



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

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CALIBRATION

Valid To: December 31, 2026

Certificate Number: 2357.24

In recognition of the successful completion of the A2LA evaluation process (including an assessment of the organization's compliance with A2LA's Calibration Program Requirements), accreditation is granted to this laboratory at the location listed above as well as the one satellite location listed below to perform the following calibrations^{1,6}:

I. Dimensional

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Micrometers ³ – Inside, Outside & Depth	Up to 4 in (4 to 12) in (12 to 48) in	(7.9 + 2.8L) μin (22 + 4.7L) μin (12 + 5.6L) μin	Gage blocks
Flatness	Up to 1 in	6.1 μin	Optical flats/parallel
Parallelism	Up to 0.001 in	6.6 μin	Optical flats/parallel
Calipers ³	Up to 4 in (4 to 12) in (12 to 48) in	(30 + 1.3L) μin 290 μin (270 + 2.8L) μin	Gage blocks
Height Gage ³	Up to 4 in (4 to 12) in (12 to 24) in	(58 + 0.76L) μin (48 + 3.4L) μin (36 + 4.3L) μin	Gage blocks with surface plate

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
DC Voltage – Generate ³	(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	11 μV/V + 0.39 μV 4.9 μV/V + 0.62 μV 3.5 μV/V + 2.3 μV 3.6 μV/V + 3.9 μV 5.0 μV/V + 39 μV 6.4 μV/V + 0.39 mV	Fluke 5730A
DC Voltage – Measure ³	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV (1 to 75) kV	8.9 μV/V + 230 nV 4.8 μV/V + 230 nV 4.7 μV/V + 23 μV 6.3 μV/V + 0.23 mV 6.4 μV/V + 2.3 mV 1.7 mV/V	HP 3458A opt 002 Ross VD90/HP 34401A
DC Current – Generate ³	Up to 220 μA 220 μA to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A (11 to 20.5) A (16.5 to 149.999) A (10 to 1025) A	41 μA/A + 5.4 nA 33 μA/A + 6.2 nA 33 μA/A + 39 nA 41 μA/A + 0.62 μA 71 μA/A + 12 μA 0.28 mA/A + 0.37 mA 0.78 mA/A + 0.58 mA 4.4 mA/A + 0.11 mA 5.1 mA/A + 0.39 mA	Fluke 5730A Fluke 5730A/5725A Fluke 5520A w/ 5500A 50 turn coil
DC Current – Measure ³	(0 to 100) nA (0.1 to 1) μA (1 to 10) μA (10 to 100) μA 100 μA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 20) A (20 to 100) A (100 to 300) A	66 μA/A + 31 pA 32 μA/A + 31 pA 16 μA/A + 78 pA 20 μA/A + 0.62 nA 19 μA/A + 3.9 nA 19 μA/A + 39 nA 28 μA/A + 0.39 μA 89 μA/A + 7.8 μA 51 μA/A 72 μA/A 58 μA/A	HP 3458A opt 002 Y5020 w/HP 3458A 9211A w/HP 3458A

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
Electrical Simulation of Thermocouples ³ –			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.30 °C 0.099 °C 0.085 °C 0.099 °C 0.13 °C	Fluke 5520A
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.21 °C 0.11 °C 0.091 °C 0.11 °C 0.15 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.20 °C 0.12 °C 0.10 °C 0.15 °C 0.24 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.38 °C 0.22 °C 0.21 °C 0.24 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.38 °C 0.14 °C 0.099 °C 0.085 °C	
Electrical Simulation of RTDs ³ –			
Pt 385 / 100	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.082 °C 0.12 °C 0.12 °C 0.10 °C 0.091 °C 0.10 °C 0.18 °C	Fluke 5520A
Phase ³ – Generate	(0 to 360)°	0.58°	Fluke 5520A

Parameter/Equipment	Range	CMC ^{2, 4, 5} (±)	Comments
DC Power – Generate ³	0.01 mW to 337 W (0.01 to 3060) W (3.06 to 20.91) kW	0.018 % 0.017 % 0.057 %	Fluke 5520A
AC Power ³ – Generate, PF = (0 to 1) ⁷			Fluke 5520A
(10 to 45) Hz: (0.1089 to 2.9696) mW (0.297 to 10.8893) mW (1.089 to 29.6958) mW (2.97 to 108.8934) mW (10.89 to 296.958) mW (29.7 to 725.945) mW (72.6 to 1484.922) mW 148.5 mW to 6.7648 W	(33 to 329.99) mV: (3.3 to 8.999) mA (9 to 32.999) mA (33 to 89.99) mA (90 to 329.99) mA (330 to 899.9) mA (0.9 to 2.1999) A (2.2 to 4.4999) A (4.5 to 20.5) A	0.15 % 0.15 % 0.040 % 0.040 % 0.049 % 0.052 % 0.064 % 0.11 %	
1.089 mW to 9.179 W 2.97 mW to 33.659 W 10.89 mW to 91.7898 W (0.0297 to 336.5898) W (0.1089 to 917.898) W (0.297 to 2243.898) W (0.726 to 4589.898) W 1.485 W to 20.91 kW	330 mV to 1020 V: (3.3 to 8.999) mA (9 to 32.999) mA (33 to 89.99) mA (90 to 329.99) mA (330 to 899.9) mA (0.9 to 2.1999) A (2.2 to 4.4999) A (4.5 to 20.5) A	0.15 % 0.15 % 0.044 % 0.044 % 0.053 % 0.056 % 0.067 % 0.12 %	
(45 to 65) Hz: (0.109 to 3.0) mW (0.297 to 10.89) mW (1.09 to 29.7) mW (3.0 to 108.9) mW (10.9 to 297) mW (29.7 to 726) mW 72.6 mW to 1.5 W 148.5 mW to 6.8 W	(33 to 329.999) mV: (3.3 to 8.999) mA (9 to 32.999) mA (33 to 89.99) mA (90 to 329.99) mA (330 to 899.9) mA (0.9 to 2.1999) A (2.2 to 4.4999) A (4.5 to 20.5) A	0.23 % 0.14 % 0.11 % 0.13 % 0.10 % 0.10 % 0.11 % 0.10 %	
1.09 mW to 9.2 W 2.97 mW to 33.6 W 10.9 mW to 91.8 W 29.7 mW to 336.6 W 108.9 mW to 918 W 297 mW to 2244 W 72.6 mW to 4590 W (1.49 to 20 910) W	330 mV to 1020 V: (3.3 to 8.999) mA (9 to 32.999) mA (33 to 89.99) mA (90 to 329.99) mA (330 to 899.9) mA (0.9 to 2.1999) A (2.2 to 4.4999) A (4.5 to 20.5) A	0.34 % 0.062 % 0.094 % 0.062 % 0.086 % 0.071 % 0.098 % 0.077 %	

