



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, 2020

Certificate Number: 2357.24

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1,6</sup>:

I. Dimensional

Parameter/Equipment	Range	CMC <sup>2,4</sup> ( $\pm$ )	Comments
Micrometers <sup>3</sup>	Up to 4 in (4 to 12) in (12 to 48) in	(30 + 1.0L) $\mu$ in (34 + 1.5L) $\mu$ in (46 + 2.1L) $\mu$ in	Gage blocks
Flatness <sup>3</sup>	Up to 1 in	6.1 $\mu$ in	Optical flats/parallel
Parallelism <sup>3</sup>	Up to 1 in	6.6 $\mu$ in	Optical flats/parallel
Calipers <sup>3</sup>	Up to 4 in (4 to 12) in (12 to 48) in	(30 + 1.3L) $\mu$ in (290 + 1.3L) $\mu$ in (270 + 2.8L) $\mu$ in	Gage blocks
Height Gage <sup>3</sup>	Up to 4 in (4 to 12) in (12 to 24) in	(58 + 0.76L) $\mu$ in (61 + 0.88L) $\mu$ in (52 + 1.6L) $\mu$ in	Gage blocks
Surface Plate Flatness <sup>3</sup> (Flatness Only)	24 in x 24 in Min 72 in x 144 in Max	(6.6 + 2.0D) $\mu$ in	Mahr leveling system; D is the diagonal length of surface plate in inches

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,5</sup> ( $\pm$ )	Comments
DC Voltage – Generate <sup>3</sup>	(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 $\mu$ V/V + 0.39 $\mu$ V 4.9 $\mu$ V/V + 0.62 $\mu$ V 3.5 $\mu$ V/V + 2.3 $\mu$ V 3.6 $\mu$ V/V + 3.9 $\mu$ V 5.0 $\mu$ V/V + 39 $\mu$ V 6.4 $\mu$ V/V + 0.39 mV	Fluke 5720A/5730A
DC Voltage – Measure <sup>3</sup>	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV	8.9 nV/V + 230 nV 4.8 $\mu$ V/V + 230 nV 4.7 $\mu$ V/V + 23 nV 6.3 $\mu$ V/V + 0.23 mV 6.4 $\mu$ V/V + 2.3 mV	HP 3458A opt 002
DC Current – Generate <sup>3</sup>	Up to 220 $\mu$ A 220 $\mu$ A 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 $\mu$ A/A + 5.4 nA 33 $\mu$ A/A + 6.2 nA 33 $\mu$ A/A + 39 nA 41 $\mu$ A/A + 0.62 $\mu$ A 71 $\mu$ A/A + 12 $\mu$ A 0.28 mA/A + 0.37 mA  0.78 mA/A + 0.58 mA  4.0 mA/A + 0.11 mA 5.1 mA/A + 0.39 mA	Fluke 5720A/5730A  Fluke 5720A/5730A/5725A  Fluke 5520A  w/ 5500A 50 turn coil
DC Current – Measure <sup>3</sup>	(0 to 100) nA (0.1 to 1) $\mu$ A (1 to 10) $\mu$ A (10 to 100) $\mu$ A 100 $\mu$ A 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 $\mu$ A/A + 31 pA 32 $\mu$ A/A + 31 pA 16 $\mu$ A/A + 78 pA 20 $\mu$ A/A + 0.62 nA 19 $\mu$ A/A + 3.9 nA 19 $\mu$ A/A + 39 nA 28 $\mu$ A/A + 0.39 $\mu$ A 89 $\mu$ A/A + 7.8 $\mu$ A  31 $\mu$ A/A 72 $\mu$ A/A 58 $\mu$ A/A	HP 3458A opt 002          Y5020 w/HP 3458A 9211A w/HP 3458A

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Simulation of Thermocouples <sup>3</sup> –			
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 <sup>3</sup> –			
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

