SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

TRADEPORT ELECTRONICS CALIBRATION LABORATORY
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CALIBRATION

Valid To: July 31, 2026 Certificate Number: 2450.01

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 to perform the following calibrations[1, 6]:

I Dimensional

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Length / Displayment[3] – Generation			
Plunger Type, Lever Type, Cylindrical Bore Gauges	(0 to 25.4) mm	1.1 µm	Hypso I_CAL 25 & optical flat
Height Gauges, Caliper (Outside / Inside)	Fixed Length (20, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600) mm	7.4 µm	AMAC AMC/2425/10/1 & optical flat

II. Electrical – DC / Low Frequency

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
DC Voltage[3] – Generate	(0 to 120) mV 120 mV to 1.2 V (1.2 to 12) V (12 to 120) V (120 to 330) V (330 to 1020) V	12 µV/V + 5.8 µV 8.5 µV/V + 2.1 µV 7.8 µV/V + 16 µV 11 µV/V + 0.24 mV 11 µV/V + 1.8 mV 11 µV/V + 2.4 mV	Fluke 5560A
	(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	8.0 µV/V + 0.68 µV 7.0 µV/V + 1.4 µV 7.0 µV/V + 6.5 µV 7.0 µV/V + 12 µV 8.0 µV/V + 140 µV 9.0 µV/V + 1.5 mV	Fluke 5700A
	(0 to 0.202) V (0.202 to 2.02) V (2.02 to 20.2) V (20.2 to 220) V (200 to 1025) V	15 µV/V + 2.7 µV 9.0 µV/V + 2.6 µV 8.0 µV/V + 0.16 mV 12 µV/V + 0.31 mV 12 µV/V + 9.0 mV	Transmille 4010
	(> 1 to 10) kV (10 to 20) kV (20 to 30) kV (30 to 40) kV	0.58 % + 25 V 0.58 % + 26 V 0.58 % + 27 V 0.58 % + 30 V	Pintek HVC-801
DC Voltage[3] – Measure	(0 to 100) mV (0 to 1) V (0 to 10) V (0 to 100) V (0 to 1000) V	11 µV /V + 1.0 µV 10 µV/V + 1.0 µV 10 µV/V + 2.1 µV 12 µV/V + 34 µV 24 µV/V + 0.13 mV	Agilent 3458A
	100 V to 15 kV	3.9 %	Tektronix P6015A with 1 MΩ impedance oscilloscope
	(0.5 to 6) kV (> 6 to 10) kV	0.035 % + 0.58 V 0.035 % + 5.8 V	Vitrek 4700
	(> 10 to 40) kV (40 to 70) kV (70 to 100) kV	0.058 % + 5.8 V 0.058 % + 58 V 0.058 % + 0.12 kV	Vitrek 4700 & Vitrek HVL-100 probe

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Current[3] – Generate	(0 to 120) µA 120 µA to 1.2 mA (1.2 to 12) mA (12 to 120) mA 120 mA to 1.2 A (1.2 to 3.1) A (3.1 to 10) A (10 to 12) A (12 to 20) A (20 to 30.2) A	120 µA/A + 6.2 nA 100 µA/A + 20 nA 100 µA/A + 0.14 µA 100 µA/A + 1.4 µA 0.016 % + 23 µA 0.030 % + 0.40 mA 0.030 % + 0.62 mA 0.030 % + 0.77 mA 0.10 % + 1.3 mA 0.10 % + 2.6 mA	Fluke 5560A
	(> 20 to 50) A (50 to 100) A (100 to 500) A (500 to 1000) A (1000 to 1500) A	0.25 % + 0.20 A 0.25 % + 0.68 A 0.25 % + 1.1 A 0.27 % + 1.9 A 0.27 % + 2.8 A	Fluke 5560A & Fluke 5500A/COIL
	(> 20 to 120) A	0.25 % + 0.0034 A	200A/100mV current shunt, Agilent 3458A & APM SPS40VDC1000W
	(0 to 220) µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A	50 µA/A + 10 nA 50 µA/A + 22 nA 50 µA/A + 0.25 µA 60 µA/A + 1.8 µA 80 µA/A + 59 µA	Fluke 5700A
	(0 to 202) µA (0.2 to 2.02) mA (2 to 20.2) mA (20 to 202) mA	0.01 % + 12 nA 0.050 % + 79 nA 0.050 % + 0.37 µA 0.05 % + 3.7 µA	Transmille 4010
	(0.2 to 2.02) A (2 to 20.2) A (20.2 to 30) A	0.013 % + 60 µA 0.030 % + 1.4 mA 0.050 % + 1.5 mA	
	(> 20 to 50) A (50 to 100) A (100 to 500) A (500 to 1000) A	0.25 % + 0.20 A 0.25 % + 0.40 A 0.25 % + 1.0 A 0.25 % + 1.8 A	Transmille 4010 & Fluke 5500A/COIL

