SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017,
ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3-2006

TRESCAL, INC.
554 NW 77th St
Boca Raton, FL 33487
Deborah McLaren Phone: 561 999 1896

CALIBRATION

Valid To: November 30, 2026 Certificate Number: 1877.02

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, 7]:

I. Dimensional

Parameter/Equipment	Range	CMC[2] (±)	Comments
Micrometers[3]			
Spindle Linearity	Up to 48 in	30 µin + 5.2 µin/in	Gage blocks
Length Indicators[3] (Drop, Test, LVDTs)	Up to 1 in	74 µin	Starrett 716 dial indicator calibrator
Height Gages[3]	Up to 24 in	290 µin + 1.5 µin/in	Gage blocks, surface plate
Calipers[3]			
Outside Diameter	Up to 48 in	30 µin + 5.2 µin/in	Gage blocks
Step & Depth		31 µin + 5.2 µin/in	
Length & Plain Diameter (Length Standards, Cylindrical Plugs & Pins, Feeler Gages)	Up to 4 in	11 µin + 4.3 µin/in	Trimos ULM

Parameter/Equipment	Range	CMC[2] (±)	Comments
Thread Gages			
Major Diameter	Up to 4 in	11 µin + 4.3 µin/in	Trimos ULM
60 ° Pitch Diameter	Up to 4 in (4.5 to 80 TPI)	75 µin	Trimos ULM, thread wire set

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4, 5, 6] (±)	Comments
DC Voltage – Generate[3]	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (330 to 1000) V	0.8 µV + 16 nV/mV 17 µV + 5 µV/V 88 µV + 8 µV/V 0.56 mV + 14 µV/V 2.7 mV + 14 µV/V	Fluke 5522A
DC Voltage – Measure	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	0.33 µV + 17 µV/V 0.52 µV + 8 µV/V 8.8 µV + 8.1 µV/V 35 µV + 10 µV/V 1.2 mV + 11 µV/V	Agilent 3458A
DC High Voltage – Measure	(1 to 20) kV (20 to 35) kV (35 to 40) kV	2.3 % 1.2 % 2.3 %	Fluke 80K-40, Agilent 34401A
DC Current – Generate[3]	(0 to 330) µA 330 µA to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3.0) A (3 to 11) A (11 to 20.5) A	16 nA + 0.12 nA/µA 41 nA + 80 nA/mA 0.21 µA + 80 nA/mA 2.1 µA + 80 nA/mA 33 µA + 0.16 mA/A 0.37 mA + 0.13 mA/A 0.49 mA + 0.39 mA/A 9.4 mA + 0.8 mA/A	Fluke 5522A
DC Clamp Meters	(10 to 16.5) A (16.5 to 150) A (150 to 1025) A	50 mA + 6.5 mA/A 0.18 A + 3.4 mA/A 0.83 A + 3.3 mA/A	Fluke 5522A w/ 5500 coil

