



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

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CALIBRATION

Valid To: February 29, 2012

Certificate Number: 1618.01

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

I. Dimensional

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Micrometers <sup>3</sup>	(0 to 1) in (1 to 2) in (2 to 3) in (3 to 4) in (4 to 5) in (5 to 6) in (6 to 7) in (7 to 8) in (8 to 10) in (10 to 12) in (12 to 20) in	34 µin 48 µin 67 µin 88 µin 130 µin 150 µin 170 µin 190 µin 220 µin 270 µin 390 µin	Gage blocks
Height Gages <sup>3</sup>	(0 to 12) in (0 to 36) in	130 µin 510 µin	Caliper checker
Length <sup>3</sup> –  Rules	(0 to 12) in (12 to 40) in (40 to 60) in	0.0091 in 0.0091 in 0.0091 in	12 in caliper checker 40 in caliper checker Gage blocks
Tape Measures	(0 to 25) ft	0.0091 in	40 in caliper checker

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Calipers <sup>3</sup>	(0 to 12) in (12 to 40) in	190 μin 530 μin	Caliper checker
Optical Comparator, Microscopes <sup>3</sup> –  Length Angle	(0 to 12) in (0 to 90)°	170 μin 38 s	Gage blocks Angle blocks
Crimpers <sup>3</sup> –  Tensile Test Outside Diameter Inside Diameter	(0 to 100) lbs (0 to 0.4) in (0 to 0.4) in	0.51 lbs 89 μin 240 μin	Com-ten force stand Micrometer Pin Gages
Depth Gages <sup>3</sup>	(0 to 1) in (0 to 2) in (0 to 3) in (0 to 4) in (0 to 5) in (0 to 6) in (0 to 7) in (0 to 8) in (0 to 9) in (0 to 10) in (0 to 11) in (0 to 12) in	60 μin 67 μin 69 μin 85 μin 110 μin 110 μin 110 μin 110 μin 110 μin 110 μin 210 μin 210 μin	Gage blocks
Dial and Test Indicators <sup>3</sup>	(0 to 1) in (0 to 2) in (0 to 3) in (0 to 4) in	34 μin 40 μin 69 μin 96 μin	Gage blocks
Cylindrical OD <sup>3</sup>	(0 to 1) in (0 to 2) in (0 to 3) in (0 to 4) in (0 to 5) in (0 to 6) in (0 to 7) in (0 to 8) in (0 to 10) in	21 μin 36 μin 52 μin 68 μin 83 μin 100 μin 120 μin 140 μin 170 μin	Gage blocks and supermicrometer

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Cylindrical OD, Pin Sets <sup>3</sup>	(0 to 1) in	42 μin	Laser micrometer
Cylindrical ID, Ring Gages <sup>3</sup>	(0 to 1) in (0 to 2) in (0 to 3) in (0 to 4) in (0 to 5) in (0 to 6) in (6 to 7) in (0 to 8) in (0 to 9) in (0 to 10) in	17 μin 34 μin 50 μin 66 μin 91 μin 91 μin 91 μin 91 μin 91 μin 91 μin	Gage blocks
Squareness <sup>3</sup>	(0 to 12) in	65 μin	Surface plate, master square, & linear amplifier
Levels <sup>3</sup>	(0 to 6) in	180 μin	Surface plate, sine plate, & linear amplifier
Outside Threads <sup>3</sup>	(0 to 1) in (0 to 2) in (0 to 3) in (0 to 4) in (0 to 5) in (0 to 6) in	32 μin 39 μin 57 μin 72 μin 87 μin 110 μin	Gage blocks, thread wires, and supermicrometer

## II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2, 6</sup> (±)	Comments
DC Voltage <sup>3</sup> – Generate	(0 to 10) V	4.2 μV/V + 0.5 μV	Fluke 732A & Fluke 720A
	10 V to 1 kV	6.7 μV/V + 400 μV	Fluke 732A, 752A, & 5720A
	(1 to 30) kV	0.066 % + 7 μV	Hallmark PVD kilovolt divider & Agilent 34401A