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
DC Current[3] – Measure	(0 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 3) A (3 to 10) A (10 to 20) A	25 µA/A + 2.1 nA 25 µA/A + 17 nA 25 µA/A + 0.17 µA 40 µA/A + 2.4 µA 120 µA/A + 50 µA 0.016 % + 4.4 mA 0.039 % + 4.4 mA 0.21 % + 9.7 mA	Agilent 3458A Fluke 8846A Agilent 3458A & 50 A/50 mV current shunt
Resistance[3] – Generate	(0 to 12) Ω (12 to 120) Ω 120 Ω to 1.2 kΩ (1.2 to 12) kΩ (12 to 120) kΩ 120 kΩ to 1.2 MΩ (1.2 to 12) MΩ (12 to 120) MΩ 120 MΩ to 1.2 GΩ (0 to 100) Ω (100 to 330) Ω 330 Ω to 1.1 kΩ (1.1 to 3.3) kΩ (3.3 to 10) kΩ (10 to 33) kΩ (33 to 100) kΩ (100 to 330) kΩ 330 kΩ to 1 MΩ (1 to 3.3) MΩ (3.3 to 10) MΩ (10 to 33) MΩ (33 to 100) MΩ (100 to 330) MΩ 330 MΩ to 1.0 GΩ	23 µΩ/Ω + 1.0 mΩ 23 µΩ/Ω + 1.4 mΩ 23 µΩ/Ω + 11 mΩ 23 µΩ/Ω + 0.13 Ω 23 µΩ/Ω + 5.9 Ω 23 µΩ/Ω + 10 Ω 34 µΩ/Ω + 0.11 kΩ 0.039 % + 16 kΩ 0.33 % + 1.1 MΩ 0.010 % + 50 mΩ 0.010 % + 50 mΩ 0.010 % + 51 mΩ 0.010 % + 94 mΩ 0.010 % + 0.14 Ω 0.010 % + 0.82 Ω 0.010 % + 1.4 Ω 0.010 % + 43 Ω 0.010 % + 53 Ω 0.010 % + 0.17 kΩ 0.010 % + 0.30 kΩ 0.010 % + 9.3 kΩ 0.050 % + 0.10 MΩ 1.0 % + 0.21 MΩ 2.0 % + 0.70 MΩ	Fluke 5560A Transmille 4010

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Resistance[3] – Generate (cont)			
Resistance – Generate, (2-wire & 4-wire) Fixed Points	0 Ω 1 Ω 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	56 μΩ 120 μΩ 220 μΩ 370 μΩ 720 μΩ 2.0 mΩ 3.0 mΩ 16 mΩ 32 mΩ 120 mΩ 290 mΩ 1.7 Ω 2.7 Ω 25 Ω 51 Ω 490 Ω 1.7 kΩ 16 kΩ	Fluke 5700A
	0.001 Ω 0.01 Ω 0.1 Ω 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ	0.15 μΩ 0.94 μΩ 16 μΩ 0.16 mΩ 0.73 mΩ 14 mΩ 87 mΩ 1.0 Ω 23 Ω	KAENAHO B CCCP fixed value resistor
Resistance[3] – Measure (2-Wire & 4-Wire)	(0 to 10) Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	18 μΩ/Ω + 0.11 mΩ 15 μΩ/Ω + 1.0 mΩ 13 μΩ/Ω + 7.5 mΩ 13 μΩ/Ω + 75 mΩ 13 μΩ/Ω + 0.75 Ω 18 μΩ/Ω + 8.3 Ω 53 μΩ/Ω + 0.20 kΩ 0.050 % + 0.24 kΩ 0.50 % + 0.24 MΩ	Agilent 3458A

