



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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CALIBRATION

Valid To: May 31, 2020

Certificate Number: 3023.01

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. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,4,6</sup> (±)	Comments
DC Voltage <sup>3</sup> – Generate	Up 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	5.4 µV/V + 0.39 µV 3.1 µV/V + 0.62 µV 2.3 µV/V + 2.4 µV 2.3 µV/V + 3.9 µV 3.1 µV/V + 39 µV 4.7 µV/V + 0.39 mV	Fluke 5700A/EP (5720)
DC Voltage <sup>3</sup> – Measure	Up to 200 mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1000) V	4.7 µV/V + 0.093 µV 3.1 µV/V + 0.39 µV 3.1 µV/V + 3.9 µV 4.7 µV/V + 39 µV 4.7 µV/V + 0.47 mV	Fluke 8508A
DC Voltage <sup>3</sup> – Measure, High Voltage	(1 to 15) kV  (15 to 20) kV  (21 to 70) kV  (71 to 100) kV	0.037 % + 0.08 V  0.22 % + 4.0 V  0.04 % + 0.25 V  0.10 %	Vitrek 4700  Vitrek 4600A  Vitrek 4700A /HVL-70  Phenix DVD100 with Keysight 34401A

Parameter/Equipment	Range	CMC <sup>2,4,6</sup> (±)	Comments
DC Current <sup>3</sup> – Generate	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	33 µA/A + 5.4 nA 27 µA/A + 6.2 nA 27 µA/A + 39 nA 35 µA/A + 0.62 µA 54 µA/A + 12 µA	Fluke 5700A/EP (5720)
	(2.2 to 3.0) A (3 to 11) A (11 to 20) A (20 to 100) A	0.023 % + 32 µA 0.026 % + 0.37 mA 0.062 % + 0.58 mA 0.020 % + 21 mA	Fluke 5520 Fluke 5725A Fluke 5520 Ballantine 1620A with Fluke 5520
Clamp-On – Non-Toroidal	(20 to 150) A (150 to 1000) A	0.55 % + 0.14 A 0.56 % + 0.50 mA	Fluke 5520A with 50 turn coil
DC Current <sup>3</sup> – Measure	Up to 200 µA 200 µA to 2 mA (2 to 20) mA (20 to 200) mA 200 mA to 2 A (2 to 20) A	12 µA/A + 0.31 nA 12 µA/A + 3.1 nA 12 µA/A + 31 nA 35 µA/A + 0.62 µA 0.016 % + 12 µA 0.035 % + 0.31 mA	Fluke 8508A
	(21 to 100) A (101 to 300) A	0.040 % + 0.7 mA 0.040 % + 0.7 mA	with L&N shunts
DC Resistance <sup>3</sup> – Generate, Fixed Points	1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	74 µΩ/Ω 19 µΩ/Ω 19 µΩ/Ω 8.5 µΩ/Ω 8.5 µΩ/Ω 7.0 µΩ/Ω 7.0 µΩ/Ω 7.0 µΩ/Ω 7.0 µΩ/Ω 8.5 µΩ/Ω 8.5 µΩ/Ω 15 µΩ/Ω 15 µΩ/Ω 29 µΩ/Ω 40 µΩ/Ω 85 µΩ/Ω	Fluke 5700A/EP (5720)

