CMC <sup>2, 4, 7</sup> (±)	Comments
Oscilloscopes <sup>3</sup> –			
DC Voltage			
50 Ω	(0 to 6) V	0.19 % + 31 μV	Fluke 5522A
1 MΩ	(0 to 130) V	0.039 % + 40 μV	
Square Wave Voltage			
10 Hz to 10 kHz (50 Ω)	1 mVp-p to 6 Vp-p	0.19 % + 69 μV	
10 Hz to 1 kHz (1 MΩ)	1 mVp-p to 130 Vp-p	0.078 % + 130 μV	
(1 to 10) kHz (1 MΩ)	1 mVp-p to 130 Vp-p	0.19 % + 130 μV	
Square Wave Frequency	10 Hz to 10 kHz	1.9 μHz/Hz + 0.58R	
Rise Time – Generate			
1 kHz to 2 MHz	≤ 300 ps	78 ps	
(2 to 10) MHz	< 350 ps	78 ps	
Time Marker			<i>t</i> = time in seconds
(50 Ω)	5 s to 20 ms 20 ms to 1 ns	(25 + 1000 <i>t</i> ) μs/s 1.9 μs/s + 0.0031 ns	
Pulse Width	(4 to 500) ns 20 ms to 200 ns	3.9 % + 2 ns 1.9 μs/s + 0.18 ns	
Square, Sine, & Triangle Waveforms			
10 Hz to 100 kHz			
(1 MΩ)	1.8 mV to 55 Vp-p	2.3 % + 150 μV	
(50 Ω)	1.8 mV to 2.5 Vp-p	2.3 % + 78 μV	
Level Sine Wave			
5 mV to 5.5 V	50 kHz to 10 MHz	1.6 % + 240 μV	
	(10 to 100) MHz	2.7 % + 240 μV	
	(100 to 300) MHz	3.1 % + 240 μV	
	(300 to 600) MHz	4.7 % + 240 μV	
4 mV to 3.5 V	(600 to 1100) MHz	5.4 % + 240 μV	
Flatness Relative to 50 kHz	50 kHz to 100 MHz	1.2 % + 97 μV	
	(100 to 300) MHz	1.6 % + 97 μV	
	(300 to 600) MHz	3.1 % + 97 μV	
	(600 to 1100) MHz	3.9 % + 97 μV	
Frequency	50 kHz to 1100 MHz	1.9 μHz/Hz + 550 μHz	



III. Mechanical

Parameter/Equipment	Range	CMC <sup>2, 4, 6, 9</sup> ( $\pm$ )	Comments
Torque – Measure Wrenches & Drivers <sup>3</sup>	(1 to 2) lbf·in (2 to 10) lbf·in (5 to 50) lbf·in (40 to 400) lbf·in (100 to 1000) lbf·in (50 to 250) lbf·ft (60 to 600) lbf·ft	1.2 % + 0.58R 0.59 % + 0.58R 0.76 % + 0.58R 0.42 % + 0.58R 0.37 % + 0.58R 0.52 % + 0.58R 0.43 % + 0.58R	Torque testers
Pressure – Measure & Measuring Equipment			
Hydraulic	(0 to 3000) psia (3000 to 6000) psia (6000 to 10 000) psia	0.5 psia + 0.58R 1 psia + 0.58R 1.7 psia + 0.58R	Ruska 7615
Pneumatic	(0 to 125) psig (125 to 2500) psig	0.0081 % + 0.0063 psi 0.0095 % + 0.0044 psi	Fluke 7250xi
	(0 to 1) psig (1 to 20) psig	0.0001 psi + 0.58R 0.009 % + 0.58R	Fluke 7250xi <sup>3</sup>
	(0 to 50) psia	0.008 psia + 0.58R	Ruska 6220
	(0 to 1) inH <sub>2</sub> O (1 to 30) inH <sub>2</sub> O	0.000 68 inH <sub>2</sub> O + 0.58R 0.011 % + 0.58R	Fluke 7250LP <sup>3</sup>
	(0 to 12.5) psig (12.5 to 250) psig	0.0017 psi + 0.58R 0.0093 % + 0.58R	Fluke 7250xi <sup>3</sup>
Vacuum <sup>3</sup> – Measure & Measuring Equipment	(-14.5 to 0) psi	0.0016 psi + 0.58R	Fluke 7250xi

