



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3-2006

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CALIBRATION

Valid To: March 31, 2019

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 calibrations¹:

I. Dimensional

Parameter/Equipment	Range	CMC ^{2,4} (\pm)	Comments
Calipers	Up to 60 in	(300 + 4.5L) μ in	Gage blocks
Micrometers – Outside, Depth and Inside	Up to 12 in Up to 36 in Up to 72 in	(31 + 6.3L) μ in (58 + 7L) μ in (580 + 3.4L) μ in	Gage blocks
Height Gages	Up to 40 in Up to 60 in	(120 + 5.7L) μ in (590 + 2.9L) μ in	Gage blocks
Indicators	Up to 1 in Up to 2 in Up to 10 in	46 μ in 92 μ in 590 μ in	Gage blocks
Indicator – Amplified	Up to 0.002 in	3 μ in	Gage blocks

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Gage Block Comparators	Up to 0.0003 in Up to 0.001 in	2.0 μin 2.5 μin	Gage blocks
Master Comparators – Meter	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	Up to 12 in (>12 to 24) in	110 μin 170 μin	Gage blocks, amplifier
Gage blocks	(0.01 to 4) in (5 to 20) in	(3.2 + 1.8L) μin (1.2 + 2.4L) μin	Gage blocks and comparators
Length – Measure ⁵	Up to 72 in	(120 + 6.6L) μin	Gage blocks, amplifier
Ring Gages	Up to 1 in (>1 to 12) in	20 μin (18 + 3D) μin	Master comparator, gage blocks
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) μin (60 + 9D) μin 20 μin (18 + 3D) μin	P&W Supermicrometer™, thread wires, gage blocks
P&W Supermicrometer™ – Spindle Meter	1 in 0.001 in	15 μin 10 μin	Gage blocks
Thread Ring Gages (60°) – Pitch Diameter	Up to 1 in (>1 to 6) in	(58 + 11D) μin (60 + 9D) μin	Comparison to thread set plugs

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Plug Gages	Up to 1 in (>1 to 12) in	10 µin (7 + 3D) µin	P&W Supermicrometer™, gage blocks, universal comparator

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
DC Voltage – 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 ³ – 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 5520A
DC Voltage ³ – Measure	(0 to 200) mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1050) V	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	Fluke 8508A

Parameter/Equipment	Range	CMC ^{2,7} (\pm)	Comments
DC Current – Generate	(0 to 220) μ A (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 μ A/A + 6 nA 35 μ A/A + 7 nA 35 μ A/A + 40 nA 45 μ A/A + 0.7 μ A 80 μ A/A + 12 μ A 360 μ A/A + 480 μ A	Fluke 5720A/5725A
DC Current ³ – Generate	(0 to 330) μ A (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	120 μ A/A + 0.016 μ A 78 μ A/A + 0.039 μ A 78 μ A/A + 0.19 μ A 78 μ A/A + 1.9 μ A 160 μ A/A + 31 μ A 300 μ A/A + 31 μ A 390 μ A/A + 390 μ A 1 mA/A + 580 μ A	Fluke 5520A
DC Current ³ – Measure	(0 to 200) μ A (0.2 to 2) mA (2 to 20) mA (20 to 200) mA (0.2 to 2) A (2 to 20) A	12 μ A/A + 0.41 nA 12 μ A/A + 4 nA 13 μ A/A + 40 nA 36 μ A/A + 0.84 μ A 170 μ A/A + 16 μ A 380 μ A/A + 400 μ A	Fluke 8508A