Parameter/Equipment	Range	CMC[2, 4, 5, 6] (±)	Comments
DC Current – Measure	(0 to 100) nA (0.1 to 1) µA (1 to 10) µA (10 to 100) □A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 2) A (2 to 20) A (20 to 30) A (30 to 200) A (200 to 400) A (400 to 1000) A	41 pA + 89 µA/A 70 pA + 21 µA/A 0.7 nA + 18 µA/A 5.8 nA + 9.2 µA/A 58 nA + 9.7 µA/A 0.58 µA + 8 µA/A 5.8 µA + 17 µA/A 59 µA + 81 µA/A 30 µA + 0.17 mA/A 3.9 mA + 0.26 mA/A 0.0058 % 0.0057 % 0.0055 % 0.0065 %	Agilent 3458A Fluke 8508A Agilent 3458A
DC Resistance – Generate	(0 to 10.9999) Ω (11 to 32.9999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω (330 to 1099.999) Ω (1.1 to 3.299 999) kΩ (3.3 to 10.999 99) kΩ (11 to 32.999 99) kΩ (33 to 109.9999) kΩ (110 to 329.9999) kΩ (330 to 1099.999) kΩ (1.1 to 3.299 999) MΩ (3.3 to 10.999 99) MΩ (11 to 32.999 99) MΩ (33 to 109.9999) MΩ (110 to 329.9999) MΩ (330 to 1100) MΩ	1.2 mΩ + 24 µΩ/Ω 1.5 mΩ + 24 µΩ/Ω 1.9 mΩ + 22 µΩ/Ω 4.1 mΩ + 22 µΩ/Ω 9.1 mΩ + 22 µΩ/Ω 41 mΩ + 22 µΩ/Ω 92 mΩ + 22 µΩ/Ω 0.41 Ω + 22 µΩ/Ω 0.9 Ω + 22 µΩ/Ω 8.4 Ω + 26 µΩ/Ω 14 Ω + 26 µΩ/Ω 93 Ω + 48 µΩ/Ω 0.4 kΩ + 0.1 mΩ/Ω 4.4 kΩ + 0.2 mΩ/Ω 16 kΩ + 0.4 mΩ/Ω 0.35 MΩ + 2.4 mΩ/Ω 4.4 MΩ + 12 mΩ/Ω	Fluke 5522A
DC Resistance – Measure	(0 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ (1 to 2) GΩ (2 to 20) GΩ	55 µΩ + 15 µΩ/Ω 0.52 mΩ + 13 µΩ/Ω 0.53 mΩ + 10 µΩ/Ω 5.3 mΩ + 10 µΩ/Ω 53 mΩ + 11 µΩ/Ω 2.3 Ω + 17 µΩ/Ω 0.1 kΩ + 55 µΩ/Ω 1 kΩ + 0.52 mΩ/Ω 10 kΩ + 5.1 mΩ/Ω 1.2 MΩ + 1.4 mΩ/Ω 12 MΩ + 1.4 mΩ/Ω	Agilent 3458A Fluke 8508A

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Electrical Calibration of Thermocouple Generate & Measure –			
Type E	(-200 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.39 °C 0.13 °C 0.12 °C 0.13 °C 0.17 °C	Fluke 5522A
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 0.13 °C 0.12 °C 0.14 °C 0.18 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.26 °C 0.15 °C 0.13 °C 0.21 °C 0.31 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.31 °C 0.18 °C 0.15 °C 0.15 °C 0.21 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.44 °C 0.28 °C 0.26 °C 0.31 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.37 °C 0.28 °C 0.29 °C 0.36 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.49 °C 0.21 °C 0.15 °C 0.14 °C	

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Electrical Simulation of RTD Indicators[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	0.057 °C 0.056 °C 0.068 °C 0.081 °C 0.088 °C 0.10 °C 0.19 °C	Fluke 5522A
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	0.051 °C 0.051 °C 0.051 °C 0.057 °C 0.10 °C 0.11 °C 0.12 °C 0.13 °C	
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	0.051 °C 0.056 °C 0.056 °C 0.062 °C 0.074 °C 0.074 °C 0.081 °C 0.095 °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	0.047 °C 0.047 °C 0.051 °C 0.057 °C 0.062 °C 0.068 °C 0.068 °C 0.18 °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	0.20 °C 0.051 °C 0.056 °C 0.062 °C 0.068 °C 0.074 °C 0.081 °C 0.041 °C 0.18 °C	

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Electrical Simulation of RTD Indicators[3] – (cont)			
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	0.056 °C 0.056 °C 0.068 °C 0.081 °C 0.088 °C 0.10 °C	Fluke 5522A
PtNi 385, 120 Ω	(-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.062 °C 0.062 °C 0.11 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.23 °C	