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Voltage[3] – Generate			
(1 to 12) mV	(3 to 5) Hz (5 to 10) Hz 10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.25 % + 7.1 µV 0.085 % + 7.1 µV 0.015 % + 6.2 µV 0.037 % + 6.2 µV 0.15 % + 15 µV 0.78 % + 30 µV 0.78 % + 32 µV	Fluke 5560A
(12 to 120) mV	(3 to 5) Hz (5 to 10) Hz 10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.25 % + 8.6 µV 0.085 % + 8.6 µV 0.013 % + 7.1 µV 0.034 % + 12 µV 0.078 % + 50 µV 0.19 % + 39 µV 0.19 % + 63 µV	
120 mV to 1.2 V	(3 to 5) Hz (5 to 10) Hz (10 to 40) Hz 40.01 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.25 % + 90 µV 0.085 % + 79 µV 0.013 % + 16 µV 0.013 % + 16 µV 0.030 % + 29 µV 0.069 % + 73 µV 0.19 % + 0.15 mV 0.19 % + 0.36 mV	
(1.2 to 12) V	(3 to 5) Hz (5 to 10) Hz (10 to 40) Hz 40.01 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.25 % + 0.90 mV 0.085 % + 0.84 mV 0.013 % + 0.43 mV 0.013 % + 0.43 mV 0.030 % + 0.74 mV 0.069 % + 0.73 mV 0.19 % + 1.3 mV 0.19 % + 3.8 mV	
(12 to 120) V	(3 to 5) Hz (5 to 10) Hz (10 to 40) Hz 40.01 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.25 % + 9.7 mV 0.085 % + 8.5 mV 0.013 % + 3.2 mV 0.013 % + 3.2 mV 0.030 % + 6.7 mV 0.069 % + 8.8 mV 0.19 % + 22 mV	
(120 to 330) V	(3 to 5) Hz (5 to 10) Hz 10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.25 % + 78 mV 0.085 % + 76 mV 0.013 % + 16 mV 0.030 % + 32 mV 0.15 % + 65 mV	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Voltage[3] – Generate (cont)			
(330 to 1020) V	(3 to 5) Hz (5 to 10) Hz 10 Hz to 10 kHz	0.13 % + 95 mV 0.13 % + 85 mV 0.13 % + 85 mV	Fluke 5560A
(1 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 500 kHz to 1 MHz	0.055 % + 4.5 µV 0.021 % + 4.5 µV 0.011 % + 4.5 µV 0.037 % + 4.5 µV 0.085 % + 7.0 µV 0.11 % + 13 µV 0.17 % + 25 µV 0.34 % + 25 µV	Fluke 5700A
(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 500 kHz to 1 MHz	0.055 % + 5.1 µV 0.021 % + 5.2 µV 0.011 % + 4.2 µV 0.037 % + 5.1 µV 0.085 % + 7.0 µV 0.11 % + 12 µV 0.17 % + 25 µV 0.34 % + 25 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 500 kHz to 1 MHz	0.055 % + 13 µV 0.021 % + 8.0 µV 0.011 % + 8.0 µV 0.037 % + 8.0 µV 0.085 % + 25 µV 0.11 % + 25 µV 0.17 % + 35 µV 0.34 % + 80 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 500 kHz to 1 MHz	0.050 % + 130 µV 0.016 % + 55 µV 0.0080 % + 41 µV 0.012 % + 83 µV 0.025 % + 140 µV 0.043 % + 280 µV 0.11 % + 530 µV 0.22 % + 1.6 mV	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Voltage[3] – Generate (cont)			
(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	0.050 % + 1.3 mV 0.016 % + 560 µV 0.008 % + 440 µV 0.012 % + 860 µV 0.025 % + 1.3 mV 0.050 % + 3.3 mV 0.13 % + 7.5 mV 0.27 % + 20 mV	Fluke 5700A
(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	0.050 % + 13 mV 0.016 % + 5.8 mV 0.0080 % + 5.1 mV 0.022 % + 12 mV 0.050 % + 17 mV	
(220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.040 % + 95 mV 0.0080 % + 94 mV	
(0 to 202) mV	(10 to 45) Hz 45 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (100 to 500) kHz	0.080 % + 31 µV 0.016 % + 31 µV 0.020 % + 44 µV 0.10 % + 0.15 mV 0.40 % + 0.17 mV	Transmille 4010
(0.2 to 2.02) V	(10 to 45) Hz 45 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz 100 kHz to 1 MHz	0.050 % + 0.28 mV 0.016 % + 0.25 mV 0.021 % + 0.45 mV 0.065 % + 1.3 mV 0.30 % + 3.3 mV	
(2 to 20.2) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 100) kHz	0.050 % + 2.6 mV 0.016 % + 2.2 mV 0.021 % + 2.2 mV 0.060 % + 7.2 mV	
(20 to 202) V	(30 Hz to 45) Hz 45 Hz to 1 kHz (1 to 10) kHz (10 to 40) kHz (40 to 100) kHz	0.050 % + 28 mV 0.015 % + 23 mV 0.020 % + 80 mV 0.030 % + 0.14 V 0.20 % + 0.15 V	
(200 to 1020) V	(30 to 45) Hz 45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz	0.055 % + 0.23 V 0.020 % + 0.13 V 0.025 % + 0.17 V 0.030 % + 0.25 V	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Voltage[3] – Measure			
(1 to 10) mV	(1 to 40) Hz	0.30 µV/V + 4.1 µV	Agilent 3458A
	40 Hz to 1 kHz	0.20 µV/V + 3.0 µV	
	(1 to 20) kHz	0.30 µV/V + 3.1 µV	
	(20 to 50) kHz	1.0 µV/V + 3.1 µV	
	(50 to 100) kHz	5.0 µV/V + 9.1 µV	
	(100 to 300) kHz	40 µV/V + 66 µV	
	300 kHz to 1 MHz	40 µV/V + 66 µV	
(10 to 100) mV	(1 to 40) Hz	72 nV/V + 7.0 µV	
	40 Hz to 1 kHz	72 nV/V + 6.1 µV	
	(1 to 20) kHz	0.14 µV/V + 8.1 µV	
	(20 to 50) kHz	0.30 µV/V + 8.1 µV	
	(50 to 100) kHz	0.80 µV/V + 37 µV	
	(100 to 300) kHz	3.0 µV/V + 70 µV	
	300 kHz to 1 MHz	10 µV/V + 70 µV	
	(1 to 2) MHz	15 µV/V + 91 µV	
	(2 to 4) MHz	40 µV/V + 0.72 mV	
	(4 to 6) MHz	40 µV/V + 0.77 mV	
	(6 to 8) MHz	40 µV/V + 0.77 mV	
	(8 to 10) MHz	0.015 % + 2.3 mV	
100 mV to 1 V	(1 to 40) Hz	72 nV/V + 64 µV	
	40 Hz to 1 kHz	72 nV/V + 54 µV	
	(1 to 20) kHz	0.014 % + 72 µV	
	(20 to 50) kHz	0.030 % + 0.13 mV	
	(50 to 100) kHz	0.080 % + 0.21 mV	
	(100 to 300) kHz	0.30 % + 0.61 mV	
	300 kHz to 1 MHz	1.0 % + 1.7 mV	
	(1 to 2) MHz	1.5 % + 1.8 mV	
	(2 to 4) MHz	4.0 % + 7.2 mV	
	(4 to 6) MHz	4.0 % + 7.7 mV	
	(6 to 8) MHz	4.0 % + 7.7 mV	
	(8 to 10) MHz	15 % + 25 mV	
(1 to 10) V	(1 to 40) Hz	72 µV/V + 0.71 mV	
	40 Hz to 1 kHz	72 µV/V + 0.54 mV	
	(1 to 20) kHz	0.014 % + 0.71 mV	
	(20 to 50) kHz	0.030 % + 1.3 mV	
	(50 to 100) kHz	0.080 % + 1.6 mV	
	(100 to 300) kHz	0.30 % + 5.2 mV	
	300 kHz to 1 MHz	1.0 % + 16 mV	
(10 to 100) V	(1 to 40) Hz	0.020 % + 9.3 mV	
	40 Hz to 1 kHz	0.020 % + 8.6 mV	
	(1 to 20) kHz	0.020 % + 12 mV	
	(20 to 50) kHz	0.035 % + 14 mV	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Voltage[3] – Measure (cont)			
(10 to 100) V	(50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.12 % + 34 mV 0.40 % + 35 mV 1.5 % + 35 mV	Agilent 3458A
(100 to 700) V	(1 to 50) Hz 50 Hz to 1 kHz (1 to 10) kHz	0.040 % + 87 mV 0.040 % + 80 mV 0.060 % + 80 mV	
100 V to 15 kV	60 Hz	3.9 %	Tektronix P6015A with 1MΩ impedance oscilloscope
(0.5 to 5) kV (> 5 to 10) kV	60 Hz	0.14 % + 0.60 V 0.14 % + 29 V	Vitrek 4700
(> 10 to 20) kV (20 to 50) kV (50 to 70) kV	60 Hz	0.14 % + 29 V 0.14 % + 58 V 0.14 % + 0.12 kV	Vitrek 4700 + Vitrek HVL-100 Probe
100 V to 1 kV	400 Hz	0.46 % + 0.13 V	Vitrek 4700