Parameter/Equipment	Range	CMC <sup>2, 4, 5, 6</sup> ( $\pm$ )	Comments
DC Voltage <sup>3</sup> – Measure	Up to 200 mV (0.2 to 2.0) V (2.0 to 20) V (20 to 200) V (200 to 1000) V	6.7 $\mu$ V/V + 0.1 $\mu$ V 3.0 $\mu$ V/V + 0.4 $\mu$ V 3.0 $\mu$ V/V + 4.0 $\mu$ V 4.5 $\mu$ V/V + 40 $\mu$ V 4.7 $\mu$ V/V + 500 $\mu$ V	Fluke 8508A
	(0 to 10) V	4.2 $\mu$ V/V + 0.5 $\mu$ V	Fluke 732A & Fluke 720A
	10 V to 1 kV	6.7 $\mu$ V/V + 400 $\mu$ V	Fluke 732A, 752A, & 5720A
	(1 to 30) kV	0.031 % + 7 $\mu$ V	Hallmark PVD kilovolt divider & Agilent 34401A
DC Current <sup>3</sup> – Generate	(0 to 2) pA (2 to 20) pA (20 to 200) pA 200 pA to 2 nA (2 to 20) nA	2.4 % + 0.02 pA 0.64 % + 0.02 pA 0.27 % + 0.04 pA 0.11 % + 0.13 nA 0.09 % + 1.1 pA	Keithly 263
	10 $\mu$ A to 10 A (10 to 15) A	35 $\mu$ A/A + 0.1 $\mu$ A 0.012 % + 1 $\mu$ A	Standard resistor, Fluke 8508A multimeter and Fluke 5520A
	(15 to 100) A	0.042 % + 1 $\mu$ A	Standard shunt, Fluke 8508A multimeter, Ballantine 1620A and Fluke 5720A
	(10 to 500) A (500 to 1000) A	1.2 % + 0.5 A 1.6 % + 0.5 A	Fluke 5500A/Coil & 5520A
	(20 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	40 $\mu$ A/A + 6 nA 35 $\mu$ A/A + 7 nA 35 $\mu$ A/A + 40 nA 45 $\mu$ A/A + 0.7 $\mu$ A 80 $\mu$ A/A + 12 $\mu$ A	Fluke 5720A
	(0 to 200) $\mu$ A (0.2 to 2.0) mA (2.0 to 20) mA (20 to 200) mA 20 mA to 2 A	6.5 $\mu$ A/A + 0.4 nA 6.5 $\mu$ A/A + 4 nA 8.0 $\mu$ A/A + 40 nA 33 $\mu$ A/A + 0.8 $\mu$ A 0.017 % + 16 $\mu$ A	Fluke 8508A

Parameter/Equipment	Range	CMC <sup>2,5,6</sup> (±)	Comments
DC Current <sup>3</sup> – Measure (cont)	10 µA to 10 A	0.0044 % IV	L&N 7000 series, Biddle Cat. # 601235, & Fluke 8508A
	(10 to 15) A (15 to 100) A (100 to 300) A	0.012 % IV 0.030 % IV 0.046 % IV	L&N 4360 Shunt w/ Fluke 8508A L&N 4361 Shunt w/ Fluke 8508A L&N 4363 Shunt w/ Fluke 8508A
Capacitance <sup>3</sup> – Measure, @ 1 kHz	(10, 100, 1000) pF	0.012 % IV	General Radio 1615-A, General Radio 1404 series, and ESI SC 1000 standard capacitors
	1 pF to 1 µF	0.018 % IV	General Radio 1615-A
Capacitance <sup>3</sup> – Generate, @ 1 kHz	(10, 100, 1000) pF	0.0018 % IV	General Radio 1404 series and ESI SC 1000 standard capacitors
	1 pF to 1 µF	0.053 % IV + 0.7 pF	General Radio 1413 decade capacitor
Resistance <sup>3</sup> – Measure	(0.1 to 10) Ω 10 Ω to 1 kΩ (1 to 100) kΩ 100 kΩ to 100 MΩ	73 µΩ/Ω 43 µΩ/Ω 24 µΩ/Ω 55 µΩ/Ω	Fluke 8508A & ESI SR1010 & SR1050 standard resistors
	0.01 Ω 0.001 Ω 0.0001 Ω	82 µΩ/Ω 0.011% 0.019 %	Fluke 8508A & Guildline 1659, Biddle #601235 L&N 4334B standard resistors
Shunts	0.01 Ω and below	50 µΩ/Ω	Fluke 8508A & Agilent 34401A & L&N 4361 standard shunt
Resistance <sup>3</sup> – Generate	(0.1 to 10) Ω 10 Ω to 1 kΩ (1 to 100) kΩ 100 kΩ to 100 MΩ	76 µΩ/Ω 39 µΩ/Ω 39 µΩ/Ω 41 µΩ/Ω	Thomas 1 Ω, ESI SR104 & SR 1010 standard resistors  ESI SR 1050 standard resistors