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Voltage – Generate[3]			
(1 to 33) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 200) kHz (200 to 500) kHz	5.5 µV + 0.64 µV/mV 5 µV + 0.12 µV/mV 5 µV + 0.16 µV/mV 5.6 µV + 0.8 µV/mV 12 µV + 2.8 µV/mV 47 µV + 6.4 µV/mV 47 µV + 6.4 µV/mV	Fluke 5522A
(33 to 330) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 200) kHz (200 to 500) kHz	14 µV + 0.24 µV/mV 24 µV + 87 nV/mV 11 µV + 0.13 µV/mV 35 µV + 0.28 µV/mV 47 µV + 0.64 µV/mV 0.11 mV + 1.6 µV/mV 0.11 mV + 1.6 µV/mV	
330 mV to 3.3 V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 200) kHz (200 to 500) kHz	0.12 mV + 0.24 mV/V 88 µV + 0.12 mV/V 99 µV + 0.15 mV/V 0.12 mV + 0.24 mV/V 0.29 mV + 0.56 mV/V 1.1 mV + 1.9 mV/V 1.1 mV + 1.9 mV/V	

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Voltage – Generate[3] (cont)			
(3.3 to 33) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	1.3 mV + 0.24 mV/V 0.94 mV + 0.12 mV/V 1.6 mV + 0.18 mV/V 1.4 mV + 0.28 mV/V 3.7 mV + 0.72 mV/V	Fluke 5522A
(33 to 330) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	6.8 mV + 0.15 mV/V 10 mV + 0.16 mV/V 12 mV + 0.2 mV/V 13 mV + 0.24 mV/V 93 mV + 1.6 mV/V	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	87 mV + 0.24 mV/V 74 mV + 0.2 mV/V 88 mV + 0.24 mV/V	
AC Voltage[3] – Measure			
Up 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	6.1 µV + 0.0003 mV/mV 4.1 µV + 0.0002 mV/mV 4.2 µV + 0.0003 mV/mV 4.9 µV + 0.001 mV/mV 9 µV + 0.005 mV/mV 45 µV + 0.04 mV/mV	Agilent 3458A
(0.1 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 (0.3 to 1) MHz (1 to 2) MHz	12 µV + 0.000 07 mV/mV 2.7 µV + 0.000 07 mV/mV 11 µV + 0.000 14 mV/mV 0.12 µV + 0.0003 mV/mV 17 µV + 0.0008 mV/mV 47 µV mV + 0.003 mV/mV 0.12 mV + 0.01 mV/mV 3.8 mV + 0.01 mV/mV	
(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 (0.3 to 1) MHz (1 to 2) MHz	0.12 mV + 0.000 07 V/V 0.1 mV + 0.000 07 V/V 0.11 mV + 0.000 14 V/V 0.12 mV + 0.0003 V/V 0.17 mV + 0.0008 V/V 0.47 mV + 0.003 V/V 1.2 mV + 0.010 V/V 38 mV + 0.015 V/V	

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Voltage[3] – Measure (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 (0.3 to 1) MHz (1 to 2) MHz	1.2 mV + 0.000 07 V/V 1 mV + 0.000 07 V/V 1 mV + 0.000 14 V/V 1.2 mV + 0.0003 V/V 1.7 mV + 0.0008 V/V 4.7 mV + 0.003 V/V 12 mV + 0.01 V/V 0.38 V + 0.015 V/V	Agilent 3458A
(100 to 1000) 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 (0.3 to 1) MHz (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	13 mV + 0.0002 V/V 11 mV + 0.0002 V/V 11 mV + 0.0002 V/V 13 mV + 0.000 35 V/V 21 mV + 0.0012 V/V 57 mV + 0.004 V/V 0.17 V + 0.015 V/V 98 mV + 0.0004 V/V 84 mV + 0.0004 V/V 98 mV V + 0.0006 V/V 0.14 V + 0.0012 V/V 0.27 V + 0.003 V/V	
AC High Voltage – Measure	(1 to 40) kV	5.8 %	Fluke 80K-40, Agilent 34401A