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Current[3] – Generate			
(10 to 120) µA	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.025 % + 13 nA 0.025 % + 13 nA 0.025 % + 13 nA 0.15 % + 44 nA 0.49 % + 1.0 µA	Fluke 5560A
120 µA to 1.2 mA	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.025 % + 0.12 µA 0.025 % + 0.12 µA 0.025 % + 0.13 µA 0.15 % + 0.22 µA 0.49 % + 5.1 µA	
(1.2 to 12) mA	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.025 % + 1.2 µA 0.025 % + 1.2 µA 0.025 % + 1.2 µA 0.15 % + 1.6 µA 0.49 % + 10 µA	
(12 to 120) mA	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.025 % + 11 µA 0.025 % + 6.7 µA 0.025 % + 9.7 µA 0.15 % + 16 µA 0.49 % + 0.11 mA	
120 mA to 1.2 A	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.025 % + 0.11 mA 0.025 % + 70 µA 0.025 % + 0.10 mA 0.25 % + 0.33 mA 0.49 % + 0.38 mA	
(1.2 to 3.1) A	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.037 % + 0.54 mA 0.030 % + 0.37 mA 0.037 % + 0.38 mA 0.25 % + 0.78 mA	
(3.1 to 12) A	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.037 % + 1.2 mA 0.030 % + 0.89 mA 0.037 % + 1.3 mA 0.25 % + 2.0 mA	
(12 to 20) A	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	0.1 % + 10 mA 0.069 % + 8.4 mA 0.49 % + 49 mA	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Current[3] – Generate (cont)			
(20 to 30.2) A	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	0.1 % + 11 mA 0.069 % + 9.2 mA 0.49 % + 72 mA	Fluke 5560A
(> 20 to 50) A	(50 to 100) Hz (100 to 400) Hz	0.29 % + 0.11 A 0.79 % + 0.12 A	Fluke 5560A & Fluke 5500A/coil
(50 to 100) A	(50 to 100) Hz (100 to 400) Hz	0.29 % + 0.21 A 0.79 % + 0.21 A	
(100 to 500) A	(50 to 100) Hz (100 to 400) Hz	0.29 % + 0.91 A 0.79 % + 0.91 A	
(500 to 1000) A	(50 to 100) Hz (100 to 400) Hz	0.30 % + 1.9 A 0.80 % + 1.9 A	
(1000 to 1500) A	(50 to 100) Hz (100 to 400) Hz	0.31 % + 2.7 A 0.80 % + 2.7 A	
(0 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.070 % + 28 nA 0.035 % + 24 nA 0.014 % + 21 nA 0.060 % + 42 nA 0.16 % + 82 nA	Fluke 5700A
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	0.070 % + 140 nA 0.035 % + 170 nA 0.014 % + 140 nA 0.060 % + 420 nA 0.16 % + 810 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	0.070 % + 1.5 µA 0.035 % + 1.4 µA 0.014 % + 1.4 µA 0.060 % + 4.3 µA 0.16 % + 8.1 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	0.070 % + 1.4 µA 0.035 % + 1.4 µA 0.014 % + 1.4 µA 0.060 % + 42 µA 0.16 % + 81 µA	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Current[3] – Generate (cont)			
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.065 % + 140 µA 0.075 % + 160 µA 0.85 % + 210 µA	Fluke 5700A
(20 to 202) µA	(10 to 45) Hz 45 Hz to 1 kHz (1 to 10) kHz (10 to 30) kHz	0.20 % + 0.30 µA 0.070 % + 0.23 µA 0.80 % + 0.77 µA 1.6 % + 0.83 µA	Transmille 4010
(0.2 to 2.02) mA	(10 to 45) Hz 45 Hz to 1 kHz (1 to 10) kHz (10 to 30) kHz	0.20 % + 0.63 µA 0.060 % + 0.62 µA 0.50 % + 3.3 µA 1.0 % + 6.6 µA	
(2 to 20.2) mA	(10 to 45) Hz 45 Hz to 1 kHz (1 to 10) kHz (10 to 30) kHz	0.20 % + 4.0 µA 0.040 % + 3.4 µA 0.25 % + 4.2 µA 0.50 % + 5.0 µA	
(20 to 202) mA	(10 to 45) Hz 45 Hz to 1 kHz (1 to 10) kHz (10 to 30) kHz	0.20 % + 58 µA 0.040 % + 54 µA 0.50 % + 70 µA 0.70 % + 0.22 mA	
(0.2 to 2.02) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 30) kHz	0.20 % + 0.41 mA 0.060 % + 0.49 mA 0.50 % + 0.60 mA 0.60 % + 1.1 mA	
(2 to 30.0) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.080 % + 5.6 mA 0.30 % + 6.6 mA 0.60 % + 6.6 mA 3.0 % + 6.8 mA	
(> 20 to 50) A	(50 to 100) Hz (100 to 400) Hz	0.29 % + 0.11 A 0.79 % + 0.11 A	Transmille 4010 & Fluke 5500A/coil
(50 to 100) A	(50 to 100) Hz (100 to 400) Hz	0.29 % + 0.20 A 0.79 % + 0.20 A	
(100 to 500) A	(50 to 100) Hz (100 to 400) Hz	0.30 % + 1.0 A 0.80 % + 1.0 A	
(500 to 1000) A	(50 to 100) Hz (100 to 400) Hz	0.41 % + 2.0 A 0.85 % + 1.8 A	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Current[3] – Measure			
(10 to 100) µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 10) kHz	0.40 % + 44 nA 0.15 % + 44 nA 0.061 % + 44 nA 0.061 % + 44 nA 0.061 % + 44 nA	Agilent 3458A
100 µA to 1 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 10) kHz	0.40 % + 0.23 µA 0.15 % + 0.23 µA 0.061 % + 0.23 µA 0.031 % + 0.23 µA 0.061 % + 0.23 µA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 10) kHz	0.40 % + 2.8 µA 0.15 % + 2.8 µA 0.061 % + 2.8 µA 0.031 % + 2.8 µA 0.061 % + 2.8 µA	
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 10) kHz	0.40 % + 28 µA 0.15 % + 28 µA 0.061 % + 28 µA 0.031 % + 28 µA 0.061 % + 28 µA	
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 10) kHz	0.40 % + 0.29 mA 0.18 % + 0.29 mA 0.081 % + 0.29 mA 0.11 % + 0.29 mA 0.31 % + 0.29 mA	
(1 to 3) A	10 Hz to 1 kHz (1 to 5) kHz	0.14 % + 3.8 mA 2.3 % + 4.5 mA	Fluke 8846A
(3 to 10) A	10 Hz to 1 kHz (1 to 5) kHz	0.14 % + 9.4 mA 2.3 % + 9.7 mA	
(10 to 20) A	10 Hz to 400 Hz 400 Hz to 1 kHz	0.23 % + 18 mA 0.23 % + 38 mA	Agilent 3458A & 50A/50mV current shunt