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
Resistance <sup>3</sup> – Generate (cont)	0.01 Ω 0.001 Ω 0.0001 Ω	20 μΩ/Ω 0.011 % 0.018 %	Biddle Cat. #601235 standard resistor, Guildline type 1659 standard resistor, and L&N 4334B standard resistor
Inductance <sup>3</sup> – Generate, @ 1 kHz	100 μH to 10 H	0.029 % IV	General Radio 1482 series standard inductors and DT72A ratio transformer
Inductance <sup>3</sup> – Measure, @ 1 kHz	100 μH to 10 H	0.026 % IV	General Radio 1482 standard inductor and ESI DT 72A
Electrical Calibration of Thermocouple Indicators <sup>3</sup> –  Type E Type J Type K Type T	-200 °C to 1000 °C -200 °C to 1200 °C -200 °C to 1372 °C -250 °C to 400°C	0.18 °C 0.18 °C 0.18 °C 0.18 °C	Fluke 5720A, Hart Scientific 9101 ice point and ice point probe
Electrical Calibration of RTD Indicators <sup>3</sup> –  Pt 385, 100Ω Pt 385, 200 Ω Pt 385, 500 Ω Pt 385, 1 kΩ PtNi 385, 120 Ω Pt 3916, 100 Ω Pt 3926, 100 Ω Cu 427, 10 Ω	-200 °C to 800 °C -190 °C to 630 °C -190 °C to 630 °C -190 °C to 630 °C -80 °C to 260 °C -200 °C to 630 °C -200 °C to 630 °C -100 °C to 260 °C	0.03 °C 0.03 °C 0.03 °C 0.03 °C 0.03 °C 0.03 °C 0.03 °C 0.03 °C	Decade resistors and standard resistors ESI RS925A, General Radio 1433T, ESI SR 1010

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Current <sup>3</sup> – Measure			
Up to 200 µA	10 Hz to 10 kHz	0.030 % + 20 nA	Fluke 8508A
200 µA to 2 mA	10 Hz to 10 kHz	0.030 % + 0.2 µA	
(2 to 20) mA	10 Hz to 10 kHz	0.030 % + 2 µA	
(20 to 200) mA	10 Hz to 10 kHz	0.029 % + 20 µA	
200 mA to 2 A	10 Hz to 2 kHz (2 to 10) kHz	0.062 % + 0.2 mA 0.073 % + 0.2 mA	Fluke 8508A
(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	0.012 % + 0.2 µA 0.012 % + 0.2 µA 0.008 % + 0.2 µA 0.010 % + 0.2 µA 0.010 % + 0.2 µA	Fluke A40 shunts, Fluke 5720A, 8508A, & A40 shunts
(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	0.012 % + 2 µA 0.012 % + 2 µA 0.009 % + 2 µA 0.010 % + 2 µA 0.010 % + 2 µA	
220 mA to 2.2 A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.015 % + 20 µA 0.015 % + 20 µA 0.012 % + 20 µA 0.013 % + 20 µA 0.013 % + 20 µA	
(2 to 10) A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.065 % + 0.2 mA 0.064 % + 0.2 mA 0.064 % + 0.2 mA 0.064 % + 0.2 mA 0.064 % + 0.2 mA	
(10 to 20) A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.069 % + 0.2 mA 0.068 % + 0.2 mA 0.068 % + 0.2 mA 0.068 % + 0.2 mA 0.068 % + 0.2 mA	
(10 to 100) A	60 Hz	0.031 % + 2 mA	L&N 4361 shunt, Fluke 8508A
(100 to 300) A	60 Hz	0.047 % + 2 mA	L&N 4363 shunt, Fluke 8508A