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Current – Generate[3]			
(29 to 329.99) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.13 µA + 1.6 nA/µA 0.12 µA + 1.2 nA/µA 0.11 µA + 1 nA/µA 0.19 µA + 2.4 nA/µA 0.35 µA + 6.4 nA/µA 0.70 µA + 13 nA/µA	Fluke 5522A
330 µA to 3.2999 mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.65 µA + 1.6 µA/mA 0.45 µA + 1 µA/mA 0.39 µA + 0.8 µA/mA 0.69 µA + 1.6 µA/mA 2.9 µA + 1.6 µA/mA 3.4 µA + 8 µA/mA	
(3.3 to 32.999) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	6.4 µA + 1.4 µA/mA 4 µA + 0.72 µA/mA 2.7 µA + 0.32 µA/mA 3.7 µA + 0.64 µA/mA 7.7 + 1.6 µA/mA 14 µA + 3.2 µA/mA	
(33 to 329.99) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	65 µA + 1.4 µA/mA 42 µA + 0.72 µA/mA 29 µA + 0.31 µA/mA 68 µA + 0.8 µA/mA 0.13 mA + 1.6 µA/mA 0.27 mA + 3.2 µA/mA	
330 mA to 1.099 99 A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.56 mA + 1.4 mA/A 0.22 mA + 0.4 mA/A 2.4 mA + 4.8 mA/A 11 mA + 20 mA/A	
(1.1 to 2.999 99) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.7 mA + 1.4 mA/A 0.61 mA + 0.48 mA/A 6.1 mA + 4.8 mA/A 26 mA + 20 mA/A	
(3 to 10.9999) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	3.1 mA + 0.48 mA/A 4 mA + 0.8 mA/A 74 mA + 24 mA/A	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	15 mA + 0.96 mA/A 17 mA + 1.2 mA/A 0.27 A + 24 mA/A	

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Current – Generate[3] (cont)			
Toroidal			
(10 to 16.5) A (16.5 to 150) A (150 to 1025) A	(45 to 65) Hz	26 mA + 2.1 mA/A 50 mA + 1.9 mA/A 0.34 A + 1.9 mA/A	Fluke 5522A w/ 5500coil
(10 to 16.5) A (16.5 to 150) A (150 to 1025) A	(65 to 440) Hz	60 mA + 6 mA/A 0.11 A + 5.3 mA/A 0.86 A + 5.3 mA/A	
Non-Toroidal			
(10 to 16.5) A (16.5 to 150) A (150 to 1025) A	(45 to 65) Hz	60 mA + 3.8 mA/A 0.23 A + 3.7 mA/A 1.2 A + 3.7 mA/A	
(10 to 16.5) A (16.5 to 150) A (150 to 1025) A	(65 to 440) Hz	90 mA + 7.2 mA/A 0.28 A + 6.7 mA/A 1.6 A + 6.7 mA/A	
AC Current[3] – Measure			
(5 to 100) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 5 kHz	57 nA + 4 mA/A 45 nA + 1.5 mA/A 40 nA + 0.64 mA/A	Agilent 3458A
(0.1 to 1) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.43 µA + 0.0041 mA/mA 0.31 µA + 0.0016 mA/mA 0.26 µA + 0.000 67 mA/mA 0.25 µA + 0.000 37 mA/mA 0.26 µA + 0.000 67 mA/mA 0.63 µA + 0.0042 mA/mA 1.8 µA + 0.0056 mA/mA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	2.4 µA + 0.0041 mA/mA 2.3 µA + 0.0016 mA/mA 2.3 µA + 0.000 67 mA/mA 2.3 µA + 0.000 37 mA/mA 2.3 µA + 0.000 67 mA/mA 4.5 µA + 0.0041 mA/mA 16 µA + 0.0056 mA/mA	

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Current[3] – Measure (cont)			
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	42 µA + 0.004 mA/mA 30 µA + 0.0015 mA/mA 25 µA + 0.0006 mA/mA 24 µA + 0.0003 mA/mA 25 µA + 0.0006 mA/mA 62 µA + 0.004 mA/mA 0.18 mA + 0.0055 mA/mA	Agilent 3458A
(0.1 to 1) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz (5 to 20) kHz (20 to 50) kHz	0.42 mA + 0.0041 A/A 0.3 mA + 0.0017 A/A 0.26 mA + 0.0009 A/A 0.27 mA + 0.0011 A/A 0.37 mA + 0.0031 A/A 0.92 mA + 0.01 A/A	
(1 to 2) A	10 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.42 mA + 0.5 mA/A 0.3 mA + 0.66 mA/A 0.96 mA + 2.1 mA/A	
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	2.4 mA + 0.71 mA/A 2.7 mA + 1.9 mA/A	Fluke 8508A