Parameter/Equipment	Range	CMC <sup>2, 4, 5, 6</sup> ( $\pm$ )	Comments	
DC Resistance <sup>3</sup> – Generate (cont)	(0 to 11) $\Omega$	27 $\mu\Omega/\Omega$ + 0.78 m $\Omega$	Fluke 5520A	
	(11 to 33) $\Omega$	19 $\mu\Omega/\Omega$ + 1.2 m $\Omega$		
	(33 to 110) $\Omega$	17 $\mu\Omega/\Omega$ + 1.1 m $\Omega$		
	(0.11 to 0.33) k $\Omega$	17 $\mu\Omega/\Omega$ + 1.6 m $\Omega$		
	(0.33 to 1.1) k $\Omega$	17 $\mu\Omega/\Omega$ + 1.6 m $\Omega$		
	(1.1 to 3.3) k $\Omega$	17 $\mu\Omega/\Omega$ + 16 m $\Omega$		
	(3.3 to 11.0) k $\Omega$	17 $\mu\Omega/\Omega$ + 16 m $\Omega$		
	(11 to 33) k $\Omega$	17 $\mu\Omega/\Omega$ + 0.16 $\Omega$		
	(33 to 110) k $\Omega$	17 $\mu\Omega/\Omega$ + 0.16 $\Omega$		
	(110 to 330) k $\Omega$	19 $\mu\Omega/\Omega$ + 1.6 $\Omega$		
	(0.330 to 1.1) M $\Omega$	19 $\mu\Omega/\Omega$ + 1.6 $\Omega$		
	(1.1 to 3.3) M $\Omega$	33 $\mu\Omega/\Omega$ + 23 $\Omega$		
	(3.3 to 11) M $\Omega$	85 $\mu\Omega/\Omega$ + 39 $\Omega$		
	(11 to 33) M $\Omega$	0.016 % + 1.9 k $\Omega$		
	(33 to 110) M $\Omega$	0.031 % + 2.3 k $\Omega$		
	(110 to 330) M $\Omega$	0.19 % + 78 k $\Omega$		
	(0.33 to 1.1) G $\Omega$	0.93 % + 0.39 M $\Omega$		
Fixed Points	0.001 $\Omega$	58 $\mu\Omega/\Omega$	YEW 2792 resistor IET labs resistor YEW 2792 resistor IET labs resistor YEW 2792 resistor IET labs resistor ESI-SR1 resistor  IET labs resistor	
	0.0019 $\Omega$	210 $\mu\Omega/\Omega$		
	0.01 $\Omega$	23 $\mu\Omega/\Omega$		
	0.019 $\Omega$	110 $\mu\Omega/\Omega$		
	0.1 $\Omega$	23 $\mu\Omega/\Omega$		
	0.19 $\Omega$	61 $\mu\Omega/\Omega$		
	1.0 $\Omega$	61 $\mu\Omega/\Omega$		
	1.9 $\Omega$	21 $\mu\Omega/\Omega$		
	19 $\Omega$	10 $\mu\Omega/\Omega$		
	190 $\Omega$	10 $\mu\Omega/\Omega$		
	1.9 k $\Omega$	10 $\mu\Omega/\Omega$		
	19 k $\Omega$	10 $\mu\Omega/\Omega$		
	500 M $\Omega$	0.5 %		CISG fixed resistor
	1 G $\Omega$	1.0 %		
	10 G $\Omega$	1.0 %		
1 T $\Omega$	5.0 %			

Parameter/Equipment	Range	CMC <sup>2,4,6</sup> (±)	Comments
DC Resistance <sup>3</sup> – Measure	Up to 2 Ω	15 μΩ/Ω + 3.9 μΩ	Fluke 8508A
	(2 to 20) Ω	8.9 μΩ/Ω + 14 μΩ	
	(20 to 200) Ω	7.4 μΩ/Ω + 47 μΩ	
	200 Ω to 2 kΩ	7.4 μΩ/Ω + 0.47 mΩ	High voltage mode
	(2 to 20) kΩ	7.4 μΩ/Ω + 4.7 mΩ	
	(20 to 200) kΩ	7.4 μΩ/Ω + 47 mΩ	
	200 kΩ to 2 MΩ	8.1 μΩ/Ω + 0.93 Ω	Guildline 6500A
	(2 to 20) MΩ	15 μΩ/Ω + 9.3 Ω	
	(20 to 200) MΩ	58 μΩ/Ω + 0.93 kΩ	
200 MΩ to 1 GΩ	0.015 % + 93 kΩ		
(1.1 to 10) GΩ	0.071 %		
(10.1 to 100) GΩ	0.10 %		
101 GΩ to 1 TΩ	0.20 %		