Parameter/Equipment	Range	CMC ^{2,4,5} (±)	Comments
AC Power ³ – Generate PF = (0 to 1) ⁷ (cont)			
65 Hz to 1 kHz:	(33 to 329.99) mV:		Fluke 5520A
(0.109 to 3.0) mW	(3.3 to 8.999) mA	0.040 %	
(0.297 to 10.89) mW	(9 to 32.999) mA	0.040 %	
(1.09 to 29.7) mW	(33 to 89.99) mA	0.042 %	
(3.0 to 108.9) mW	(90 to 329.99) mA	0.039 %	
(10.9 to 297) mW	(330 to 899.9) mA	0.54 %	
(29.7 to 726) mW	(0.9 to 2.1999) A	0.053 %	
72.6 mW to 1.5 W	(2.2 to 4.4999) A	0.094 %	
148.5 mW to 6.8 W	(4.5 to 20.5) A	0.14 %	
1.089 mW to 9.179 W	330 mV to 1020 V:		
2.97 mW to 33.659 W	(3.3 to 8.999) mA	0.043 %	
10.89 mW to 91.7898 W	(9 to 32.999) mA	0.043 %	
(0.0297 to 336.5898) W	(33 to 89.99) mA	0.045 %	
(0.0189 to 917.898) W	(90 to 329.99) mA	0.042 %	
(0.297 to 2243.898) W	(330 to 899.9) mA	0.54 %	
(0.726 to 4589.898) W	(0.9 to 2.1999) A	0.055 %	
1.485 W to 20.91 kW	(2.2 to 4.4999) A	0.095 %	
	(4.5 to 20.5) A	0.14 %	
(1 to 5) kHz:	(33 to 329.99) mW:		
(0.1089 to 2.9696) mW	(3.3 to 8.999) mA	0.13 %	
(0.297 to 10.8893) mW	(9 to 32.999) mA	0.13 %	
(1.089 to 29.6958) mW	(33 to 89.99) mA	0.15 %	
(2.97 to 108.8934) mW	(90 to 329.99) mA	0.15 %	
(10.89 to 296.958) mW	(330 to 899.9) mA	0.55 %	
(29.7 to 725.945) mW	(0.9 to 2.1999) A	0.50 %	
(72.6 to 1484.922) mW	(2.2 to 4.4999) A	0.15 %	
148.5 mW to 6.7648 W	(4.5 to 20.5) A	0.18 %	
1.089 mW to 9.179 W	330 mV to 1020 V:		
2.97 mW to 33.659 W	(3.3 to 8.999) mA	0.14 %	
10.89 mW to 91.7898 W	(9 to 32.999) mA	0.14 %	
(0.0297 to 336.5898) W	(33 to 89.99) mA	0.15 %	
(0.1089 to 917.898) W	(90 to 329.99) mA	0.15 %	
(0.297 to 2243.898) W	(330 to 899.9) mA	0.55 %	
(0.726 to 4589.898) W	(0.9 to 2.1999) A	0.51 %	
1.485 W to 20.91 kW	(2.2 to 4.4999) A	0.15 %	
	(4.5 to 20.5) A	0.18 %	

Parameter/Equipment	Range	CMC ^{2, 4, 5} (±)	Comments
AC Power ³ – Generate PF = (0 to 1) ⁷ (cont)			
(5 to 10) kHz: (0.1089 to 2.9696) mW (0.297 to 10.8893) mW (1.089 to 29.6958) mW (2.97 to 108.8934) mW (10.89 to 296.958) mW (29.7 to 725.945) mW (72.6 to 989.9667) mW	(33 to 329.99) mV: (3.3 to 8.999) mA (9 to 32.999) mA (33 to 89.99) mA (90 to 329.99) mA (330 to 899.9) mA (0.9 to 2.1999) A (2.2 to 2.999 99) A	0.47 % 0.47 % 0.48 % 0.47 % 0.69 % 0.66 % 0.66 %	Fluke 5520A
1.089 mW to 9.179 W 2.97 mW to 33.659 W 10.89 mW to 91.7898 W 29.7 mW to 336.5898 W (0.1089 to 917.898) W (0.297 to 2243.898) W (0.726 to 3059.9898) W	330 mV to 1020 V: (3.3 to 8.999) mA (9 to 32.999) mA (33 to 89.99) mA (90 to 329.99) mA (330 to 899.9) mA (0.9 to 2.1999) A (2.2 to 2.999 99) A	0.46 % 0.47 % 0.47 % 0.48 % 0.47 % 0.69 % 0.66 %	
(10 to 30) kHz: (0.1089 to 2.9696) mW (0.297 to 10.8893) mW (1.089 to 29.6958) mW (2.97 to 108.8934) mW	(33 to 329.99) mV: (3.3 to 8.999) mA (9 to 32.999) mA (33 to 89.99) mA (90 to 329.99) mA	1.8 % 1.8 % 1.8 % 1.8 %	
1.089 mW to 9.179 W 2.97 mW to 33.659 W 10.89 mW to 91.7898 W 29.7 mW to 336.5898 W	330 mV to 1020 V: (3.3 to 8.999) mA (9 to 32.999) mA (33 to 89.99) mA (90 to 329.99) mA	1.8 % 1.8 % 1.8 % 1.8 %	

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
AC Voltage – Generate ³ (0.2 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 (0.5 to 1) MHz	1.2 mV/V + 3.9 μV 0.86 mV/V + 3.9 μV 0.85 mV/V + 3.9 μV 1.4 mV/V + 3.9 μV 2.0 mV/V + 4.7 μV 3.5 mV/V + 9.3 μV 4.8 mV/V + 19 μV 6.5 mV/V + 19 μV	Fluke 5730A