Parameter/Equipment	Range	CMC[2, 4, 5, 6] (±)	Comments
DC Power[3] – Generate			
	Up to 1020 V		Fluke 5522A
Up to 330 µA	Up to 337 mW	0.017 %	
Up to 3.3 mA	(0.337 to 3.366) W	0.021 %	
Up to 33 mA	(3.366 to 33.66) W	0.0093 %	
Up to 330 mA	(33.66 to 336.6) W	0.0093 %	
Up to 1.1 A	(0.3366 to 1.122) kW	0.019 %	
Up to 3 A	(1.122 to 3.06) kW	0.043 %	
Up to 11 A	(3.06 to 11.22) kW	0.044 %	
Up to 20.5 A	(11.22 to 20.91) kW	0.13 %	

Parameter/Range	Frequency		CMC[2, 4, 5] (±)		Comments	
AC Power[3] – Generate	See Table below		See Table below		Fluke 5522A	
(45 to 65) Hz	(3.366 to 33.66) W	(33.66 to 336.6) W	(0.3366 to 1.122) kW	(1.122 to 3.06) kW	(3.06 to 11.22) kW	(11.22 to 20.9) kW
Ø 0 ° PF=1.000	0.052 %		0.068 %	0.076 %	0.083 %	0.17 %
Ø 10 ° PF=0.985	0.06 %		0.075 %	0.082 %	0.088 %	0.18 %
Ø 20 ° PF=0.940	0.082 %		0.093 %	0.099 %	0.1 %	0.18 %
Ø 30 ° PF=0.866	0.11 %		0.12 %	0.13 %		0.2 %
Ø 40 ° PF=0.766	0.16 %			0.17 %		0.23 %
Ø 50 ° PF=0.643	0.21 %		0.22 %			0.27 %
Ø 60 ° PF=0.500	0.31 %					0.35 %
Ø 70 ° PF=0.342	0.48 %			0.49 %		0.51 %
Ø 80 ° PF=0.174	0.99 %					1 %
(65 to 500) Hz	(33.66 to 336.6) W	(0.3366 to 1.122) kW	(1.122 to 3.06) kW	(3.06 to 11.22) kW	(11.22 to 20.9) kW	
Ø 0 ° PF=1.000	0.052 %	0.068 %	0.076 %	0.12 %	0.21 %	
Ø 10 ° PF=0.985	0.094 %	0.1 %	0.11 %	0.14 %	0.22 %	

Parameter/Range	Frequency		CMC[2, 4, 5] (±)		Comments	
AC Power[3] – Generate	See Table below		See Table below		Fluke 5522A	
(65 to 500) Hz	(33.66 to 336.6) W	(0.3366 to 1.122) kW	(1.122 to 3.06) kW	(3.06 to 11.22) kW	(11.22 to 20.9) kW	
Ø 20 ° PF=0.940	0.17 %		0.18 %	0.2 %	0.26 %	
Ø 30 ° PF=0.866	0.26 %			0.28 %	0.33 %	
Ø 40 ° PF=0.766	0.37 %			0.39 %	0.42 %	
Ø 50 ° PF=0.643	0.53 %				0.56 %	