Parameter/Range	Frequency	CMC <sup>2,4,6</sup> (±)	Comments	
AC Voltage <sup>3</sup> – Generate	(1 to 2.2) mV	(10 to 20) Hz	0.021 % + 3.9 μV	Fluke 5700A/EP (5720)
		(20 to 40) Hz	0.0081 % + 3.9 μV	
		40 Hz to 20 kHz	0.0070 % + 3.9 μV	
		(20 to 50) kHz	0.018 % + 3.9 μV	
		(50 to 100) kHz	0.042 % + 4.7 μV	
		(100 to 300) kHz	0.093 % + 9.3 μV	
		(300 to 500) kHz	0.17 % + 19 μV	
	500 kHz to 1 MHz	0.24 % + 19 μV		
	(2.2 to 22) mV	(10 to 20) Hz	0.021 % + 0.39 mV	
		(20 to 40) Hz	78 μV/V + 0.16 mV	
		40 Hz to 20 kHz	42 μV/V + 55 μV	
		(20 to 50) kHz	69 μV/V + 93 μV	
		(50 to 100) kHz	89 μV/V + 0.19 mV	
		(100 to 300) kHz	0.025 % + 0.62 mV	
(300 to 500) kHz		0.085 % + 1.9 mV		
500 kHz to 1 MHz	0.12 % + 3.1 mV			

Parameter/Range	Frequency	CMC <sup>2, 4, 6</sup> ( $\pm$ )	Comments
AC Voltage <sup>3</sup> – Generate (cont)			
(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 500 kHz to 1 MHz	0.021 % + 12 $\mu$ V 81 $\mu$ V/V + 6.2 $\mu$ V 72 $\mu$ V/V + 6.2 $\mu$ V 0.018 % + 6.2 $\mu$ V 0.042 % + 16 $\mu$ V 0.070 % + 19 $\mu$ V 0.12 % + 23 $\mu$ V 0.22 % + 47 $\mu$ V	Fluke 5700A/EP (5720)
220 mV 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 500 kHz to 1 MHz	0.021 % + 39 $\mu$ V 78 $\mu$ V/V + 16 $\mu$ V 41 $\mu$ V/V + 7.8 $\mu$ V 69 $\mu$ V/V + 9.3 $\mu$ V 97 $\mu$ V/V + 31 $\mu$ V 0.033 % + 78 $\mu$ V 0.085 % + 0.19 mV 0.14 % + 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 500 kHz to 1 MHz	0.021 % + 0.39 mV 78 $\mu$ V/V + 0.16 mV 46 $\mu$ V/V + 55 $\mu$ V 69 $\mu$ V/V + 93 $\mu$ V 89 $\mu$ V/V + 0.19 mV 0.025 % + 0.62 mV 0.085 % + 1.9 mV 0.12 % + 3.1 mV	
(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	0.021 % + 3.9 mV 80 $\mu$ V/V + 1.6 mV 46 $\mu$ V/V + 0.55 mV 74 $\mu$ V/V + 0.93 mV 0.013 % + 2.3 mV	Fluke 5725A
(220 to 1100) V	50 Hz to 1 kHz	58 $\mu$ V/V + 3.1 mV	
750 V	(30 to 50) kHz (50 to 100) kHz	0.028 % + 8.5 mV 0.10 % + 35 mV	
1100 V	(1 to 20) kHz (20 to 30) kHz	97 $\mu$ V/V + 4.7 mV 0.028 % + 8.5 mV	