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments	
AC Current <sup>3</sup> – Generate				
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	0.025 % + 16 nA 0.016 % + 10 nA 0.012 % + 8 nA 0.028 % + 12 nA 0.11 % + 65 nA	Fluke 5720A	
220 µA 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	0.025 % + 40 nA 0.016 % + 35 nA 0.012 % + 35 nA 0.020 % + 110 nA 0.11 % + 650 nA		
(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	0.025 % + 400 nA 0.016 % + 350 nA 0.012 % + 350 nA 0.020 % + 500 nA 0.11 % + 5 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	0.025 % + 4 µA 0.016 % + 3.5 µA 0.012 % + 2.5 µA 0.020 % + 3.5 µA 0.11 % + 10 µA		
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.026 % + 35 µA 0.045 % + 80 µA 0.70 % + 650 nA		
(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	0.011 % + 1.2 µA 0.011 % + 0.2 µA 0.008 % + 0.2 µA 0.009 % + 0.2 µA 0.009 % + 0.2 µA		Fluke A40 AC Shunts, 5720A, & 8508A
(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	0.012 % + 12 µA 0.015 % + 2 µA 0.010 % + 2 µA 0.010 % + 2 µA 0.010 % + 2 µA		

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Current <sup>3</sup> – Generate (cont)			
(220 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	0.014 % + 120 μA 0.014 % + 20 μA 0.013 % + 20 μA 0.013 % + 20 μA 0.013 % + 20 μA	Fluke A40 AC Shunts, 5720A, & 8508A
(2 to 10) A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.064 % + 0.2 mA 0.063 % + 0.2 mA 0.063 % + 0.2 mA 0.063 % + 0.2 mA 0.063 % + 0.2 mA	
(10 to 100) A	45 Hz to 1 kHz	0.19 %	Fluke 5720A & Ballantine AC current calibrator
(20 to 150) A	(45 to 100) Hz (100 to 400) Hz	0.57 % + 0.51 A 0.66 % + 0.51 A	Fluke 5520A w/ 5500A/Coil
(150 to 1000) A	(45 to 100) Hz (100 to 400) Hz	0.68 % + 0.52 A 1.3 % + 0.52 A	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage <sup>3</sup> – Measure			
10 mV	10 Hz	0.028 %	Fluke 792A and 5720A
	20 Hz	0.013 %	
	40 Hz	0.014 %	
	100 Hz	0.015 %	
	1 kHz	0.012 %	
	10 kHz	0.018 %	
	20 kHz	82 μV/V	
	50 kHz	0.011 %	
	100 kHz	0.025 %	
	300 kHz	0.026 %	
	500 kHz	0.039 %	
	800 kHz	0.043 %	
	1 MHz	0.041 %	
	20 mV	10 Hz	
20 Hz		0.011 %	
40 Hz		0.011 %	
100 Hz		0.011 %	
1 kHz		79 μV/V	
10 kHz		0.017 %	
20 kHz		73 μV/V	
50 kHz		88 μV/V	
100 kHz		0.024 %	
300 kHz		0.027 %	
500 kHz		0.042 %	
800 kHz		0.048 %	
1 MHz		0.041 %	
60 mV		10 Hz	0.021 %
	20 Hz	64 μV/V	
	40 Hz	56 μV/V	
	100 Hz	47 μV/V	
	1 kHz	55 μV/V	
	10 kHz	0.016 %	
	20 kHz	41 μV/V	
	50 kHz	47 μV/V	
	100 kHz	0.021 %	
	300 kHz	0.20 %	
	500 kHz	0.29 %	
	800 kHz	0.33 %	
	1 MHz	0.38 %	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage <sup>3</sup> – Measure (cont)			
100 mV	10 Hz	0.018 %	Fluke 792A and 5720A
	20 Hz	41 μV/V	
	40 Hz	44 μV/V	
	100 Hz	34 μV/V	
	1 kHz	29 μV/V	
	10 kHz	23 μV/V	
	20 kHz	27 μV/V	
	50 kHz	25 μV/V	
	100 kHz	44 μV/V	