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
DC Power Generate <sup>3</sup>	0.01 mW to 337 W (0.01 to 3060) W (3.06 to 20.91) kW	0.18 mW/W 0.18 mW/W 0.57 mW/W	Fluke 5520A
Phase <sup>3</sup>	(0 to 360) °	0.58°	Fluke 5520A
AC Power <sup>3</sup> – Generate PF = 1  (45 to 65) Hz	(0.1089 to 2.97) mW (0.297 to 10.89) mW (1.089 to 29.7) mW (2.97 to 108.9) mW (10.89 to 297) mW (29.7 to 726) mW 72.6 mW to 1.49 W 149 mW to 6.76 W 1.09 mW to 9.18 W 2.97 mW to 33.6 W 10.9 mW to 91.8 W 29.7 mW to 337 W 109 mW to 918 W 297 mW to 2244 W 72.6 mW to 4.59 kW 1.49 W to 20.91 kW	2.3 mW/W 1.4 mW/W 1.1 mW/W 1.3 mW/W 1.0 mW/W 1.0 mW/W 1.1 mW/W 1.0 mW/W 3.4 mW/W 0.62 mW/W 0.94 mW/W 0.62 mW/W 0.86 mW/W 0.76 mW/W 0.96 mW/W 0.81 mW/W	Fluke 5520A

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
AC Voltage – Generate <sup>3</sup>  (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 0.85 mV/V + 3.9 μV 0.84 mV/V + 3.9 μV 1.4 mV/V + 3.9 μV 2.0 mV/V + 6.2 μV 3.5 mV/V + 12 μV 5.2 mV/V + 23 μV 6.9 mV/V + 31 μV	Fluke 5720A w/ 5730A

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
AC Voltage – Generate <sup>3</sup> (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	1.1 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 5720/5730A
(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 (0.5 to 1) MHz	0.30 mV/V + 3.9 μV 0.18 mV/V + 3.9 μV 0.16 mV/V + 3.9 μV 0.30 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 2.9 mV/V + 19 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 <sup>2,5</sup> (±)	Comments
AC Voltage – Generate <sup>3</sup> (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 µV/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 5720/5730A
(220 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	74 µV/V + 3.1 mV 0.11 mV/V + 4.7 mV 0.31 mV/V + 8.5 mV	Fluke 5720A 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 <sup>3</sup>			
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 µV/V + 2.3 µV 0.18 µV/V + 0.85 µV 0.25 µV/V + 0.85 µV 0.78 µV/V + 0.85 µV 3.9 µV/V + 0.85 µV 31 µV/V + 3.9 µV	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 µV/V + 3.1 µV 71 nV/V + 1.6 µV 0.11 µV/V + 1.6 µV 0.23 µV/V + 1.6 µV 0.62 µV/V + 1.6 µV 2.3 µV/V + 7.8 µV	
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 µV/V + 31 µV 59 µV/V + 16 µV 0.11 mV/V + 16 µV 0.24 mV/V + 16 µV 0.63 mV/V + 16 µV 2.3 mV/V + 78 µV	
(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 µV/V + 0.31 mV 59 µV/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 <sup>2,5</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup> (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	

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
AC Current – Generate <sup>3</sup>			
Up to 220 µA	(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 5720A/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 µA 1.0 mA/A + 0.62 µA	
(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 µA 0.16 mA/A + 0.31 µA 0.11 mA/A + 0.31 µA 0.20 mA/A + 0.54 µA 1.1 mA/A + 4.7 µA	
(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 µA 0.16 mA/A + 3.1 µA 0.11 mA/A + 2.3 µA 0.2 mA/A + 3.1 µA 1.1 mA/A + 9.3 µA	

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
AC Current – Generate <sup>3</sup> (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 5720A/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 <sup>3</sup>			
(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 <sup>2.5</sup> (±)	Comments
AC Current – Measure <sup>3</sup> (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