Parameter/Range	Frequency	CMC ^{2,7} (\pm)	Comments
AC Voltage – Generate			
Up to 22 mV	(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 μ V/V + 4 μ V 90 μ V/V + 4 μ V 80 μ V/V + 4 μ V 200 μ V/V + 5 μ V 500 μ V/V + 5 μ V 1.1 mV/V + 10 μ V 1.4 mV/V + 20 μ V 2.7 mV/V + 20 μ V	Fluke 5720A/5725A
(22 to 220) mV	(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 μ V/V + 12 μ V 90 μ V/V + 7 μ V 80 μ V/V + 7 μ V 200 μ V/V + 7 μ V 460 μ V/V + 17 μ V 900 μ V/V + 20 μ V 1.4 mV/V + 25 μ V 2.7 mV/V + 45 μ V	
(0.22 to 2.2) 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 μ V/V + 41 μ V 90 μ V/V + 16 μ V 45 μ V/V + 9 μ V 75 μ V/V + 10 μ V 110 μ V/V + 30 μ V 420 μ V/V + 80 μ V 0.1 mV/V + 200 μ V 1.7 mV/V + 310 μ V	

Parameter/Range	Frequency	CMC ^{2,7} (±)	Comments
AC Voltage – 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 µV/V + 400 µV 90 µV/V + 150 µV 45 µV/V + 150 µV 75 µV/V + 100 µV 100 µV/V + 200 µV 270 µV/V + 600 µV 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 µV/V + 4 mV 90 µV/V + 2 mV 52 µV/V + 0.7 mV 80 µV/V + 1 mV 150 µV/V + 2.5 mV 900 µV/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 µV/V + 16 mV 70 µV/V + 4 mV	
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	600 µV/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 µV/V + 5 mV 170 µV/V + 7.2 mV 600 µV/V + 11 mV	

Parameter/Range	Frequency	CMC ^{2,7} (±)	Comments
AC Voltage ³ – Generate			
(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 μV/V + 4.8 μV 120 μV/V + 4.7 μV 160 μV/V + 4.7 μV 0.78 mV/V + 4.7 μV 2.7 mV/V + 9.3 μV 6.2 mV/V + 39 μV	Fluke 5520A
(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 μV/V + 6.2 μV 110 μV/V + 6.2 μV 120 μV/V + 6.2 μV 270 μV/V + 6.3 μV 620 μV/V + 25 μV 1.6 mV/V + 54 μV	
(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 μV/V + 39 μV 120 μV/V + 47 μV 150 μV/V + 47 μV 230 μV/V + 40 μV 540 μV/V + 97 μV 1.9 mV/V + 470 μV	
(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 μV/V + 510 μV 120 μV/V + 470 μV 190 μV/V + 470 μV 270 μV/V + 470 μV 700 μV/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 μV/V + 4.8 mV 160 μV/V + 4.7 mV 190 μV/V + 4.7 mV 230 μV/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 μV/V + 9.5 mV 190 μV/V + 8.2 mV 230 μV/V + 8.8 mV	

Parameter/Range	Frequency	CMC ^{2, 7} (±)	Comments
AC Voltage ³ – 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 μV/V + 14 μV 130 μV/V + 4 μV 110 μV/V + 4 μV 110 μV/V + 2 μV 110 μV/V + 4 μV 310 μV/V + 8 μV 710 μV/V + 20 μV	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 μV/V + 120 μV 110 μV/V + 21 μV 85 μV/V + 20 μV 65 μV/V + 20 μV 85 μV/V + 20 μV 210 μV/V + 40 μV 510 μV/V + 200 μV 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 μV/V + 1.2 mV 110 μV/V + 0.2 mV 85 μV/V + 0.2 mV 65 μV/V + 0.2 mV 85 μV/V + 0.2 mV 210 μV/V + 0.4 mV 510 μV/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 μV/V + 12 mV 110 μV/V + 2 mV 85 μV/V + 2 mV 65 μV/V + 2 mV 85 μV/V + 2 mV 210 μV/V + 4 mV 510 μV/V + 20 mV 0.3 % + 200 mV 1 % + 2 V	

Parameter/Range	Frequency	CMC ^{2, 7} (±)	Comments
AC Voltage ³ – 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
AC Current – 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 ^{2, 6, 7} (±)	Comments
AC Current – 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 ³ – 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 5520A