Parameter/Range	Frequency	CMC <sup>2, 4, 6</sup> ( $\pm$ )	Comments
AC Voltage <sup>3</sup> – Measure			
Up to 200 mV	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.016 % + 12 $\mu$ V 0.012 % + 3.9 $\mu$ V 98 $\mu$ V/V + 3.9 $\mu$ V 0.010 % + 1.9 $\mu$ V 99 $\mu$ V/V + 3.9 $\mu$ V 0.027 % + 7.8 $\mu$ V 0.059 % + 19 $\mu$ V	Fluke 8508A
200 mV to 2 V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.015 % + 0.11 mV 96 $\mu$ V/V + 19 $\mu$ V 77 $\mu$ V/V + 19 $\mu$ V 59 $\mu$ V/V + 19 $\mu$ V 75 $\mu$ V/V + 19 $\mu$ V 0.019 % + 39 $\mu$ V 0.043 % + 0.19 mV 0.24 % + 1.9 mV 0.78 % + 19 mV	
(2 to 20) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.015 % + 1.1 mV 96 $\mu$ V/V + 0.19 mV 76 $\mu$ V/V + 0.19 mV 59 $\mu$ V/V + 0.19 mV 75 $\mu$ V/V + 0.19 mV 0.019 % + 0.39 mV 0.043 % + 1.9 mV 0.24 % + 19 mV 0.78 % + 0.19 V	
(20 to 200) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.014 % + 11 mV 93 $\mu$ V/V + 1.9 mV 74 $\mu$ V/V + 1.9 mV 58 $\mu$ V/V + 1.9 mV 74 $\mu$ V/V + 1.9 mV 0.019 % + 3.9 mV 0.043 % + 19 mV 0.23 % + 19 mV 0.78 % + 0.19 V	
(200 to 1000) V	(1 to 10) Hz (10 to 40) Hz 40 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.014 % + 65 mV 0.010 % + 20 mV 85 $\mu$ V/V + 20 mV 0.019 % + 41 mV 0.048 % + 0.20 V	

Parameter/Range	Frequency	CMC <sup>2, 4, 5, 6</sup> ( $\pm$ )	Comments
AC Voltage Ratio – (0 to 1.00000)	60 Hz	0.01 % of ratio	ESI 73
AC Voltage <sup>3</sup> – Measure High Voltage			
(1 to 10) kV	(30 to 200) Hz	0.19 % + 0.15 V	Vitretek 4700
(10 to 15) kV	(20 to 100) Hz	0.49 % + 20 V	Vitretek 4600A
(15 to 20) kV	60 Hz	0.28 %	Hipotronics KVM20 with Keysight 34401
(21 to 50) kV	60 Hz	0.11 % + 0.45 V	Vitretek 4700A with HLV-70
(50 to 100) kV	60 Hz	0.28 %	Phenix DVD100 with Keysight 34401A
AC Current <sup>3</sup> – Generate			
Up to 220 $\mu$ A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.022 % + 16 nA 0.014 % + 9.3 nA 0.010 % + 7.8 nA 0.025 % + 12 nA 0.085 % + 62 nA	Fluke 5700A/EP (5720)
220 $\mu$ A 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	0.022 % + 39 nA 0.014 % + 32 nA 0.010 % + 32 nA 0.017 % + 0.10 $\mu$ A 0.085 % + 0.62 $\mu$ 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	0.022 % + 0.39 $\mu$ A 0.014 % + 0.32 $\mu$ A 0.010 % + 0.32 $\mu$ A 0.017 % + 0.55 $\mu$ A 0.085 % + 4.7 $\mu$ 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	0.022 % + 3.9 $\mu$ A 0.014 % + 3.2 $\mu$ A 0.010 % + 2.4 $\mu$ A 0.39 % + 0.78 mA 0.085 % + 9.3 $\mu$ A	