Parameter/Equipment	Range	CMC <sup>2.5</sup> (±)	Comments
Resistance – Generate <sup>3</sup>	(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 <sup>2,5</sup> (±)	Comments
Resistance – Generate <sup>3</sup> (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 kΩ 8.5 kΩ 26 kΩ	Fluke 5720A/5730A
	0.33333 mΩ 1 mΩ 10 mΩ 100 mΩ	12 μΩ 12 μΩ 12 μΩ 12 μΩ	Guildline 9211A
High Resistance – Generate <sup>3</sup>	(1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ (1 to 10) GΩ (10 to 100) GΩ	1.2 mΩ/Ω 1.3 mΩ/Ω 2.4 mΩ/Ω 5.8 mΩ/Ω 18 mΩ/Ω	Biddle mega decade box
Resistance – Measure <sup>3</sup>	(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/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Oscilloscopes <sup>3</sup> –			
Amplitude – DC			
50 Ω	0 to ± 5.0 V	0.20 mV/V + 19 μV	Wavetek 9500 w/ 9530
1 MΩ	0 to ± 200 V	0.20 mV/V + 19 μV	
Amplitude – Square Wave			
50 Ω	0 mV to 5.0 V 10 Hz to 10 kHz	0.85 mV/V + 7.8 μV	
1 MΩ	1 mV to ± 200 V 10 Hz to 1 kHz	0.80 mV/V + 7.8 μV	
Leveled Sine Wave (ref 50 kHz) 5 mV to 5.5 V <sub>(p-p)</sub>	0.1 Hz to 300 MHz (300 to 550) MHz 550 MHz to 1.1 GHz (3.0 to 3.2) GHz	2.1 % 2.4 % 4.1 % 5.4 %	
Resistance – Measure	(40 to 90) Ω (0.8 to 1.2) MΩ	0.86 mΩ/Ω 0.87 mΩ/Ω	
Time Marker	450.5 ps to 55 s	0.29 μs/s	
Pulse Characterization Transition time (Rise Time) – Generate	(125 to 175) ps	18 ps	

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

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

### III. Electrical – RF/Microwave

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

### IV. Mechanical

Parameter/Equipment	Range	CMC <sup>2,4,5</sup> (±)	Comments
Pressure <sup>3</sup> –			
Pneumatic	(-13.2 to 35) psi	0.03 %	Fluke PM600-series module
	(-5 to 300) psi	0.014 %	
	(0 to 3000) psi	0.015 %	

Parameter/Equipment	Range	CMC <sup>2, 4, 5</sup> (±)	Comments
Pressure <sup>3</sup> – (cont)			
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 % + 0.00017 psi 0.011 % + 0.00060 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
Scales and Balances <sup>3</sup>	Up 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 <sup>3</sup>	(5 to 50) in·ozf  (15 to 200) in·ozf  (5 to 50) in·lbf (40 to 400) in·lbf (100 to 1000) in·lbf (25 to 250) ft·lbf  (60 to 600) ft·lbf  (200 to 2000) ft·lbf	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

Parameter/Equipment	Range	CMC <sup>2,4,5</sup> (±)	Comments
Force Measuring Equipment – Compression & Tension <sup>3</sup>	(0 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 <sup>2,5</sup> (±)	Comments
Temperature – Measuring Equipment	(0 to 70) °C	0.08 °C	Thunder Scientific 2500ST
	(-95 to 35) °C	0.12 °C	PRT w/ dry blocks
	(35 to 350) °C	0.39 °C	
Temperature – Measure <sup>3</sup>	(-200 to 100) °C (100 to 660) °C	0.012 °C 0.019 °C	5626 PRT w/ 3458A
Relative Humidity – Measure <sup>3</sup>	(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 0.56 % RH 0.63 % RH	Thunder Scientific 2500ST

#### VI. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Frequency – Measure <sup>3</sup>	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

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Frequency – Measuring Equipment <sup>3</sup>	0.001 Hz to 1 kHz 1 kHz to 50 MHz	0.12 mHz/Hz 2.4 nHz/Hz	FEI 5680A rubidium with 33250A
	10 MHz to 4.0 GHz	2.3 nHz/Hz	FEI 5680A rubidium with E4437B
Stopwatches & Timing Devices <sup>3</sup>	Up to 24 hrs	0.039 s/day	Agilent 53132A

<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. 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.

<sup>3</sup> 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.

<sup>4</sup> 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

<sup>5</sup> 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.

<sup>6</sup> This scope meets A2LA's P112 *Flexible Scope Policy*.



## *Accredited Laboratory*

A2LA has accredited

**TEKTRONIX CANADA**

*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/NCSLI Z540-1-1994 and the requirements of ANSI/NCSLI Z540.3-2006 and R205 – Specific Requirements: Calibration Laboratory Accreditation Program. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).



Presented this 10<sup>th</sup> day of April 2019.

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

Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 2357.24  
Valid to December 31, 2020

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