Parameter/Range	Frequency	CMC ^{2,7} (±)	Comments
AC Current ³ – 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 5520A
(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 ³ – 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 ^{2,7} (±)	Comments
AC Current ³ – 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	

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Resistance ³ – 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
Resistance – Generate, Fixed Points	0 Ω 1, 1.9 Ω 10, 19 Ω 100, 190 Ω 1, 1.9 kΩ 10, 19 kΩ 100, 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	40 μΩ 95 μΩ/Ω + 0.2 μΩ 23 μΩ/Ω + 1.5 μΩ 10 μΩ/Ω + 11 μΩ 9 μΩ/Ω + 120 μΩ 9 μΩ/Ω + 1.5 mΩ 11 μΩ/Ω + 15 mΩ 20 μΩ/Ω + 180 mΩ 21 μΩ/Ω + 140 mΩ 40 μΩ/Ω + 580 mΩ 47 μΩ/Ω + 1.1 Ω 100 μΩ/Ω + 15 Ω	Fluke 5720A

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments	
Resistance ³ – Generate	(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 (330 to 1100) MΩ	31 μΩ/Ω + 0.78 mΩ 23 μΩ/Ω + 1.2 mΩ 22 μΩ/Ω + 1.1 mΩ 22 μΩ/Ω + 1.6 mΩ 22 μΩ/Ω + 2.2 mΩ 22 μΩ/Ω + 16 mΩ 22 μΩ/Ω + 16 mΩ 22 μΩ/Ω + 160 mΩ 22 μΩ/Ω + 160 mΩ 25 μΩ/Ω + 1.6 Ω 25 μΩ/Ω + 1.7 Ω 47 μΩ/Ω + 24 Ω 100 μΩ/Ω + 39 Ω 200 μΩ/Ω + 2 kΩ 390 μΩ/Ω + 2 kΩ 2.3 mΩ/Ω + 78 kΩ 12 mΩ/Ω + 390 kΩ	Fluke 5520A	
Capacitance ³ – Generate	10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (0 to 50) Hz (0 to 20) Hz (0 to 6) Hz (0 to 2) Hz (0 to 0.6) Hz (0 to 0.2) Hz	(0.19 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 110) nF (110 to 330) nF (0.33 to 1.1) μF (1.1 to 3.3) μF (3.3 to 11) μF (11 to 33) μF (33 to 110) μF (110 to 330) μF (0.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	0.39 % + 0.0081 nF 0.39 % + 0.0078 nF 0.19 % + 0.0078 nF 0.19 % + 0.078 nF 0.19 % + 0.23 nF 0.19 % + 0.83 nF 0.19 % + 2.3 nF 0.19 % + 7.8 nF 0.31 % + 23 nF 0.35 % + 78 nF 0.35 % + 230 nF 0.35 % + 0.78 μF 0.35 % + 2.3 μF 0.35 % + 12 μF 0.58 % + 23 μF 0.85 % + 82 μF	Fluke 5520A *Excludes 0.7 mF



Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Simulation of Thermocouple Indicators and Indicating Systems ³ –			
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	

Parameter/Equipment	Range	CMC ^{2,4,7} (±)	Comments
Oscilloscopes ³ –			
DC Voltage			
50 Ω	(0 to 6) V	0.19 % + 31 μV	Fluke 5520A
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, and 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 ^{2,4,6} (±)	Comments
Torque Wrenches and Drivers	Up to 600 lbf·ft	0.35 %	Torque tester
Pressure – Measure and Measuring Equipment	(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
	(0 to 300) psia (300 to 1000) psia	0.005 % + 0.028 psia 0.011 % + 0.005 psia	DHI RPM 4
	(0 to 7.5) psia (7.5 to 30) psia	0.012 % + 0.0016 psia 0.013 % + 0.0016 psia	Ruska 7215i
	(0 to 1) inH ₂ O (1 to 30) inH ₂ O	0.00069 inH ₂ O + 0.58R 0.011 % + 0.58R	Fluke 7250LP
	(0 to 12.5) psi (12.5 to 250) psi	0.0017 psi + 0.58R 0.0093 % + 0.58R	Fluke 7250xi
Vacuum – Measure and Measuring Equipment	(-14.5 to 0) psi	0.0016 psi + 0.58R	Fluke 7250xi



Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Scales and Balances ³	(2 to 500) mg (1 to 5) g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg 22.6796 kg (50 lb) 25 kg 30 kg 75 kg	0.004 mg + 0.58R 0.007 mg + 0.58R 0.013 mg + 0.58R 0.017 mg + 0.58R 0.03 mg + 0.58R 0.09 mg + 0.58R 0.11 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 110 mg + 0.58R 130 mg + 0.58R 130 mg + 0.58R 170 mg + 0.58R	Troemner platinum class, and Class 1 weights
Mass – Measure	(2 to 500) mg (1 to 5) g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg 22.6796 kg (50 lb) 25 kg 30 kg 64 kg	0.012 mg 0.04 mg 0.059 mg 0.089 mg 0.14 mg 0.31 mg 0.59 mg 1.5 mg 3.1 mg 58 mg 110 mg 110 mg 120 mg 130 mg 140 mg 140 mg 290 mg	Troemner platinum class, Class 1 weights and balances

IV. Fluid Quantities

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Pipettes and Fluid Dispensers –			
Gravimetric Method	Up to 1.5 mL (1.5 to 5) mL (5 to 20) mL	0.22 µL 2.1 µL 5.3 µL	Laboratory balance, deionized water
Photometric Method ³	(0.1 to 0.49) µL (0.5 to 1.9) µL (2 to 9.9) µL (10 to 49.9) µL (50 to 199) µL (200 to 5000) µL	0.39 % 0.36 % 0.33 % 0.39 % 0.38 % 0.4 %	Artel pipette calibration system, reagents

V. Thermodynamics

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
Humidity ³ – Measure	(5 to 33) % RH (33 to 54) % RH (54 to 75) % RH (75 to 95) % RH	0.33 % RH 0.49 % RH 0.66 % RH 0.81 % RH	MBW Calibration/RH Systems 473-RP2 dew point mirror
Dew/Frost Point ³ – Measure	(-20 to 70) °C	0.2 °C	MBW/RH Systems 473-RP2
Humidity – Generate	(10 to 74) % RH > 74% RH	0.5 % RH + 0.58R 0.58 % RH + 0.58R	Thunder Scientific 2500
Temperature Sensors Source and Measure	(0 to 70) °C	(0.000 45 °C/°C) + 0.021°C	Thunder Scientific 2500

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Temperature ³ – Measure and Measuring Equipment	(-200 to 0) °C 0.01 °C (0 to 420) °C (420 to 660) °C	0.0076 °C + 0.58R 0.0053 °C + 0.58R 0.0054 °C + 0.58R 0.007 °C + 0.58R	Fluke 1594A and Rosemount 162CE
Temperature – Measuring Equipment	(-60 to 0) °C 0.01 °C (0 to 420) °C (420 to 550) °C	0.0076 °C + 0.58R 0.0053 °C + 0.58R 0.0054 °C + 0.58R 0.007 °C + 0.58R	Fluke 1594A, Rosemount 162CE and Baths

VI. Time & Frequency

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Frequency – Measuring Equipment and Measure	10 MHz	12e-11 + 0.58R	Endrun Technologies 3004 GPS
	DC to 50 GHz	13e-11 + 0.58R	Endrun GPS, 53132A, 5352B, & 83650B

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 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 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.

⁵ 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.

⁶ In the statement of CMC, a percent refers to a percentage of reading unless otherwise noted.

⁷ 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.



Accredited Laboratory

A2LA has accredited

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 17025:2005 *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 20th day of February 2018.

A handwritten signature in black ink, written over a horizontal line.

President and CEO
For the Accreditation Council
Certificate Number 4296.01
Valid to March 31, 2019

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