Parameter/Range	Frequency	CMC <sup>2, 4, 6</sup> (±)	Comments
AC Current <sup>3</sup> – Generate (cont)			
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.023 % + 32 µA 0.036 % + 78 µA 0.54 % + 0.16 mA	Fluke 5700A/EP (5720)
(2.2 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.12 % + 78 µA 0.039 % + 78 µA 0.039 % + 0.78 mA 1.6 % + 3.9 mA	Fluke 5520A
(3 to 11) A	(40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz	0.031 % + 0.13 mA 0.066 % + 0.29 mA 0.26 % + 0.58 mA	Fluke 5725A
(11 to 20) A	(45 to 100) Hz (100 to 1000) Hz (1 to 5) kHz	0.078 % + 3.9 mA 0.10 % + 3.9 mA 1.9 % + 3.9 mA	Fluke 5520A
(20 to 100) A	(45 to 1000) Hz	0.18 % + 0.10 A	Ballantine 1620 / Fluke 5520
AC Current <sup>3</sup> – Measure			
Up to 200 µA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.046 % + 19 nA 0.046 % + 19 nA 0.060 % + 19 nA 0.31 % + 19 nA	Fluke 8508A
200 µA to 2 mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.029 % + 0.19 µA 0.026 % + 0.19 µA 0.060 % + 0.19 µA 0.31 % + 0.19 µA	
(2 to 20) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.029 % + 1.9 µA 0.026 % + 1.9 µA 0.060 % + 1.9 µA 0.31 % + 1.9 µA	
(20 to 200) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.029 % + 19 µA 0.024 % + 19 µA 0.054 % + 19 µA	
200 mA to 2 A	10 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.055 % + 0.19 mA 0.063 % + 0.19 mA 0.23 % + 0.19 mA	



Parameter/Range	Frequency	CMC <sup>2, 4, 6</sup> (±)	Comments
AC Current <sup>3</sup> – Measure			
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	0.070 % + 1.9 mA 0.19 % + 1.9 mA	Fluke 8508A
(21 to 100) A	Up to 1 kHz	0.10 % + 2 mA	Fluke 8508A/VS2575
Clamp-On Toroidal Type <sup>3</sup>			
(20 to 150) A	(45 to 65) Hz (65 to 440) Hz	0.39 % + 25 mA 0.84 % + 27 mA	Fluke 5520A with 50 turn coil
(150 to 1000) A	(45 to 65) Hz (65 to 440) Hz	0.35 % + 0.12 A 0.81 % + 0.13 A	
Clamp-On Non-Toroidal Type <sup>3</sup>			
(20 to 150) A	(45 to 65) Hz (65 to 440) Hz	0.61 % + 0.25 A 1.0 % + 0.25 A	
(150 to 1000) A	(45 to 65) Hz (65 to 440) Hz	0.57 % + 0.30 A 1.0 % + 0.90 A	
Capacitance <sup>3</sup> – Generate			
(0.19 to 0.4) nF	10 Hz to 10 kHz	0.29 % + 7.8 pF	Fluke 5520A
(0.4 to 1.1) nF	10 Hz to 10 kHz	0.29 % + 7.8 pF	
(1.1 to 3.3) nF	10 Hz to 3 kHz	0.29 % + 7.8 pF	
(3.3 to 11) nF	10 Hz to 1 kHz	0.15 % + 7.8 pF	
(11 to 33) nF	10 Hz to 1 kHz	0.15 % + 7.8 pF	
(33 to 110) nF	10 Hz to 1 kHz	0.15 % + 7.8 pF	
(110 to 330) nF	10 Hz to 1 kHz	0.15 % + 0.23 nF	
(0.33 to 1.1) μF	(10 to 600) Hz	0.15 % + 0.78 nF	
(1.1 to 3.3) μF	(10 to 300) Hz	0.15 % + 2.3 nF	
(3.3 to 11) μF	(10 to 150) Hz	0.15 % + 7.8 nF	
(11 to 33) μF	(10 to 120) Hz	0.23 % + 23 nF	
(33 to 110) μF	(10 to 80) Hz	0.26 % + 78 nF	
(110 to 330) μF	Up to 50 Hz	0.26 % + 0.23 μF	
(0.33 to 1.1) mF	Up to 20 Hz	0.26 % + 0.78 μF	