	300 kHz	86 μV/V	
	500 kHz	0.016 %	
	800 kHz	0.019 %	
	1 MHz	0.023 %	
	200 mV	10 Hz	
20 Hz		39 μV/V	
40 Hz		28 μV/V	
100 Hz		20 μV/V	
1 kHz		23 μV/V	
10 kHz		19 μV/V	
20 kHz		21 μV/V	
50 kHz		25 μV/V	
100 kHz		36 μV/V	
300 kHz		76 μV/V	
500 kHz		0.014 %	
800 kHz		0.019 %	
1 MHz		0.019 %	
600 mV		10 Hz	0.011 %
	20 Hz	26 μV/V	
	40 Hz	20 μV/V	
	100 Hz	15 μV/V	
	1 kHz	19 μV/V	
	10 kHz	22 μV/V	
	20 kHz	21 μV/V	
	50 kHz	18 μV/V	
	100 kHz	14 μV/V	
	300 kHz	30 μV/V	
	500 kHz	62 μV/V	
	800 kHz	62 μV/V	
	1 MHz	78 μV/V	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage <sup>3</sup> – Measure (cont)			
1 V	10 Hz	0.013 %	Fluke 792A and 5720A
	20 Hz	27 μV/V	
	40 Hz	19 μV/V	
	100 Hz	14 μV/V	
	1 kHz	18 μV/V	
	10 kHz	9 μV/V	
	20 kHz	9 μV/V	
	50 kHz	14 μV/V	
	100 kHz	26 μV/V	
	300 kHz	69 μV/V	
	500 kHz	86 μV/V	
	800 kHz	86 μV/V	
	1 MHz	86 μV/V	
	2 V	10 Hz	
20 Hz		27 μV/V	
40 Hz		25 μV/V	
100 Hz		19 μV/V	
1 kHz		14 μV/V	
10 kHz		10 μV/V	
20 kHz		10 μV/V	
50 kHz		13 μV/V	
100 kHz		19 μV/V	
300 kHz		48 μV/V	
500 kHz		49 μV/V	
800 kHz		51 μV/V	
1 MHz		63 μV/V	
6 V		10 Hz	63 μV/V
	20 Hz	55 μV/V	
	40 Hz	18 μV/V	
	100 Hz	18 μV/V	
	1 kHz	12 μV/V	
	10 kHz	9 μV/V	
	20 kHz	9 μV/V	
	50 kHz	12 μV/V	
	100 kHz	14 μV/V	
	300 kHz	38 μV/V	
	500 kHz	34 μV/V	
	800 kHz	40 μV/V	
	1 MHz	89 μV/V	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage <sup>3</sup> – Measure (cont)			
10 V	10 Hz	87 µV/V	Fluke 792A and 5720A
	20 Hz	31 µV/V	
	40 Hz	24 µV/V	
	100 Hz	19 µV/V	
	1 kHz	12 µV/V	
	10 kHz	9 µV/V	
	20 kHz	9 µV/V	
	50 kHz	11 µV/V	
	100 kHz	14 µV/V	
	300 kHz	36 µV/V	
	500 kHz	40 µV/V	
	800 kHz	61 µV/V	
	1 MHz	86 µV/V	
	20 V	10 Hz	
20 Hz		28 µV/V	
40 Hz		24 µV/V	
100 Hz		20 µV/V	
1 kHz		14 µV/V	
10 kHz		10 µV/V	
20 kHz		10 µV/V	
50 kHz		13 µV/V	
100 kHz		17 µV/V	
300 kHz		39 µV/V	
500 kHz		42 µV/V	
800 kHz		1 µV/V	
1 MHz		86 µV/V	
60 V		10 Hz	70 µV/V
	20 Hz	31 µV/V	
	40 Hz	26 µV/V	
	100 Hz	20 µV/V	
	1 kHz	14 µV/V	
	10 kHz	11 µV/V	
	20 kHz	11 µV/V	
	50 kHz	13 µV/V	
	100 kHz	15 µV/V	
	300 kHz	55 µV/V	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage <sup>3</sup> – Measure (cont)			
100 V	10 Hz	93 μV/V	Fluke 792A and 5720A
	20 Hz	33 μV/V	
	40 Hz	25 μV/V	
	100 Hz	14 μV/V	
	1 kHz	13 μV/V	
	10 kHz	11 μV/V	
	20 kHz	12 μV/V	
	50 kHz	22 μV/V	
	100 kHz	32 μV/V	
	200 V	10 Hz	
20 Hz		28 μV/V	
40 Hz		25 μV/V	
100 Hz		14 μV/V	
1 kHz		14 μV/V	
10 kHz		11 μV/V	
20 kHz		13 μV/V	
50 kHz		27 μV/V	
100 kHz		48 μV/V	
600 V		20 Hz	48 μV/V
	40 Hz	30 μV/V	
	100 Hz	22 μV/V	
	1 kHz	18 μV/V	
	10 kHz	15 μV/V	
	20 kHz	16 μV/V	
	50 kHz	34 μV/V	
	100 kHz	64 μV/V	
1000 V	20 Hz	64 μV/V	High voltage divider and Agilent 34401A
	40 Hz	31 μV/V	
	100 Hz	23 μV/V	
	1 kHz	22 μV/V	
	10 kHz	19 μV/V	
	20 kHz	22 μV/V	
	50 kHz	42 μV/V	
	100 kHz	67 μV/V	
(1 to 30) kV	60 Hz	0.50 %	High voltage divider and Agilent 34401A