Parameter/Range	Frequency		CMC[2, 4, 5] (±)		Comments
AC Power[3] – Generate	See Table below		See Table below		Fluke 5522A
(65 to 500) Hz	(33.66 to 336.6) W	(0.3366 to 1.122) kW	(1.122 to 3.06) kW	(3.06 to 11.22) kW	(11.22 to 20.9) kW
Ø 60 ° PF=0.500	0.76 %			0.77 %	0.78 %
Ø 70 ° PF=0.342	1.2 %				
Ø 80 ° PF=0.174	2.5 %				
500 Hz to 1 kHz	(33.66 to 336.6) W	(0.3366 to 1.122) kW	(1.122 to 3.06) kW	(3.06 to 11.22) kW	(11.22 to 20.9) kW
Ø 0 ° PF=1.000	0.052 %	0.068 %	0.076 %	0.12 %	0.21 %

Parameter/Range	Frequency	CMC[2, 4, 5, 6] (±)	Comments
Phase Generate[3] – (0 to 360)°	(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	0.1° 0.26° 0.51° 2.6° 5.1° 10°	Fluke 5522A
Capacitance[3] – Generate			
(0.19 to 0.3999) nF	10 Hz to 10 kHz	8.8 pF + 4 pF/nF	Fluke 5522A
(0.4 to 1.0999) nF	10 Hz to 10 kHz	9.7 pF + 4 pF/nF	
(1.1 to 3.2999) nF	10 Hz to 3 kHz	13 pF + 4 pF/nF	
(3.3 to 10.9999) nF	10 Hz to 1 kHz	15 pF + 2 pF/nF	
(11 to 32.9999) nF	10 Hz to 1 kHz	0.1 nF + 2 pF/nF	
(33 to 109.999) nF	10 Hz to 1 kHz	0.15 nF + 2 pF/nF	
(110 to 329.999) nF	10 Hz to 1 kHz	0.46 nF + 2 pF/nF	
(0.33 to 1.099 99) µF	(10 to 600) Hz	1.5 nF + 2 nF/µF	
(1.1 to 3.299 99) µF	(10 to 300) Hz	4.6 nF + 2 nF/µF	
(3.3 to 10.9999) µF	(10 to 150) Hz	15 nF + 2 nF/µF	
(11 to 32.9999) µF	(10 to 120) Hz	59 nF + 3.2 nF/µF	
(33 to 109.999) µF	(10 to 80) Hz	0.2 µF + 3.6 nF/µF	
(110 to 329.999) µF	(0 to 50) Hz	0.64 µF + 3.6 nF/µF	
(0.33 to 1.099 99) mF	(0 to 20) Hz	2 µF + 3.6 µF/mF	
(1.1 to 3.299 99) mF	(0 to 6) Hz	7 µF + 3.5 µF/mF	
(3.3 to 10.9999) mF	(0 to 2) Hz	38 µF + 2.6 µF/mF	
(11 to 32.9999) mF	(0 to 0.6) Hz	90 µF + 6 µF/mF	
(33 to 110) mF	(0 to 0.2) Hz	0.37 mF + 8.8 µF/mF	

Parameter/Equipment	Range	CMC[2, 5, 6] (±)	Comments
Oscilloscopes[3] –			
Volts – DC Signal			
Into 50 Ω	± 0 mV to 6.6 V	33 µV + 2 mV/V	Fluke 5522A SC1100
Into 1 MΩ	± 0 mV to 130 V	33 µV + 0.39 mV/V	
Volts – Squarewave			
Into 50 Ω	1 mVpp to 6.6 Vpp;	91 µV + 4.3 mV/V	
Into 1 MΩ	1 mVpp to 130 Vpp; 10 Hz to 1 kHz (1 to 100) kHz	 0.2 mV + 0.8 mV/V 0.24 mV + 2 mV/V	
Edge Into 50 Ω	≤ 300 ps (Up to 2 MHz) ≤ 350 ps (Above 2 MHz)	82 ps 82 ps	
Leveled Sine Wave	50 kHz Reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	0.33 mV + 17 mV/V 0.4 mV + 31 mV/V 0.43 mV + 36 mV/V 0.53 mV + 57 mV/V 0.58 mV + 67 mV/V	
Time Marker	5 s to 50 ms 50 ms to 1 ns	0.0021 % + (*T*/1000) % 0.000 36 %	*T = time in seconds*