Parameter/Range	Frequency	CMC <sup>2,5,6</sup> (±)	Comments
Capacitance <sup>3</sup> – Generate, Fixed Values			
100 pF	1 kHz	0.10 %	GR 1409
1 nF	1 kHz	0.054 %	
10 nF	1 kHz	0.054 %	
100 nF	1 kHz	0.054 %	
1 μF	1 kHz	0.054 %	
10 μF	100 Hz	0.064 %	CRC X93X106 CRC X93X107
100 μF	100 Hz	0.20 %	
900 μF	50 Hz	0.22 %	CISG-900 μF
Capacitance <sup>3</sup> – Measure			
Up to 6400 pF	1 kHz	0.020 %	GR 1689 RLC Digibridge
(6.4 to 100) nF	1 kHz	0.021 %	
(100 to 1600) nF	1 kHz	0.020 %	
(1.6 to 25) μF	1 kHz	0.021 %	
Inductance <sup>3</sup> – Generate			
100 μH	10 kHz 1 kHz	0.053 % 0.11 %	Fixed inductors GR 1482 series
1 mH	1 kHz 100 Hz	0.026 % 0.31 %	
10 mH	1 kHz 100 Hz	0.023 % 0.042 %	
100 mH	1 kHz 100 Hz	0.024 % 0.042 %	
1H	1 kHz 100 Hz	0.023 % 0.042 %	
10 H	1 kHz 100 Hz	0.024 % 0.042 %	

Parameter/Range	Frequency	CMC <sup>2,5,6</sup> (±)	Comments
Inductance <sup>3</sup> – Measure (4.1 to 65) H (256 to 4100) mH (16 to 256) mH (1 to 16) mH	1 kHz 1 kHz 1 kHz 1 kHz	0.023 % 0.023 % 0.023 % 0.023 %	GR 1689 RLC Digibridge

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
Electrical Calibration of Thermocouple Devices <sup>3</sup> – Measure and Generate			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.29 °C 0.093 °C 0.078 °C 0.093 °C 0.12 °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	0.16 °C 0.093 °C 0.097 °C 0.10 °C 0.14 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.19 °C 0.11 °C 0.093 °C 0.15 °C 0.23 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.23 °C 0.13 °C 0.12 °C 0.11 °C 0.16 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.37 °C 0.22 °C 0.20 °C 0.26 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.37 °C 0.22 °C 0.20 °C 0.26 °C	

Parameter/Equipment	Range	CMC <sup>2,4,6</sup> (±)	Comments
Electrical Calibration of Thermocouple Devices <sup>3</sup> – Measure and Generate (cont)  Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.37 °C 0.14 °C 0.093 °C 0.078 °C	Fluke 5520A
Electrical Calibration of RTD Indicators and Indicating Systems <sup>3</sup> – Generate  Pt 385, 100 Ω	(-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	0.031 °C 0.039 °C 0.054 °C 0.062 °C 0.070 °C 0.078 °C 0.16 °C	Fluke 5520A
Oscilloscopes <sup>3</sup> –  DC Signal Output  50 Ω Load 1 MΩ Load  Square Wave Output  50 Ω Load 1 MΩ Load  Leveled Sine Wave (Into 50 Ω)  5 mV <sub>(p-p)</sub> to 5.5 V <sub>(p-p)</sub>  Leveled Sine Flatness (50 kHz Reference)  5 mV <sub>(p-p)</sub> to 5.5 V <sub>(p-p)</sub>	(-6 to 6) V (-130 to 130) V   1 mV <sub>(p-p)</sub> to 6.6 V <sub>(p-p)</sub> 1 mV <sub>(p-p)</sub> to 130 V <sub>(p-p)</sub>  50 kHz Reference  50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	0.19 % + 31 μV 0.039 % + 31 μV   0.19 % + 31 μV <sub>(p-p)</sub> 0.078 % + 31 μV <sub>(p-p)</sub>  1.6 % + 0.23 mV <sub>(p-p)</sub>  1.2 % + 78 μV <sub>(p-p)</sub> 1.6 % + 78 μV <sub>(p-p)</sub> 3.1 % + 78 μV <sub>(p-p)</sub>	Fluke 5520A/SC600      Fluke 5520A