Parameter/Range	Frequency	CMC ^{2,5} (\pm)	Comments
AC Voltage – Generate ³ (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 (0.5 to 1) MHz	0.3 mV/V + 3.9 μ V 0.18 mV/V + 3.9 μ V 0.16 mV/V + 3.9 μ V 0.3 mV/V + 3.9 μ V 0.55 mV/V + 4.7 μ V 1.2 mV/V + 9.3 μ V 1.6 mV/V + 19 μ V 2.5 mV/V + 19 μ V	
(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 (0.5 to 1) MHz	0.36 mV/V + 12 μ V 91 μ V/V + 6.2 μ V 80 μ V/V + 6.2 μ V 0.19 mV/V + 6.2 μ V 0.44 mV/V + 16 μ V 0.73 mV/V + 19 μ V 1.2 mV/V + 23 μ V 2.4 mV/V + 47 μ V	
(0.22 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 (0.5 to 1) MHz	0.49 mV/V + 39 μ V 81 μ V/V + 16 μ V 42 μ V/V + 7.8 μ V 75 μ V/V + 9.3 μ V 0.14 mV/V + 31 μ V 0.36 mV/V + 78 μ V 0.88 mV/V + 0.19 mV 1.6 mV/V + 0.47 mV	
(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 (0.5 to 1) MHz	0.37 mV/V + 0.39 mV 0.09 mV/V + 0.16 mV 43 μ V/V + 54 μ V 78 μ V/V + 93 μ V 0.11 mV/V + 0.19 mV 0.28 mV/V + 0.62 mV 0.91 mV/V + 1.9 mV 1.6 mV/V + 3.1 mV	

Parameter/Range	Frequency	CMC ^{2,5} (\pm)	Comments
AC Voltage – Generate ³ (cont)			
(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 (0.5 to 1) MHz	0.59 mV/V + 7.8 mV 0.14 mV/V + 2.3 mV 74 μ V/V + 0.78 mV 0.20 mV/V + 3.1 mV 0.47 mV/V + 7.8 mV 1.3 mV/V + 85 mV 4.2 mV/V + 85 mV 11 mV/V + 0.17 V	Fluke 5730/5725A
(220 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	74 μ V/V + 3.1 mV 0.11 mV/V + 4.7 mV 0.31 mV/V + 8.5 mV	Fluke 5730A w/ 5725A
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.29 mV/V + 8.5 mV 1.1 mV/V + 35 mV	
AC Voltage – Measure ³			
Up to 10 mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.27 μ V/V + 2.3 μ V 0.18 μ V/V + 0.85 μ V 0.25 μ V/V + 0.85 μ V 0.78 μ V/V + 0.85 μ V 3.9 μ V/V + 0.85 μ V 31 μ V/V + 3.9 μ V	HP 3458A opt 002
(10 to 100) mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.13 μ V/V + 3.1 μ V 71 nV/V + 1.6 μ V 0.11 μ V/V + 1.6 μ V 0.23 μ V/V + 1.6 μ V 0.62 μ V/V + 1.6 μ V 2.3 μ V/V + 7.8 μ V	
100 mV to 1 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	61 μ V/V + 31 μ V 59 μ V/V + 16 μ V 0.11 mV/V + 16 μ V 0.24 mV/V + 16 μ V 0.63 mV/V + 16 μ V 2.3 mV/V + 78 μ V	
(1 to 10) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	59 μ V/V + 0.31 mV 59 μ V/V + 0.16 mV 0.11 mV/V + 0.16 mV 0.24 mV/V + 0.16 mV 0.63 mV/V + 0.16 mV 2.3 mV/V + 0.78 mV	

Parameter/Range	Frequency	CMC ^{2,5} (\pm)	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 (100 to 300) kHz	0.16 mV/V + 3.1 mV 0.16 mV/V + 1.6 mV 0.16 mV/V + 1.6 mV 0.28 mV/V + 1.6 mV 0.94 mV/V + 1.6 mV 3.1 mV/V + 7.8 mV	HP 3458A opt 002
(100 to 700) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz	0.32 mV/V + 31 mV 0.31 mV/V + 16 mV 0.47 mV/V + 16 mV	
(1 to 60) kV	60 Hz	7.0 mV/V	Ross VD90/HP 34401A
AC Current – Generate ³			
Up to 220 μ A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.40 mA/A + 16 nA 0.16 mA/A + 9.3 nA 0.10 mA/A + 7.8 nA 0.28 mA/A + 12 nA 1.0 mA/A + 62 nA	Fluke 5730A
(0.22 to 2.2) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.35 mA/A + 39 nA 0.19 mA/A + 31 nA 0.15 mA/A + 31 nA 0.22 mA/A + 0.10 μ A 1.0 mA/A + 0.62 μ A	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.34 mA/A + 0.39 μ A 0.16 mA/A + 0.31 μ A 0.11 mA/A + 0.31 μ A 0.20 mA/A + 0.54 μ A 1.1 mA/A + 4.7 μ A	
(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	0.36 mA/A + 3.9 μ A 0.16 mA/A + 3.1 μ A 0.11 mA/A + 2.3 μ A 0.2 mA/A + 3.1 μ A 1.1 mA/A + 9.3 μ A	

Parameter/Range	Frequency	CMC ^{2,4,5} (±)	Comments
AC Current – Generate ³ (cont)			
(0.22 to 2.2) A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.26 mA/A + 31 µA 0.41 mA/A + 78 µA 6.2 mA/A + 0.16 mA	Fluke 5730A/5725A
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.41 mA/A + 0.13 mA 0.76 mA/A + 0.29 mA 2.9 mA/A + 0.58 mA	Fluke 5520A
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.96 mA/A + 3.9 mA 1.2 mA/A + 3.9 mA 23 mA/A + 3.9 mA	
(29 to 329.99) µA (0.33 to 3.2999) mA (3.3 to 32.999) mA (33 to 329.99) mA	(10 to 30) kHz (10 to 30) kHz (10 to 30) kHz (10 to 30) kHz	12 mA/A + 0.31 µA 7.8 mA/A + 0.47 µA 3.5 mA/A + 3.1 µA 3.2 mA/A + 0.16 mA	
(16.5 to 149.999) A	(45 to 65) Hz (65 to 440) Hz	0.47 % 0.88 %	Fluke 5520A w/5500A coil
(150 to 1025) A	(45 to 65) Hz (65 to 440) Hz	0.47 % 0.88 %	
AC Current – Measure ³			
(0 to 100) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 5 kHz	3.3 mA/A + 23 nA 1.2 mA/A + 23 nA 0.50 mA/A + 23 nA	HP 3458A opt 002
100 µA to 1 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	3.4 mA/A + 0.16 µA 1.3 mA/A + 0.16 µA 0.53 mA/A + 0.16 µA 0.25 mA/A + 0.16 µA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	3.4 mA/A + 1.6 µA 1.3 mA/A + 1.6 µA 0.51 mA/A + 1.6 µA 0.25 mA/A + 1.6 µA	