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
Capacitance[3] – Generate			
(0 to 1.2) nF	100 Hz to 10 kHz	0.11 % + 2.5 pF	Fluke 5560A
(1.2 to 12) nF	150 Hz to 5 kHz	0.11 % + 10 pF	
(12 to 120) nF	200 Hz to 1.3 kHz	0.12 % + 78 pF	
120 pF to 1.2 µF	(2 to 310) Hz	0.12 % + 0.83 nF	
(1.2 to 12) µF	(0.5 to 250) Hz	0.12 % + 7.7 nF	
(12 to 120) µF	(0.5 to 40) Hz	0.14 % + 72 nF	
120 µF to 1.2 mF	(0.1 to 11) Hz	0.23 % + 1.4 µF	
(1.2 to 12) mF	(0.03 to 4) Hz	0.23 % + 11 µF	
(12 to 120) mF	(0.01 to 1.3) Hz	0.47 % + 0.10 mF	
(0.95 to 9.5) µF	1 kHz	0.70 % + 1.0 nF	Transmille 4010
(9.5 to 95) µF		0.70 % + 6.0 nF	
95 µF to 0.95 mF		0.70 % + 5.3 nF	
(0.95 to 9.5) mF		0.70 % + 6.0 µF	
(9.5 to 100) mF		0.70 % + 24 µF	
Fixed Points Capacitance			
1 nF	1 kHz	0.25 % + 0.61 pF	
2 nF		0.25 % + 42 pF	
5 nF		0.25 % + 32 pF	
10 nF		0.25 % + 6.0 pF	
100nF		0.25 % + 60 pF	
1 µF		0.40 % + 0.60 µF	
10 µF		0.60 % + 0.60 µF	
Inductance[3] – Generate			
(13 to 120) µH	1 kHz	0.19 % + 0.82 µH	Fluke 5560A
	550 Hz to 13 kHz	Add 0.25 %	
	490 Hz to 17 kHz	Add 1 %	
120 µH to 1.2 mH	1 kHz	0.11 % + 5.9 µH	
	330 Hz to 1.6 kHz	Add 0.25 %	
	260 Hz to 2.5 kHz	Add 1 %	
(1.2 to 12) mH	110 Hz	0.11 % + 59 µH	
(1.2001 to 3.3) mH	(0.5 to 800) Hz	Add 0.25 %	
	(0.5 to 980) Hz	Add 1 %	
(3.3 to 12) mH	(0.5 to 1000) Hz	Add 0.25 %	
	(0.5 to 1400) Hz	Add 1 %	