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage <sup>3</sup> – Generate			
10 mV	10 Hz	0.037 %	Fluke 792A and 5720A
	20 Hz	0.016 %	
	40 Hz	0.018 %	
	100 Hz	0.018 %	
	1 kHz	0.015 %	
	10 kHz	0.020 %	
	20 kHz	0.013 %	
	50 kHz	0.024 %	
	100 kHz	0.056 %	
	300 kHz	0.17 %	
	500 kHz	0.55 %	
	800 kHz	0.86 %	
	1 MHz	0.86 %	
20 mV	10 Hz	0.050 %	
	20 Hz	0.046 %	
	40 Hz	0.031 %	
	100 Hz	0.030 %	
	1 kHz	0.030 %	
	10 kHz	0.033 %	
	20 kHz	0.029 %	
	50 kHz	0.041 %	
	100 kHz	0.079 %	
	300 kHz	0.16 %	
	500 kHz	0.25 %	
	800 kHz	0.38 %	
	1 MHz	0.38 %	
60 mV	10 Hz	0.049 %	
	20 Hz	0.045 %	
	40 Hz	0.022 %	
	100 Hz	0.021 %	
	1 kHz	0.021 %	
	10 kHz	0.025 %	
	20 kHz	0.021 %	
	50 kHz	0.032 %	
	100 kHz	0.078 %	
	300 kHz	0.19 %	
	500 kHz	0.19 %	
	800 kHz	0.35 %	
	1 MHz	0.35 %	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage <sup>3</sup> – Generate (cont)			
100 mV	10 Hz	0.041 %	Fluke 792A and 5720A
	20 Hz	0.037 %	
	40 Hz	0.017 %	
	100 Hz	0.016 %	
	1 kHz	0.016 %	
	10 kHz	0.016 %	
	20 kHz	0.016 %	
	50 kHz	0.028 %	
	100 kHz	0.064 %	
	300 kHz	0.11 %	
	500 kHz	0.17 %	
	800 kHz	0.32 %	
	1 MHz	0.32 %	
200 mV	10 Hz	0.032 %	
	20 Hz	0.031 %	
	40 Hz	0.013 %	
	100 Hz	0.012 %	
	1 kHz	0.012 %	
	10 kHz	0.012 %	
	20 kHz	0.012 %	
	50 kHz	0.024 %	
	100 kHz	0.055 %	
	300 kHz	0.11 %	
	500 kHz	0.16 %	
	800 kHz	0.30 %	
	1 MHz	0.30 %	
600 mV	10 Hz	0.033 %	
	20 Hz	0.031 %	
	40 Hz	0.012 %	
	100 Hz	0.010 %	
	1 kHz	0.010 %	
	10 kHz	0.010 %	
	20 kHz	0.010 %	
	50 kHz	0.022 %	
	100 kHz	0.051 %	
	300 kHz	0.11 %	
	500 kHz	0.18 %	
	800 kHz	0.32 %	
	1 MHz	0.32 %	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage <sup>3</sup> – Generate (cont)			
1 V	10 Hz	0.031 %	Fluke 792A and 5720A
	20 Hz	0.029 %	
	40 Hz	0.011 %	
	100 Hz	89 μV/V	
	1 kHz	90 μV/V	
	10 kHz	89 μV/V	
	20 kHz	89 μV/V	
	50 kHz	0.021 %	
	100 kHz	0.050 %	
	300 kHz	0.099 %	
	500 kHz	0.16 %	
	800 kHz	0.30 %	
	1 MHz	0.30 %	
	2 V	10 Hz	
20 Hz		0.027 %	