Parameter/Range	Frequency	CMC ^{2,4,5} (±)	Comments
AC Current – Measure ³ (cont)			
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	3.4 mA/A + 16 µA 1.3 mA/A + 16 µA 0.50 mA/A + 16 µA 0.25 mA/A + 16 µA	HP 3458A opt 002
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	3.4 mA/A + 0.16 mA 1.4 mA/A + 0.16 mA 0.69 mA/A + 0.16 mA 0.85 mA/A + 0.16 mA	
(1 to 20) A	55 Hz to 1 kHz (1 to 5) kHz	0.15 mA/A 0.21 mA/A	HP 3458A w/ Y5020A
AC Level Flatness – Measure ³			3V Thermal Convertor
3 V	(10 to < 100) Hz (100 to < 1000) Hz (1 to < 10) kHz (10 to < 30) kHz (30 to < 100) kHz (100 to < 300) kHz (0.3 to < 1) MHz (1 to < 3) MHz (3 to < 8) MHz (8 to < 10) MHz (10 to < 20) MHz (20 to < 30) MHz (30 to < 50) MHz (50 to < 70) MHz (70 to < 80) MHz (80 to < 100) MHz 100 MHz	0.12 % 0.12 % 0.12 % 0.12 % 0.23 % 0.29 % 0.29 % 0.58 % 0.70 % 0.71 % 0.71 % 0.76 % 1.8 % 2.8 % 3.6 % 3.9 % 4.8 %	

Parameter/Equipment	Range	CMC ^{2,5} (\pm)	Comments
Resistance – Generate ³	(0 to 11) Ω	33 $\mu\Omega/\Omega$ + 0.78 m Ω	Fluke 5520A
	(11 to 33) Ω	24 $\mu\Omega/\Omega$ + 1.2 m Ω	
	(33 to 110) Ω	22 $\mu\Omega/\Omega$ + 1.1 m Ω	
	(110 to 330) Ω	23 $\mu\Omega/\Omega$ + 1.6 m Ω	
	330 Ω to 1.1 k Ω	22 $\mu\Omega/\Omega$ + 1.6 m Ω	
	(1.1 to 3.3) k Ω	23 $\mu\Omega/\Omega$ + 16 m Ω	
	(3.3 to 11) k Ω	23 $\mu\Omega/\Omega$ + 16 m Ω	
	(11 to 33) k Ω	23 $\mu\Omega/\Omega$ + 160 m Ω	
	(33 to 110) k Ω	23 $\mu\Omega/\Omega$ + 160 m Ω	
	(110 to 330) k Ω	26 $\mu\Omega/\Omega$ + 1.6 Ω	
	330 k Ω to 1.1 M Ω	26 $\mu\Omega/\Omega$ + 1.6 Ω	
	(1.1 to 3.3) M Ω	48 $\mu\Omega/\Omega$ + 23 Ω	
	(3.3 to 11) M Ω	0.10 m Ω/Ω + 39 Ω	
	(11 to 33) M Ω	0.21 m Ω/Ω + 1.9 k Ω	
	(33 to 110) M Ω	0.40 m Ω/Ω + 2.3 k Ω	
	(110 to 330) M Ω	2.3 m Ω/Ω + 78 k Ω	
	330 M Ω to 1.1 G Ω	12 m Ω/Ω + 390 k Ω	Fluke 5730A
	1 Ω	0.13 m Ω	
	1.9 Ω	0.18 m Ω	
	10 Ω	0.23 m Ω	
	19 Ω	0.42 m Ω	
	100 Ω	1.1 m Ω	
	190 Ω	2.0 m Ω	
	1.0 k Ω	6.7 m Ω	
	1.9 k Ω	13 m Ω	
	10 k Ω	67 m Ω	
	19 k Ω	0.12 Ω	
	100 k Ω	0.81 Ω	
	190 k Ω	2.6 Ω	
	1.0 M Ω	49 Ω	
	1.9 M Ω	58 Ω	
	10 M Ω	4.0 k Ω	Guildline 9211A
	19 M Ω	8.5 k Ω	
	100 M Ω	26 k Ω	
	0.333 33 m Ω	12 $\mu\Omega$	
	1 m Ω	12 $\mu\Omega$	
10 m Ω	12 $\mu\Omega$		
100 m Ω	22 $\mu\Omega$		