Parameter/Equipment	Range	CMC[2,5] (±)	Comments
Inductance[3] – Generate (cont)			
(12 to 120) mH	100 Hz	0.11 % + 0.12 mH	Fluke 5560A
(12.001 to 83) mH	(0.1 to 180) Hz	Add 0.25 %	
	(0.1 to 230) Hz	Add 1 %	
(83 to 120) mH	(0.1 to 320) Hz	Add 0.25 %	
	(0.1 to 1000) Hz	Add 1 %	
120 mH to 1.2 H	10 Hz	0.14 % + 1.0 mH	
(0.12001 to 0.65) H	(0.05 to 30) Hz	Add 0.25 %	
	(0.05 to 55) Hz	Add 1 %	
(0.65 to 1.2) H	(0.05 to 30) Hz	Add 0.25 %	
	(0.05 to 170) Hz	Add 1 %	
(1.2 to 12) H	3 Hz	0.19 % + 10 mH	
(1.2001 to 5.5) H	(0.01 to 8) Hz	Add 0.25 %	
	(0.01 to 16) Hz	Add 1 %	
(5.5 to 12) H	(0.01 to 19) Hz	Add 0.25 %	
	(0.01 to 37) Hz	Add 1 %	
(12 to 120) H	2 Hz	0.23 % + 0.10 H	
(12.001 to 30) H	(0.005 to 4) Hz	Add 0.25 %	
	(0.002 to 9) Hz	Add 1 %	
(30 to 120) H	(0.005 to 7) Hz	Add 0.25 %	
	(0.002 to 14) Hz	Add 1 %	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
Electrical Simulation of Thermocouple Indicating Systems[3] –			
Type B	(600 to 800) °C	0.43 °C	Fluke 5560A
	(800 to 1000) °C	0.33 °C	
	(1000 to 1550) °C	0.30 °C	
	(1550 to 1820) °C	0.33 °C	
Type C	(0 to 150) °C	0.25 °C	
	(150 to 650) °C	0.20 °C	
	(650 to 1000) °C	0.26 °C	
	(1000 to 1800) °C	0.44 °C	
	(1800 to 2316) °C	0.78 °C	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
Electrical Simulation of Thermocouple Indicating Systems[3] – (cont)			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.39 °C 0.15 °C 0.11 °C 0.16 °C 0.22 °C	Fluke 5560A
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.28 °C 0.13 °C 0.11 °C 0.20 °C 0.34 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.28 °C 0.13 °C 0.11 °C 0.20 °C 0.34 °C	
Type L	(-200 to -100) °C (-100 to 800) °C (800 to 900) °C	0.30 °C 0.19 °C 0.11 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.40 °C 0.22 °C 0.19 °C 0.18 °C 0.27 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.41 °C 0.30 °C 0.31 °C 0.40 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.41 °C 0.30 °C 0.31 °C 0.40 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.59 °C 0.20 °C 0.13 °C 0.11 °C	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
Electrical Simulation of Thermocouple Indicating Systems[3] – (cont)			
Type U	(-200 to 0) °C (0 to 600) °C	0.40 °C 0.11 °C	Transmille 4010
Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.44 °C 0.34 °C 0.30 °C 0.33 °C	
Type C	(0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.30 °C 0.26 °C 0.31 °C 0.50 °C 0.84 °C	
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.50 °C 0.16 °C 0.14 °C 0.16 °C 0.21 °C	
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.27 °C 0.16 °C 0.17 °C 0.17 °C 0.23 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1370) °C	0.33 °C 0.18 °C 0.16 °C 0.26 °C 0.40 °C	
Type L	(-200 to -100) °C (-100 to 800) °C (800 to 900) °C	0.37 °C 0.26 °C 0.17 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.40 °C 0.22 °C 0.19 °C 0.18 °C 0.27 °C	

Parameter/Equipment	Range	CMC[2,5] (±)	Comments
Electrical Simulation of Thermocouple Indicating Systems[3] – (cont)			
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.57 °C 0.35 °C 0.33 °C 0.40 °C	Transmille 4010
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.47 °C 0.36 °C 0.37 °C 0.46 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.63 °C 0.24 °C 0.16 °C 0.14 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.56 °C 0.27 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of RTD Indicators & Indicating Systems[3] –			
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	0.050 °C 0.050 °C 0.070 °C 0.090 °C 0.10 °C 0.12 °C 0.23 °C	Fluke 5560A
Pt 3926, 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	0.050 °C 0.050 °C 0.080 °C 0.090 °C 0.10 °C 0.12 °C	
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.25 °C 0.040 °C 0.050 °C 0.060 °C 0.070 °C 0.080 °C 0.090 °C 0.10 °C 0.23 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of RTD Indicators & Indicating Systems[3] – (cont)			
Pt 385, 200 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.040 °C 0.040 °C 0.040 °C 0.050 °C 0.12 °C 0.13 °C 0.14 °C 0.16 °C	Fluke 5560A
Pt 385, 500 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.040 °C 0.050 °C 0.050 °C 0.060 °C 0.080 °C 0.080 °C 0.090 °C 0.11 °C	
Pt 385, 1000 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.030 °C 0.030 °C 0.040 °C 0.050 °C 0.060 °C 0.070 °C 0.070 °C 0.23 °C	
PtNi 385, 120 Ω	(-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.080 °C 0.080 °C 0.14 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.30 °C	
Pt 25, 25 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	0.50 °C 0.50 °C 0.60 °C 0.60 °C 0.60 °C 0.60 °C 0.60 °C	Transmille 4010

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of RTD Indicators & Indicating Systems[3]– (cont)			
Pt 100, 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	0.13 °C 0.13 °C 0.55 °C 0.55 °C 0.55 °C 0.55 °C 0.55 °C	Transmille 4010
Pt 250, 250 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 800) °C	0.25 °C 0.25 °C 0.30 °C 0.30 °C 0.30 °C 0.30 °C 0.30 °C	
Pt 25, 500 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	0.10 °C 0.10 °C 0.90 °C 0.90 °C 0.90 °C 0.90 °C 0.90 °C	
Pt 100, 1000 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 800) °C	0.080 °C 0.080 °C 0.45 °C 0.45 °C 0.45 °C 0.45 °C 0.45 °C	
Fixed Point Temperature (4 Wire) (-100 to 800) °C	-100 °C 0 °C 30 °C 60 °C 100 °C 200 °C 400 °C 800 °C	0.011 °C 0.002 °C 0.004 °C 0.008 °C 0.011 °C 0.022 °C 0.041 °C 0.08 °C	