Parameter/Equipment	Range	CMC <sup>2, 4, 9</sup> (±)	Comments
Scales & Balances <sup>3</sup>	2 mg (5 to 500) mg (1 to 2) g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg 25 kg 30 kg 75 kg	0.0029 mg + 0.58R 0.012 mg + 0.58R 0.040 mg + 0.58R 0.0072 mg + 0.58R 0.013 mg + 0.58R 0.017 mg + 0.58R 0.019 mg + 0.58R 0.04 mg + 0.58R 0.07 mg + 0.58R 2.2 mg + 0.58R 3.1 mg + 0.58R 5.9 mg + 0.58R 14 mg + 0.58R 29 mg + 0.58R 110 mg + 0.58R 130 mg + 0.58R 130 mg + 0.58R 170 mg + 0.58R	Troemner platinum class, & Class 1 weights
Mass – Measure	(1, 2, 3, 10, 20, 30, 100, 200, 300, 500) mg (1, 2, 3, 5) g 10 g 20 g 30g 50 g 100 g 200 g 300 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg 25 kg  1 lb (453.59 g) 5 lb (2.27 kg) 10 lb (4.54 kg) 20 lb (9.07 kg) 25 lb (11.34 kg) 50 lb (22.68 kg)	0.002 mg 0.006 mg 0.007 mg 0.01 mg 0.03 mg 0.04 mg 0.07 mg 0.04 mg 0.1 mg 0.1 mg 0.3 mg 0.4 mg 3 mg 4 mg 5 mg 9 mg  0.4 mg 1.6 mg 3 mg 4 mg 4 mg 10 mg	Troemner ultra class, Class 0, Class 1 weights & balances.

#### IV. Fluid Quantities

Parameter/Equipment	Range	CMC <sup>2, 4, 6, 9</sup> ( $\pm$ )	Comments
Pipette & Fluid Dispensers –			
Gravimetric Method	Up to 1.5 mL (1.5 to 5) mL (5 to 20) mL	0.74 $\mu$ L 2.1 $\mu$ L 5.3 $\mu$ L	Laboratory balance, deionized water
Photometric Method <sup>3</sup>	(0.1 to 0.49) $\mu$ L (0.5 to 1.9) $\mu$ L (2 to 9.9) $\mu$ L (10 to 49.9) $\mu$ L (50 to 199) $\mu$ L (200 to 5000) $\mu$ L	0.39 % 0.36 % 0.33 % 0.39 % 0.38 % 0.4 %	Artel pipette calibration system, reagents
Mass Flow – Measure & Measuring Equipment	(5 to 50) sccm (50 to 500) sccm (0.5 to 5) slm (5 to 25) slm (25 to 250) slm	0.24 % + 0.58R 0.25 % + 0.58R 0.25 % + 0.58R 0.23 % + 0.58R 0.23 % + 0.58R	Fluke A700k/molbloc

#### V. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2, 4, 9</sup> ( $\pm$ )	Comments
Humidity <sup>3</sup> – Measure	(5 to 33) % RH (33 to 54) % RH (54 to 75) % RH (75 to 95) % RH	0.32 % RH 0.48 % RH 0.66 % RH 0.82 % RH	RH Systems 473- RP2
Dew/Frost Point <sup>3</sup> – Measure	(-20 to 70) °C	0.18 °C	RH Systems 473- RP2
Humidity – Measuring Equipment	(10 to 95) % RH	0.52 % RH + 0.58R	Thunder Scientific 2500