Parameter/Equipment	Range	CMC ^{2,4,5} (\pm)	Comments
High Resistance – Generate ³	(1 to 10) M Ω (10 to 100) M Ω 100 M Ω to 1 G Ω (1 to 10) G Ω (10 to 100) G Ω	1.2 m Ω / Ω 1.3 m Ω / Ω 2.4 m Ω / Ω 5.8 m Ω / Ω 18 m Ω / Ω	Biddle mega decade box
Resistance – Measure ³	(0 to 10) Ω (10 to 100) Ω 100 Ω to 1 k Ω (1 to 10) k Ω (10 to 100) k Ω (0.1 to 1) M Ω (1 to 10) M Ω (10 to 100) M Ω (100 to 1200) M Ω	17 $\mu\Omega$ / Ω + 39 $\mu\Omega$ 13 $\mu\Omega$ / Ω + 0.39 m Ω 11 $\mu\Omega$ / Ω + 0.39 m Ω 11 $\mu\Omega$ / Ω + 3.9 m Ω 11 $\mu\Omega$ / Ω + 39 m Ω 16 $\mu\Omega$ / Ω + 1.6 Ω 43 $\mu\Omega$ / Ω + 78 Ω 0.40 m Ω / Ω + 0.78 Ω 4.8 m Ω / Ω + 7.8 k Ω	HP 3458A opt 002
Oscilloscopes ³ – Amplitude – DC: 50 Ω 1 M Ω Amplitude – Square Wave: 50 Ω 1 M Ω Leveled Sine Wave (Ref 50 kHz) 5 mV to 5.5 V _(p-p) Resistance – Measure Time Marker Pulse Characterization Transition time (Rise Time) – Generate	(0 to \pm 5.0) V (0 to \pm 200) V 0 mV to 5.0 V 10 Hz to 10 kHz 1 mV to \pm 200 V 10 Hz to 1 kHz 0.1 Hz to 300 MHz (300 to 550) MHz 550 MHz to 1.1 GHz (3.0 to 3.2) GHz (40 to 90) Ω (0.8 to 1.2) M Ω 450.5 ps to 55 s (125 to 175) ps	0.20 mV/V + 19 μ V 0.20 mV/V + 19 μ V 0.85 mV/V + 7.8 μ V 0.80 mV/V + 7.8 μ V 2.1 % 2.4 % 4.1 % 5.4 % 0.80 m Ω / Ω 0.81 m Ω / Ω 0.29 μ s/s 18 ps	Wavetek 9500 w/ 9530

Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
Capacitance – Generate ³ (220 to 399.9) pF (0.4 to 1.0999) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 32.9999) nF (33 to 109.999) nF (110 to 330) nF 330 nF 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 330 μF to 1.1 mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	10 Hz to 10 kHz 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 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	6.0 mF/F + 7.8 pF 4.3 mF/F + 7.8 pF 4.1 mF/F + 7.8 pF 2.1 mF/F + 7.8 pF 2.1 mF/F + 78 pF 2.1 mF/F + 78 pF 2.1 mF/F + 0.23 nF 2.1 mF/F + 0.78 nF 2.0 mF/F + 2.3 nF 2.2 mF/F + 7.8 nF 3.2 mF/F + 23 nF 3.7 mF/F + 78 nF 3.7 mF/F + 0.23 μF 3.7 mF/F + 0.78 μF 3.5 mF/F + 2.3 μF 3.5 mF/F + 7.8 μF 5.8 mF/F + 23 μF 8.5 mF/F + 78 μF	Fluke 5520A/SC1100
Capacitance – Measure ³ 100 pF to 1 mF	10 Hz to 2 MHz	0.29 % + 0.029 pF	QUADTECH 7600 – CMC valid at 1 kHz only

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
RF Power – Generate ³ (23 to -55) dBm	DC to 10 MHz (10 to 50) MHz (50 to 80) MHz	0.12 dB 0.28 dB 0.49 dB	Agilent 33250A
(+13 to -136) dBm (+10 to -136) dBm (+7 to -136) dBm	250 kHz to 2 GHz (> 2 to 3) GHz (> 3 to 4) GHz	0.65 dB 1.1 dB 1.2 dB	Agilent E4437B

Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
RF Power – Generate & Measure ³			
(-30 to +30) dBm (-70 to -30) dBm	3 Hz to 100 kHz	0.060 dB 0.091 dB	HP 33250A / 3458A
(+10 to +20) dBm (-10 to +10) dBm (-20 to -10) dBm	100 kHz to 4.2 GHz	0.079 dB 0.080 dB 0.079 dB	E441X, 8482A w/ generator
(-20 to -60) dBm	9 kHz to 18 GHz	0.076 dB	E441X, E9304A w/ generator
RF Display Average Noise (DANL) ³ (-140 to 0) dB	(9 to 50) kHz 50 kHz to 5 MHz (5 to 400) MHz (0.4 to 3) GHz (3 to 4) GHz	1.4 dB 2.2 dB 0.33 dB 0.48 dB 0.54 dB	50 Ohm load
Residual Response ³ (-130 to 0) dBm	9 kHz to 4 GHz	0.69 dB	50 Ohm load

IV. Mechanical

Parameter/Equipment	Range	CMC ^{2,4,8} (±)	Comments
Pressure ³ – Measuring Equipment			
Pneumatic	(-2.16 to 2.16) psig (-13.2 to 35) psig (35 to 300) psig (300 to 1000) psig (1000 to 3000) psig	0.06 % of Full Scale 0.03 % of Full Scale 0.014 % 0.014 % 0.014 %	Fluke PM600-series module
Pressure Absolute	(0.9 to 15.0) psia (1.5 to 50) psia (10 to 300) psia (ATM to 1000) psia (ATM to 2000) psia	0.022 % + 0.000 17 psi 0.011 % + 0.000 60 psi 0.011 % + 0.0034 psi 0.01 % + 0.012 psi 0.013 % + 0.034 psi	Fluke PM 600-A100K Fluke PM 600-A350K Fluke PM600-A2M Fluke PM600-A7M Fluke PM600-A20M

Parameter/Equipment	Range	CMC ^{2, 4, 8} (±)	Comments
Scales & Balances ³	(2 to 500) mg 500 mg to 2 g (2 to 3) g (3 to 5) g (5 to 10) g (10 to 50) g (50 to 100) g (100 to 200) g (200 to 300) g (300 to 500) g (0.5 to 1) kg (1 to 2) kg (2 to 3) kg (3 to 5) kg (5 to 10) kg (10 to 20) kg (20 to 50) kg (50 to 100) kg	12 µg 44 µg 48 µg 56 µg 60 µg 0.15 mg 0.30 mg 0.61 mg 0.91 mg 1.9 mg 3.6 mg 7.0 mg 9.8 mg 15 mg 0.12 g 60 mg 0.25 g 0.39 g	Master weights
Torque – Measure ³	(5 to 50) ozf·in (15 to 200) ozf·in (5 to 50) lbf·in (40 to 400) lbf·in (100 to 1000) lbf·in (25 to 250) lbf·ft (60 to 600) lbf·ft (200 to 2000) lbf·ft	0.60 % 0.32 % 0.30 % 0.31 % 0.46 % 0.43 % 0.65 % 0.45 %	CDI 2000-04-02/snap-on TTC4 CDI 2000-05-02/snap-on TTC5 CDI 4 in 1 2000-400-02/snap-on TTC400 CDI 2000-12-02/snap-on TTC12 CDI 2000-14-02/snap-on TTC14
Force Measuring Equipment – Compression & Tension ³	(0.1 to 1) lbf (1 to 10) lbf (10 to 50) lbf (50 to 100) lbf (100 to 200) lbf	0.061 % 0.031 % 0.038 % 0.056 % 0.056 %	Weights