Parameter/Equipment	Range	CMC[2,5] (±)	Comments
Oscilloscope[3] –			
Square Wave Amplitude:	V_{p-p} 1 mV to 6.5 V	0.23 % + 41 µV	Fluke 5560A
50 Ω Load	≤ 1 kHz	0.23 % + 41 µV	
	> 1 kHz	0.090 % + 41 µV	
1 MΩ Load	V_{p-p} 1 mV to 120 V	0.090 % + 41 µV	
	≤ 1 kHz		
	> 1 kHz		
DC Signal Output:	V_{dc} (0 to 6.5) V	0.23 % + 41 µV	
50 Ω Load	V_{dc} (0 to 120) V	0.050 % + 41 µV	
1 MΩ Load			
Leveled Sine Wave Amplitude:	50 kHz (reference)	1.9 % + 0.31 mV	
5 mV_{p-p} to 5.5 V_{p-p}			
Flatness:			
Relative to 50 kHz	50 kHz to 100 MHz	1.4 % + 0.10 mV	
5 mV_{p-p} to 5.5 V_{p-p}	(100 to 300) MHz	2.8 % + 0.12 mV	
	(300 to 600) MHz	2.8 % + 0.12 mV	
	(600 to 1100) MHz	3.7 % + 0.12 mV	
5 mV_{p-p} to 3.5 V_{p-p}	(600 to 1100) MHz	3.7 % + 0.12 mV	
Time Marker:	(5 to 1) s	1.3 ms/s	
50 Ω Load	(500 to 1) ms	8.2 µs/s	
	(500 to 1) µs	0.82 ns/s	
	(500 to 1) ns	0.82 ps/s	
Edge-Rise Time	> 50 mV to 2.5V		
	990 Hz to 1 MHz	175 pS	
	> 1 to 5 MHz	175 pS	
	> 5 to 10 MHz	175 pS	
Square Wave Amplitude:			Transmille 4010 with SCP 600 option
1 MΩ Load	V_{p-p} 1 mV to 300 V at 1 kHz	0.25 % + 38 µV	
DC Signal Output:			
1 MΩ Load	V_{dc} (0 to 300) V	0.01 % + 0.84 µV	

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Oscilloscope[3] – (cont)			
Leveled Sine Wave Amplitude: 600 mV_{p-}	50 kHz reference (> 5 to 600) MHz	0.26 % + 69 µV 0.26 % + 69 µV	Transmille 4010 with SCP 600 option
Timebase:			
50 Ω Load	(5 to 1) s (500 to 1) ms (500 to 100) µs (50 to 1) µs (500 to 2) ns	0.010 % + 0.58 ms 0.010 % + 58 µs 0.010 % + 5.8 µs 0.010 % + 0.58 ns 0.010 % + 0.58 ps	
Edge-Rise Time	1 kHz	1.5 nS	

Parameter/Range	Range	CMC[2, 4, 5] (±)	Comments
Phase – Measuring Equipment[3]	(10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.11° 0.26° 0.50° 2.5° 5.0° 10°	Fluke 5560A
	(40 to 60) Hz (60 to 100) Hz (100 to 400) Hz	0.11° 0.26° 0.50°	Transmille 4010
DC Power[3]			
	10 µW to 100 mW > 100 mW to 100 W > 100 W to 1 kW > (1 to 30) kW	0.012 % 0.016 % 0.031 % 0.10 %	Fluke 5560A
	40µW to 2 W (> 2 to 200) W > 200W to 30kW	0.030 % 0.014 % 0.031 %	Transmille 4010

Parameter/Range	Range	CMC[2, 4, 5] (±)	Comments
AC Power[3] –			
PF = 1			
(10 to 65) Hz	10 µW to 100 mW > 100 mW to 100 W > 100 W to 1 kW > (1 to 30) kW	0.030 % 0.030 % 0.035 % 0.077 %	Fluke 5560A
(65 to 500) Hz	10 µW to 100 mW > 100 mW to 100 W > 100 W to 1 kW > (1 to 30) kW	0.031 0.030 % 0.035 % 0.077 %	
500 Hz to 1 kHz	10 µW to 100 mW > 100 mW to 100 W > 100 W to 1 kW > (1 to 30) kW	0.030 % 0.030 % 0.035 % 0.077 %	
(> 1 to 5) kHz	10 µW to 100 mW > 100 mW to 100 W > 100 W to 1 kW > (1 to 30) kW	0.031 % 0.031 % 0.036 % 0.25 %	
(> 5 to 10) kHz	10 µW to 100 mW > 100 mW to 100 W > 100 W to 1 kW	0.15 % 0.25 % 0.25 %	
PF = 1			Transmille 4010
(40 to 60) Hz	40 µW to 2 W (> 2 to 200) W > 200W to 30kW	0.21 % 0.21 % 0.20 %	
(> 60 to 100) Hz	40µW to 2 W (> 2 to 200) W > 200W to 30kW	0.079 % 0.088 % 0.10 %	
(> 100 to 400) Hz	40µW to 2 W (> 2 to 200) W > 200W to 30kW	0.079 % 0.088 % 0.31 %	

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
RF Absolute Power – Measure			
(20 to 44) dBm	10 MHz to 4 GHz	0.73 dB	30 dB attenuator with HP8482B
(-30 to 20) dBm	0.1 MHz to 4 GHz	0.16 dB	HP437B & HP 8482A
(-20 to -70) dBm	10 MHz to 8 GHz (> 8 to 10) GHz (> 10 to 14) GHz (> 14 to 18) GHz	0.11 dB 0.13 dB 0.14 dB 0.16 dB	HP437B & HP8481D HP437B & HP8481D HP437B & HP8481D HP437B & HP8481D
(10 to -10) dBm	10 MHz to 8 GHz (> 8 to 10) GHz (> 10 to 14) GHz (> 14 to 18) GHz	0.13 dB 0.17 dB 0.17 dB 0.21 dB	HP437B & HP8481A HP437B & HP8481A HP437B & HP8481A HP437B & HP8481A