Parameter/Equipment	Range	CMC <sup>2,4,9</sup> ( $\pm$ )	Comments
Temperature Sensors – Measuring Equipment & Measure	(0 to 70) °C	0.062 °C + 0.58R	Thunder Scientific 2500
Temperature <sup>3</sup> – Measure	(-196 to 0) °C (0 to 420) °C (420 to 660) °C	0.0042 °C + 0.58R 0.0045 °C + 0.58R 0.0048 °C + 0.58R	Fluke 1594A & 5699
Temperature – Measuring Equipment	-196 °C (-60 to 0) °C (0 to 420) °C (420 to 550) °C	0.0042 °C + 0.58R 0.0042 °C + 0.58R 0.0045 °C + 0.58R 0.0048 °C + 0.58R	LN2 Fluke 1594A, 5699, & baths
Infrared <sup>3</sup> – Thermometers & Cameras	(-15 to 0) °C (0 to 35) °C (35 to 100) °C (100 to 200) °C (200 to 350) °C (350 to 500) °C	0.55 °C + 0.58R 0.51 °C + 0.58R 0.46 °C + 0.58R 0.63 °C + 0.58R 0.95 °C + 0.58R 2.1 °C + 0.58R	Fluke 4180 & 4181  Emissivity $\epsilon = 0.95$ , where $\lambda = (8 \text{ to } 14) \mu\text{m}$

## VI. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2,4,9</sup> ( $\pm$ )	Comments
Frequency – Measuring Equipment	10 MHz	$12 \times 10^{-11} \text{ Hz} + 0.58R$	Endrun Technologies Praecis Cfr
	Up to 80 MHz	$13 \times 10^{-11} \text{ Hz} + 0.58R$	Endrun Technologies Praecis Cfr, Agilent 33250A
Frequency <sup>3</sup> – Measuring Equipment	Up to 80 MHz	$2.5 \times 10^{-6} \text{ Hz/Hz} + 0.58R$	Agilent 33250A

Parameter/Equipment	Range	CMC <sup>2, 4, 9</sup> ( $\pm$ )	Comments
Frequency – Measure	Up to 5 GHz	$12 \times 10^{-11} \text{ Hz/Hz} + 0.58R$	Endrun Technologies Praecis Cfr & Agilent 53132A
Frequency <sup>3</sup> – Measure	Up to 5 GHz	$3.1 \times 10^{-9} \text{ Hz/Hz} + 0.58R$	Agilent 53132A
Stopwatches & Timers <sup>3</sup>	Up to 24 hours	$27 \text{ ms} + 0.58R$	53132A & 33250A

<sup>1</sup> This laboratory offers commercial calibration service and field calibration service.

<sup>2</sup> 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.

<sup>3</sup> 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.

<sup>4</sup> In the statement of CMC,  $L$  is the numerical value of the nominal length of the device measured in micro-inches.  $R$  is the resolution of the unit under test.  $D$  is the numerical value of the nominal diameter of the device measured in micro-inches.

<sup>5</sup> This laboratory meets R205 – *Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed above and is considered equivalent to that of a calibration.

<sup>6</sup> In the statement of CMC, percentages are of reading unless otherwise noted.

<sup>7</sup> 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 percentage or fraction of the reading plus a fixed floor specification.

<sup>8</sup> This scope meets A2LA's *P112 Flexible Scope Policy*.

<sup>9</sup> 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.



## Accredited Laboratory

A2LA has accredited

### **RSA INDUSTRIES INC DBA AMERICAN GAGE**

*Placentia, CA*

for technical competence in the field of

### Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and the requirements of ANSI/NCSL 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 April 2017*).



Presented this 28<sup>th</sup> day of April, 2023.

A blue ink signature of Trace McInturff, written over a horizontal line.

Mr. Trace McInturff, Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 4296.01  
Valid to March 31, 2025

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