V. Thermodynamics

Parameter/Equipment	Range	CMC ^{2,8} (±)	Comments
Temperature – Measuring Equipment	(0 to 70) °C	0.08 °C	Thunder Scientific 2500ST
	(-95 to 35) °C (35 to 350) °C	0.12 °C 0.39 °C	PRT w/ dry blocks
Temperature – Measure ³	(-200 to 100) °C (100 to 660) °C	0.012 °C 0.019 °C	5626 PRT w/ 3458A
Relative Humidity – Measure ³	(10 to 40) % RH (41 to 60) % RH (61 to 95) % RH	1.1 % RH 1.3 % RH 1.4 % RH	Rotronic HC2-S / HP22-A, humidity meter
Relative Humidity – Measuring Equipment	(10 to 14.7) % RH (14.7 to 49) % RH (49 to 73.5) % RH (73.5 to 95) % RH	0.51 % RH 0.54 % RH 0.55 % RH 0.59 % RH	Thunder Scientific 2500ST

VI. Time & Frequency

Parameter/Equipment	Range	CMC ^{2,8} (±)	Comments
Frequency – Measure ³	0.001 Hz to 1 kHz (1 to 1000) kHz (1 to 225) MHz (0.225 to 3.0) GHz	0.12 mHz/Hz 2.3 nHz/Hz 2.3 nHz/Hz 2.3 nHz/Hz	5680A rubidium w/ Agilent 53132A
Frequency – Measuring Equipment ³	0.001 Hz to 1 kHz 1 kHz to 50 MHz	0.66 µHz/Hz 0.16 nHz/Hz	FEI 5680A rubidium with 33250A
	10 MHz to 4.0 GHz	2.3 nHz/Hz	FEI 5680A rubidium with E4437B
Tachometers, Non-Contact	(10 to 100 000) RPM	0.0023 RPM	FEI 5680A rubidium with 33250A
Stopwatches & Timing Devices ³	Up to 24 hrs	0.039 s/day	Agilent 53132A

SATELLITE FACILITY

TEKTRONIX CANADA, INC.
 3333 Unity Drive
 Mississauga, Ontario L5L 3S6 CANADA
 Patricia Shepherd Phone 416 434 7087

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
DC Voltage – Generate ³	(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	11 µV/V + 0.39 µV 4.9 µV/V + 0.62 µV 3.5 µV/V + 2.3 µV 3.6 µV/V + 3.9 µV 5.0 µV/V + 39 µV 6.4 µV/V + 0.39 mV	Fluke 5730A
DC Voltage – Measure ³	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV	8.9 µV/V + 230 nV 4.8 µV/V + 230 nV 4.7 µV/V + 23 µV 6.3 µV/V + 0.23 mV 6.4 µV/V + 2.3 mV	HP 3458A opt 002
DC Current – Generate ³	Up to 220 µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A (11 to 20.5) A (16.5 to 149.999) A (10 to 1025) A	41 µA/A + 5.4 nA 33 µA/A + 6.2 nA 33 µA/A + 39 nA 41 µA/A + 0.62 µA 71 µA/A + 12 µA 0.28 mA/A + 0.37 mA 0.78 mA/A + 0.58 mA 4.4 mA/A + 0.11 mA 5.1 mA/A + 0.39 mA	Fluke 5730A Fluke 5730A/5725A Fluke 5520A w/ 5500A 50 turn coil

Parameter/Equipment	Range	CMC ^{2,5} (\pm)	Comments
DC Current – Measure ³	(0 to 100) nA (0.1 to 1) μ A (1 to 10) μ A (10 to 100) μ A 100 μ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	66 μ A/A + 31 pA 32 μ A/A + 31 pA 16 μ A/A + 78 pA 20 μ A/A + 0.62 nA 19 μ A/A + 3.9 nA 19 μ A/A + 39 nA 28 μ A/A + 0.39 μ A 89 μ A/A + 7.8 μ A	HP 3458A opt 002
Electrical Simulation of Thermocouples ³ –			
Type E	(-250 to -100) $^{\circ}$ C (-100 to -25) $^{\circ}$ C (-25 to 350) $^{\circ}$ C (350 to 650) $^{\circ}$ C (650 to 1000) $^{\circ}$ C	0.30 $^{\circ}$ C 0.099 $^{\circ}$ C 0.085 $^{\circ}$ C 0.099 $^{\circ}$ C 0.13 $^{\circ}$ C	Fluke 5520A
Type J	(-210 to -100) $^{\circ}$ C (-100 to -30) $^{\circ}$ C (-30 to 150) $^{\circ}$ C (150 to 760) $^{\circ}$ C (760 to 1200) $^{\circ}$ C	0.21 $^{\circ}$ C 0.11 $^{\circ}$ C 0.091 $^{\circ}$ C 0.11 $^{\circ}$ C 0.15 $^{\circ}$ C	
Type K	(-200 to -100) $^{\circ}$ C (-100 to -25) $^{\circ}$ C (-25 to 120) $^{\circ}$ C (120 to 1000) $^{\circ}$ C (1000 to 1372) $^{\circ}$ C	0.20 $^{\circ}$ C 0.12 $^{\circ}$ C 0.10 $^{\circ}$ C 0.15 $^{\circ}$ C 0.24 $^{\circ}$ C	
Type R	(0 to 250) $^{\circ}$ C (250 to 400) $^{\circ}$ C (400 to 1000) $^{\circ}$ C (1000 to 1767) $^{\circ}$ C	0.38 $^{\circ}$ C 0.22 $^{\circ}$ C 0.21 $^{\circ}$ C 0.24 $^{\circ}$ C	
Type T	(-250 to -150) $^{\circ}$ C (-150 to 0) $^{\circ}$ C (0 to 120) $^{\circ}$ C (120 to 400) $^{\circ}$ C	0.38 $^{\circ}$ C 0.14 $^{\circ}$ C 0.099 $^{\circ}$ C 0.085 $^{\circ}$ C	

Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
AC Voltage – Generate ³			
(0.2 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 (0.5 to 1) MHz	1.2 mV/V + 3.9 μV 0.86 mV/V + 3.9 μV 0.85 mV/V + 3.9 μV 1.4 mV/V + 3.9 μV 2.0 mV/V + 4.7 μV 3.5 mV/V + 9.3 μV 4.8 mV/V + 19 μV 6.5 mV/V + 19 μV	Fluke 5730A
(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 (0.5 to 1) MHz	0.3 mV/V + 3.9 μV 0.18 mV/V + 3.9 μV 0.16 mV/V + 3.9 μV 0.3 mV/V + 3.9 μV 0.55 mV/V + 4.7 μV 1.2 mV/V + 9.3 μV 1.6 mV/V + 19 μV 2.5 mV/V + 19 μV	
(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 (0.5 to 1) MHz	0.36 mV/V + 12 μV 91 μV/V + 6.2 μV 80 μV/V + 6.2 μV 0.19 mV/V + 6.2 μV 0.44 mV/V + 16 μV 0.73 mV/V + 19 μV 1.2 mV/V + 23 μV 2.4 mV/V + 47 μV	
(0.22 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 (0.5 to 1) MHz	0.49 mV/V + 39 μV 81 μV/V + 16 μV 42 μV/V + 7.8 μV 75 μV/V + 9.3 μV 0.14 mV/V + 31 μV 0.36 mV/V + 78 μV 0.88 mV/V + 0.19 mV 1.6 mV/V + 0.47 mV	
(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 (0.5 to 1) MHz	0.37 mV/V + 0.39 mV 0.09 mV/V + 0.16 mV 43 μV/V + 54 μV 78 μV/V + 93 μV 0.11 mV/V + 0.19 mV 0.28 mV/V + 0.62 mV 0.91 mV/V + 1.9 mV 1.6 mV/V + 3.1 mV	

Parameter/Range	Frequency	CMC ^{2,5} (\pm)	Comments
AC Voltage – Generate ³ (cont)			
(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 (0.5 to 1) MHz	0.59 mV/V + 7.8 mV 0.14 mV/V + 2.3 mV 74 μ V/V + 0.78 mV 0.20 mV/V + 3.1 mV 0.47 mV/V + 7.8 mV 1.3 mV/V + 85 mV 4.2 mV/V + 85 mV 11 mV/V + 0.17 V	Fluke 5730/5725A
(220 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	74 μ V/V + 3.1 mV 0.11 mV/V + 4.7 mV 0.31 mV/V + 8.5 mV	Fluke 5730A w/ 5725A
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.29 mV/V + 8.5 mV 1.1 mV/V + 35 mV	
AC Voltage – Measure ³			
Up to 10 mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.27 μ V/V + 2.3 μ V 0.18 μ V/V + 0.85 μ V 0.25 μ V/V + 0.85 μ V 0.78 μ V/V + 0.85 μ V 3.9 μ V/V + 0.85 μ V 31 μ V/V + 3.9 μ V	HP 3458A opt 002
(10 to 100) mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.13 μ V/V + 3.1 μ V 71 nV/V + 1.6 μ V 0.11 μ V/V + 1.6 μ V 0.23 μ V/V + 1.6 μ V 0.62 μ V/V + 1.6 μ V 2.3 μ V/V + 7.8 μ V	
100 mV to 1 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	61 μ V/V + 31 μ V 59 μ V/V + 16 μ V 0.11 mV/V + 16 μ V 0.24 mV/V + 16 μ V 0.63 mV/V + 16 μ V 2.3 mV/V + 78 μ V	
(1 to 10) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	59 μ V/V + 0.31 mV 59 μ V/V + 0.16 mV 0.11 mV/V + 0.16 mV 0.24 mV/V + 0.16 mV 0.63 mV/V + 0.16 mV 2.3 mV/V + 0.78 mV	

Parameter/Range	Frequency	CMC ^{2,5} (\pm)	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 (100 to 300) kHz	0.16 mV/V + 3.1 mV 0.16 mV/V + 1.6 mV 0.16 mV/V + 1.6 mV 0.28 mV/V + 1.6 mV 0.94 mV/V + 1.6 mV 3.1 mV/V + 7.8 mV	HP 3458A opt 002
(100 to 700) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz	0.32 mV/V + 31 mV 0.31 mV/V + 16 mV 0.47 mV/V + 16 mV	
AC Current – Generate ³			
Up to 220 μ A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.40 mA/A + 16 nA 0.16 mA/A + 9.3 nA 0.10 mA/A + 7.8 nA 0.28 mA/A + 12 nA 1.0 mA/A + 62 nA	Fluke 5730A
(0.22 to 2.2) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.35 mA/A + 39 nA 0.19 mA/A + 31 nA 0.15 mA/A + 31 nA 0.22 mA/A + 0.10 μ A 1.0 mA/A + 0.62 μ A	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.34 mA/A + 0.39 μ A 0.16 mA/A + 0.31 μ A 0.11 mA/A + 0.31 μ A 0.20 mA/A + 0.54 μ A 1.1 mA/A + 4.7 μ A	
(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	0.36 mA/A + 3.9 μ A 0.16 mA/A + 3.1 μ A 0.11 mA/A + 2.3 μ A 0.2 mA/A + 3.1 μ A 1.1 mA/A + 9.3 μ A	