Parameter/Equipment	Frequency	CMC <sup>2,6</sup> ( $\pm$ )	Comments
Oscilloscopes <sup>3</sup> (cont) –  Time Marker (50 $\Omega$ Load)	(5 to 2) ns 10 ns (50 to 20) ns 20 ms to 100 ns 5 s to 50 ms	1.9 $\mu$ s/s 1.9 $\mu$ s/s 1.9 $\mu$ s/s 1.9 $\mu$ s/s 58 $\mu$ s/s	Fluke 5520A
AC Power <sup>3</sup> – Generate  1 > PF < 0.5 (1.0 to 1008) V (0.1 to 50) A	(16 to 850) Hz	67 $\mu$ W/W	Fluke 6105A

## II. Electrical – Microwave/RF

Parameter/Range	Frequency	CMC <sup>2,6</sup> ( $\pm$ )	Comments
RF Power <sup>3</sup> – Generate  (-48 to 24) dBm (-74 to -48) dBm (-94 to -74) dBm (-48 to 20) dBm (-17 to 20) dBm (-74 to -17) dBm (-17 to 20) dBm (-94 to -74) dBm (-130 to -94) dBm	(10 to 125) MHz 100 kHz to 125 MHz 100 kHz to 300 MHz (125 to 300) MHz 300 MHz to 1.4 GHz 300 MHz to 4 GHz (3 to 4) GHz 300 MHz to 4 GHz 10 MHz to 3 GHz	0.039 dBm 0.16 dBm 0.39 dBm 0.078 dBm 0.39 dBm 0.78 dBm 0.39 dBm 0.39 dBm 1.2 dBm	Fluke 9640A w/9640A-50 head

### III. Mechanical

Parameter/Equipment	Range	CMC <sup>2, 5, 6</sup> (±)	Comments
Torque – Measure	(5 to 50) in·lbf	0.28 %	CDI 5000-ST with CDI 2000-400-02 4 in 1 transducer
	(40 to 400) in·lbf	0.28 %	
	(100 to 1000) in·lbf	0.28 %	
	(25 to 250) ft.lbf	0.28 %	CDI 5000-ST with CDI 2000-12-02
	(60 to 600) ft·lbf	0.28 %	
	(100 to 1000) ft·lbf	0.28 %	

### IV. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2, 6</sup> (±)	Comments
Frequency – Measure	DC to 3 GHz	0.18 µHz/Hz	HP53132 OPT.010
Frequency – Generate	10 MHz DC to 80 MHz 80 MHz to 4 GHz	1 Part in 10 <sup>-12</sup> Hz 2.0 µHz/Hz 0.031 µHz/Hz + 0.12 mHz	HP 58503A / GPS HP33250A Fluke 9640

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

<sup>2</sup> Calibration and Measurement Capability Uncertainty (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of  $k = 2$ . The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

<sup>3</sup> Field calibration service is available for this calibration 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 using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure the measurand in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a fraction/percentage of the reading plus a fixed floor specification.

<sup>5</sup> In the statement of CMC, the value is defined as the percentage of the reading unless otherwise indicated.

<sup>6</sup> In the statement of CMC, the resolution of the unit under test is not taken into account.



## *Accredited Laboratory*

A2LA has accredited

# **CANADIAN INSTRUMENTATION SERVICES GROUP LTD.**

*Peterborough, Ontario, CANADA*

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 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 7<sup>th</sup> day of May 2018.

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

President and CEO  
For the Accreditation Council  
Certificate Number 3023.01  
Valid to May 31, 2020

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