40 Hz		0.011 %	
100 Hz		86 μV/V	
1 kHz		85 μV/V	
10 kHz		85 μV/V	
20 kHz		85 μV/V	
50 kHz		0.021 %	
100 kHz		0.048 %	
300 kHz		0.095 %	
500 kHz		0.15 %	
800 kHz		0.29 %	
1 MHz		0.29 %	
6 V		10 Hz	0.032 %
	20 Hz	0.032 %	
	40 Hz	0.012 %	
	100 Hz	56 μV/V	
	1 kHz	55 μV/V	
	10 kHz	54 μV/V	
	20 kHz	54 μV/V	
	50 kHz	92 μV/V	
	100 kHz	0.014 %	
	300 kHz	0.038 %	
	500 kHz	0.014 %	
	800 kHz	0.21 %	
	1 MHz	0.21 %	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage <sup>3</sup> – Generate (cont)			
10 V	10 Hz	0.030 %	Fluke 792A and 5720A
	20 Hz	0.029 %	
	40 Hz	0.011 %	
	100 Hz	53 μV/V	
	1 kHz	51 μV/V	
	10 kHz	51 μV/V	
	20 kHz	51 μV/V	
	50 kHz	86 μV/V	
	100 kHz	0.013 %	
	300 kHz	0.034 %	
	500 kHz	0.12 %	
	800 kHz	0.19 %	
	1 MHz	0.19 %	
20 V	10 Hz	0.027 %	
	20 Hz	0.027 %	
	40 Hz	0.010 %	
	100 Hz	52 μV/V	
	1 kHz	49 μV/V	
	10 kHz	49 μV/V	
	20 kHz	49 μV/V	
	50 kHz	81 μV/V	
	100 kHz	0.012 %	
	300 kHz	0.031 %	
	500 kHz	0.11 %	
	800 kHz	0.17 %	
	1 MHz	0.17 %	
60 V	10 Hz	0.032 %	
	20 Hz	0.031 %	
	40 Hz	0.012 %	
	100 Hz	65 μV/V	
	1 kHz	64 μV/V	
	10 kHz	63 μV/V	
	20 kHz	63 μV/V	
	50 kHz	98 μV/V	
	100 kHz	0.020 %	
	300 kHz	0.12 %	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage <sup>3</sup> – Generate (cont)			
100 V	10 Hz	0.030 %	Fluke 792A and 5720A
	20 Hz	0.029 %	
	40 Hz	0.011 %	
	100 Hz	60 µV/V	
	1 kHz	60 µV/V	
	10 kHz	59 µV/V	
	20 kHz	59 µV/V	
	50 kHz	93 µV/V	
	100 kHz	0.018 %	
200 V	10 Hz	0.027 %	Fluke 792A, 5720A, and 5205A
	20 Hz	0.027 %	
	40 Hz	0.011 %	
	100 Hz	57 µV/V	
	1 kHz	57 µV/V	
	10 kHz	56 µV/V	
	20 kHz	57 µV/V	
	50 kHz	89 µV/V	
	100 kHz	0.017 %	
600 V	20 Hz	0.033 %	Fluke 792A, 5720A, and 5205A
	40 Hz	0.033 %	
	100 Hz	79 µV/V	
	1 kHz	78 µV/V	
	10 kHz	0.044 %	
	20 kHz	0.044 %	
	50 kHz	0.089 %	
	100 kHz	0.12 %	
	1000 V	20 Hz	
40 Hz		0.032 %	
100 Hz		77 µV/V	
1 kHz		77 µV/V	
10 kHz		0.043 %	
20 kHz		0.043 %	
50 kHz		0.086 %	
100 kHz		0.12 %	
(1 to 6) kV		60 Hz	0.26 %