Parameter/Range	Frequency	CMC ^{2,4,5} (±)	Comments
AC Current – Generate ³ (cont)			
(0.22 to 2.2) A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.26 mA/A + 31 µA 0.41 mA/A + 78 µA 6.2 mA/A + 0.16 mA	Fluke 5730A/5725A
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.41 mA/A + 0.13 mA 0.76 mA/A + 0.29 mA 2.9 mA/A + 0.58 mA	Fluke 5520A
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.96 mA/A + 3.9 mA 1.2 mA/A + 3.9 mA 23 mA/A + 3.9 mA	
(29 to 329.99) µA (0.33 to 3.2999) mA (3.3 to 32.999) mA (33 to 329.99) mA	(10 to 30) kHz (10 to 30) kHz (10 to 30) kHz (10 to 30) kHz	12 mA/A + 0.31 µA 7.8 mA/A + 0.47 µA 3.5 mA/A + 3.1 µA 3.2 mA/A + 0.16 mA	
(16.5 to 149.999) A	(45 to 65) Hz (65 to 440) Hz	0.47 % 0.88 %	Fluke 5520A w/5500A coil
(150 to 1025) A	(45 to 65) Hz (65 to 440) Hz	0.47 % 0.88 %	
AC Current – Measure ³			
(0 to 100) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 5 kHz	3.3 mA/A + 23 nA 1.2 mA/A + 23 nA 0.50 mA/A + 23 nA	HP 3458A opt 002
100 µA to 1 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	3.4 mA/A + 0.16 µA 1.3 mA/A + 0.16 µA 0.53 mA/A + 0.16 µA 0.25 mA/A + 0.16 µA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	3.4 mA/A + 1.6 µA 1.3 mA/A + 1.6 µA 0.51 mA/A + 1.6 µA 0.25 mA/A + 1.6 µA	

Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
AC Current – Measure ³ (cont)			
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	3.4 mA/A + 16 µA 1.3 mA/A + 16 µA 0.50 mA/A + 16 µA 0.25 mA/A + 16 µA	HP 3458A opt 002
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	3.4 mA/A + 0.16 mA 1.4 mA/A + 0.16 mA 0.69 mA/A + 0.16 mA 0.85 mA/A + 0.16 mA	

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
Resistance – Generate ³	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω 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 330 kΩ 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 MΩ to 1.1 GΩ	33 µΩ/Ω + 0.78 mΩ 24 µΩ/Ω + 1.2 mΩ 22 µΩ/Ω + 1.1 mΩ 23 µΩ/Ω + 1.6 mΩ 22 µΩ/Ω + 1.6 mΩ 23 µΩ/Ω + 16 mΩ 23 µΩ/Ω + 16 mΩ 23 µΩ/Ω + 160 mΩ 23 µΩ/Ω + 160 mΩ 26 µΩ/Ω + 1.6 Ω 26 µΩ/Ω + 1.6 Ω 48 µΩ/Ω + 23 Ω 0.10 mΩ/Ω + 39 Ω 0.21 mΩ/Ω + 1.9 kΩ 0.40 mΩ/Ω + 2.3 kΩ 2.3 mΩ/Ω + 78 kΩ 12 mΩ/Ω + 390 kΩ	Fluke 5520A

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
Resistance – Generate ³ (cont)	1 Ω 1.9 Ω 10 Ω 19 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	0.13 mΩ 0.18 mΩ 0.23 mΩ 0.42 mΩ 1.1 mΩ 2.0 mΩ 6.7 mΩ 13 mΩ 67 mΩ 0.12 Ω 0.81 Ω 2.6 Ω 49 Ω 58 Ω 4.0 kΩ 8.5 kΩ 26 kΩ	Fluke 5730A
Resistance – Measure ³	(0 to 10) Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (100 to 1200) MΩ	17 μΩ/Ω + 39 μΩ 13 μΩ/Ω + 0.39 mΩ 11 μΩ/Ω + 0.39 mΩ 11 μΩ/Ω + 3.9 mΩ 11 μΩ/Ω + 39 mΩ 16 μΩ/Ω + 1.6 Ω 43 μΩ/Ω + 78 Ω 0.40 mΩ/Ω + 0.78 Ω 4.8 mΩ/Ω + 7.8 kΩ	HP 3458A opt 002

Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
Capacitance – Generate ³ (220 to 399.9) pF (0.4 to 1.0999) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 32.9999) nF (33 to 109.999) nF (110 to 330) nF 330 nF to 1.1 μF (1.1 to 3.3) μF (3.3 to 11) μF	10 Hz to 10 kHz 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 Hz to 1 kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz	6.0 mF/F + 7.8 pF 4.3 mF/F + 7.8 pF 4.1 mF/F + 7.8 pF 2.1 mF/F + 7.8 pF 2.1 mF/F + 78 pF 2.1 mF/F + 78 pF 2.1 mF/F + 0.23 nF 2.1 mF/F + 0.78 nF 2.0 mF/F + 2.3 nF 2.2 mF/F + 7.8 nF	Fluke 5520A/SC1100

Parameter/Range	Frequency	CMC ^{2,5} (\pm)	Comments
Capacitance – Generate ³ (cont)			
(11 to 33) μ F	(10 to 120) Hz	3.2 mF/F + 23 nF	Fluke 5520A/SC1100
(33 to 110) μ F	(10 to 80) Hz	3.7 mF/F + 78 nF	
(110 to 330) μ F	(0 to 50) Hz	3.7 mF/F + 0.23 μ F	
330 μ F to 1.1 mF	(0 to 20) Hz	3.7 mF/F + 0.78 μ F	
(1.1 to 3.3) mF	(0 to 6) Hz	3.5 mF/F + 2.3 μ F	
(3.3 to 11) mF	(0 to 2) Hz	3.5 mF/F + 7.8 μ F	
(11 to 33) mF	(0 to 0.6) Hz	5.8 mF/F + 23 μ F	
(33 to 110) mF	(0 to 0.2) Hz	8.5 mF/F + 78 μ F	

II. Time & Frequency

Parameter/Equipment	Range	CMC ^{2,8} (\pm)	Comments
Frequency – Measuring Equipment ³	0.001 Hz to 1 kHz 1 kHz to 50 MHz	0.66 μ Hz/Hz 0.16 nHz/Hz	FEI 5680A rubidium with 33250A

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. CMC's 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 value of the nominal length of the device measured in inches. R is the numerical value of the resolution of the device measured in inches. Percentages are percentage of reading, unless otherwise indicated

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

⁶ This scope meets A2LA's *P112 Flexible Scope Policy*.

⁷ Measurement uncertainty at PF other than 1 is calculated using the Manufacturers Guide in the Service Manual stating "Overall uncertainty for power output in Watts (or VARs) is based on the root sum square (rss) of the individual uncertainties in percent for the selected voltage, current, and power factor parameters.

⁸ 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

TEKTRONIX, INC.
Mississauga, CANADA

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/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 April 2017*).



Presented this 29th day of July 2024.

A blue ink signature of Trace McInturff, written in a cursive style.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2357.24
Valid to December 31, 2026

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