IV. Mechanical

Parameter/Equipment	Range	CMC[2] (±)	Comments
Pressure[3] – Generate & Measure			
Pneumatic	(-14 to 300) PSI	0.076 PSI	Druck DPI610
	(0 to 2000) PSI	0.02 % + 0.34 PSI	
Hydraulic	(> 2000 to 10,000) PSI	0.1 % + 0.69 PSI	Crystal Pressure 10KPSIXP2I & Additel ADT936

V. Thermodynamics

Parameter/Range	Range	CMC[2, 4, 5] (±)	Comments
Temperature Generation –			
(5 to 60) °C	(5 to 60) °C	0.36 °C	Sansel HCAL 1102U (Chamber)
(-25 to 140) °C	(-25 to 140) °C	0.26 °C	Kaye LTR-140 (Dry Well)
Relative Humidity Generation –			
(5 to 95) % RH	(5 to 95) % RH	0.90 %	Sansel HCAL 1102U (Chamber)
Temperature Measurement[3] –			
(5 to 60) °C	(5 to 60) °C	0.51 °C	Sansel HTD-200
Relative Humidity Measurement[3] –			
(5 to 95) % RH	(5 to 95) % RH	1.1 %	Sansel HTD-200

VI. Time & Frequency

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Frequency & Period – Measuring Equipment	10 MHz	0.035 mHz	Brandywine Communication GPS time/frequency system
	(0.01 to 119.99) Hz	3.0 pHz/Hz + 5.8 mHz	Fluke 5560A
	(120.0 to 1199.9) Hz (1.200 to 11.999) kHz (12.00 to 119.99) kHz (120.0 to 1199.9) kHz (1.200 to 2.000) MHz (0.05 to 100) MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	3.0 pHz/Hz + 58 mHz 3.0 pHz/Hz + 0.58 Hz 3.0 pHz/Hz + 5.8 Hz 3.0 pHz/Hz + 58 Hz 3.0 pHz/Hz + 0.58 kHz 3.0 pHz/Hz + 5.8 kHz 3.0 pHz/Hz + 5.8 kHz 3.0 pHz/Hz + 5.8 kHz 3.0 pHz/Hz + 58 kHz	(With 10 MHz GPS external clock)

VII. EMC

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
ESD Simulators –			EN 61000-4-2
Contact Voltage (Positive & Negative)	(2 to 8) kV ± 5 % (10 to 30) kV ± 5 %	0.35 % 4.4 %	Tektronix DPO7254 with Noiseken Target 06-00067A, Noiseken Attenuator 00-00010A, Tektronix attenuator 011-0053-03, Tektronix probe P6015A, Brandenburg HV meter 139D
Rise/Fall Time	(0.6 to 1) ns	1.2 %	
Peak Current	(7.5 to 30) A ± 15 %	2.3 %	
30 ns Current	(4 to 16) A ± 30 %	2.2 %	
60 ns Current	(2 to 8) A ± 30 %	3.0 %	

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
EFT/Burst Generator[3] – 50 Ω / 1 kΩ Load; 100 kHz / 5 kHz			EN 61000-4-4
Voltage (Positive & Negative)	(0.25 to 4.4) kV	4.3 %	Tektronix DPO7254 with Noiseken attenuators AT-810 & AT-811
Rise/Fall Time	5 ns ± 30 %	3.6 %	
Burst Duration	50 ns ± 30 %	3.6 %	
Impulse Duration			
5 kHz	20 ms ± 20 %	3.7 %	
100 kHz	1 ms ± 20 %	3.7 %	
Burst Period (5/100) kHz	300 ms ± 20 %	3.7 %	
Repetition Cycle			
5 kHz	200 µs ± 20 %	3.7 %	
100 kHz	10 µs ± 20 %	3.7 %	
Surge Generator[3] –			EN 61000-4-5
Open Circuit – Voltage (Positive & Negative)	(0.5 to 4.4) kV	2.6 %	Tektronix DPO7254 with Pintek DP-100, Pearson 110A, Tektronix 011-0060-02
Rise/Fall Time	1.2 µs	2.7 %	
Duration	50 µs	2.6 %	
Short Circuit – Current (Positive & Negative)	(41.67 to 2200) A	1.3 %	
Front Time	8 µs	1.3 %	
Duration	20 µs	1.3 %	

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Ring Wave Generator[3] –			EN 61000-4-12
Open Circuit – Voltage (Positive & Negative)	(0.5 to 4) kV	5.9 %	Tektronix DPO7254 with Pintek DP-100, Pearson 110A, Tektronix 011-0060-02
Rise/Fall Time	1 µs	6.0 %	
Duration	10 µs	6.0 %	
Short Circuit – Current (Positive * Negative)	(200 & 500) A	5.8 %	
Rise/Fall Time	8 µs	6.0 %	
PQT[3] –			EN 61000-4-11
Testing Voltage at 220 V With no Loading –			
Dip Voltage	(0 to 70) %	2.7 %	Tektronix DPO7254 with Pintek DP-100
Duration (1 to 100) cycles	16.6 ms to 1.666 s	2.6 %	
Phase Angle	(0 to 360)°	2.7 %	
Rise/Fall Time	2 cycles, 30 °	2.7 %	

[1] This laboratory offers commercial and field calibration services.

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

[3] Field calibration service is available for this calibration. 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] Unless otherwise noted, in the statement of CMC, percent refers to percent of reading.

[5] 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 are expressed as either a specific value that covers the full range or as a fraction/percent of the reading plus a fixed floor specification.

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

[7] 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.