III. Electrical – RF/Microwave

Parameter/Equipment	Frequency	CMC <sup>2,6</sup> (±)	Comments
RF Power <sup>3</sup>	(1 to 1000) MHz	0.32 %	Agilent 478A-H75 and 34401A

IV. Mechanical

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
Pressure Measuring Equipment <sup>3</sup> –			
Vacuum	(-15 to 0) psi	0.047 %	PTE-1, pressure calibrator
Pressure	(0 to 15) psi	0.047 %	PTE-1, pressure calibrator
	(0 to 100) psi	0.047 %	
	(0 to 500) psi	0.058 %	Deadweight tester Deadweight tester
	(0 to 1000) psi	0.15 %	
	(1000 to 10 000) psi	0.15 %	
Pressure	(0 to 1) inH <sub>2</sub> O	0.071 %	PTE-1, pressure calibrator
	(0 to 5) inH <sub>2</sub> O	0.071 %	
	(0 to 50) inH <sub>2</sub> O	0.071 %	
Torque <sup>3</sup> – Measure	(0 to 2000) ft·lb	0.34 %	CDI Torque calibrator

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
Scales <sup>3</sup> , Balances <sup>3</sup> , and Force <sup>3</sup> –  (0 to 6.7) kg	(1 to 500) mg	0.01 mg	Class 1 weights
	1 g	0.034 mg	
	10 g	0.051 mg	
	20 g	0.078 mg	
	30 g	0.096 mg	
	50 g	0.14 mg	
	100 g	0.28 mg	
	200 g	0.56 mg	
	300 g	0.66 mg	
	500 g	0.95 mg	
(0 to 3000) lb	1000 g	5.2 mg	Class 2 weights
	1.5 kg	5.3 mg	Class 2 weights
	3.0 kg	16 mg	
	6.711 kg	19 mg	
	1 lb	150 mg	Class 6 weights
	2 lb	340 mg	
5 lb	320 mg		
10 lb	390 mg		
20 lb	850 mg		
50 lb	2.1 g		
Load Cells/Force	250 lb	6.2 g	
	(0 to 500) lb (500 to 3000) lb	13 g 7.4 g	Transfer method
Load Cells/Force	(0 to 500) lb	1.5 % FS	Interface load cells
	(0 to 5) klb	1.5 % FS	
	(0 to 50) klb	1.6 % FS	

#### V. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
Relative Humidity <sup>3</sup> – Measure	(0 to 90) % RH (91 to 100) % RH	1.5 % RH 2.9 % RH	Vaisala HMI 41 w/HMP 46

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
Temperature <sup>3</sup> – Measuring Equipment and Measure	(-80 to -30) °C	0.24 °C	Hart 1560 w/2560 black stack thermometer, Hart 5626 PRT and bath
	(-30 to 100) °C	0.025 °C	Hart 1560 w/ 2560 black stack thermometer, Hart 5626 PRT and Lauda RE106 fluid bath
	(50 to 550) °C	0.58 °C	Hart 1560 w/2560 black stack thermometer, Hart 5626 PRT and Jofra 600S dry well

#### VI. Time and Frequency

Parameter/Equipment	Frequency	CMC <sup>2</sup> (±)	Comments
Frequency <sup>3</sup> –  Measure	(0.1, 1, 5, 10) MHz	2.1 parts in 10 <sup>11</sup>	WWVB and NIST receiver
	DC to 12.4 GHz	1.0 part in 10 <sup>9</sup>	Rubidium and quartz oscillators
	(12.4 to 18) GHz	1.1 parts in 10 <sup>8</sup>	
	(18 to 26) GHz	9.4 parts in 10 <sup>8</sup>	

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

<sup>2</sup> Calibration and Measurement Capability (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. Calibration and Measurement Capabilities 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> The measurands stated are generated with the Fluke 5720A series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. CMCs 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>5</sup> The measurands stated are measured with the Keithly 263, Fluke 8508A, or Fluke 5500A series of instruments. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a combination of the fraction of the reading/output plus a range specification.
- <sup>6</sup> In the statement of CMC, percentages are to be read as percent of reading; otherwise, “% RH” represents percent relative humidity, “% FS” represents percent of full scale, and “% IV” represents percent of indicated value.



World Class Accreditation

The American Association for Laboratory Accreditation

# Accredited Laboratory

A2LA has accredited

**J. H. METROLOGY CO., INC.**

*Rolling Meadows, IL*

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 any additional program requirements in the field of calibration. 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 8 January 2009*).

Presented this 5<sup>th</sup> day of November 2010.



  
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Peter Abney

President & CEO  
For the Accreditation Council  
Certificate Number 1618.01  
Valid to February 29, 2012  
Revised January 30, 2012

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