IV. Fluid Quantities

Parameter/Equipment	Range	CMC[2, 5, 6, 8] (±)	Comments
Liquid Flow – Measure[3]	(0.7 to 180) GPM	1.2 %	Blancett 110-500 (lin)/B2800 turbine flow meter
Volumetric – Measure	(0.1 to 50) µL 100 µL 200 µL 500 µL 1 mL 2 mL 5 mL 10 mL 20 mL 50 mL	0.023 µL 0.024 µL 0.026 µL 0.038 µL 0.064 µL 0.12 µL 0.3 µL 0.6 µL 1.2 µL 3 µL	ISO 8655 gravimetric method using electronic balance

V. Mechanical

Parameter/Equipment	Range	CMC[2, 5, 6, 8] (±)	Comments
Mass – Measure, Fixed Points	1 mg 2 mg 3 mg 5 mg 10 mg 20 mg 30 mg 50 mg 100 mg 200 mg 300 mg 500 mg 1 g 2 g 3 g 5 g 10 g 20 g 30 g 50 g 100 g 200 g 300 g 500 g 1 kg 2 kg 3 kg 4 kg 5 kg 10 kg 20 kg 25 kg 30 kg 32 kg	2.9 µg 2.9 µg 3.4 µg 2.9 µg 2.9 µg 2.9 µg 3.4 µg 2.9 µg 2.9 µg 2.9 µg 3.4 µg 2.9 µg 6.5 µg 6.5 µg 9 µg 6.5 µg 9.4 µg 14 µg 17 µg 24 µg 46 µg 96 µg 0.15 mg 0.32 mg 0.48 mg 0.66 mg 1.3 mg 1.3 mg 3.9 mg 7.3 mg 0.11 g 0.11 g 0.11 g 0.11 g	Substitution method using mass standards with mass comparators
Mass – Measure, Direct Weigh	Up to 5.1 g (> 5.1 to 520) g (> 0.52 to 2.3) kg (> 2.3 to 5.1) kg (> 5.1 to 32) kg	0.43 µg + 0.000 28 % 0.33 mg 1.7 mg 5.4 mg 66 mg	UMX5 comparator XP505 comparator XP2004S comparator XP5003S comparator XPE32003LC comparator

Parameter/Equipment	Range	CMC[2, 5, 6, 8] (±)	Comments
Scales	Up to 3000 lbs	0.82 x *R*	Class F weights
Scales – Substitution Testing	(3000 to 6000) lbs	1.2 x *R*	EURAMET CG-18
Pressure – Measuring Equipment[3]			
Pneumatic Gage Pressure	Up to 10 000 psig	0.024 %	DH instruments RPM4/HPMS A70MS/A20MS-AF reference pressure monitor
	(-14.7 to 15) psig (15 to 300) psig (300 to 750) pisg (750 to 1500) psig	0.0037 psi 0.012 % 0.012 % 0.024 %	Mensor CPC6000
Hydraulic Gage Pressure	Up to 36 000 psig	43 psi	Additel ADT681-10-GP2500-BAR pressure gage
Torque Measure – Torque Tools	5 lbf·in to 600 lbf·ft	0.31 %	CDI torque transducers
Balances[3]	Up to 32 kg	Matrix value x *R*	Class Ultra, 1 & 4 weights

	Unit Under Test Resolution						
	0.000 01g	0.0001 g	0.001 g	0.01 g	0.1 g	1 g	10 g
Up to 5 g	1.0						
(> 5 to 10) g	2.2						
(> 10 to 20) g	3.1	0.93					
(> 20 to 50) g	4.4	1.1					
(> 50 to 100) g	7.1	1.7					
(> 100 to 200) g	15	3.1	0.87				
(> 200 to 500) g		7.3	1.1				
> 500 g to 1 kg		15	1.7				
(> 1 to 5) kg			7.3	1.1			
(> 5to 10) kg			10	1.3			
(> 10 to 20) kg					4.9	0.95	
(> 20 to 32) kg					7.3	1.1	

VI. Thermodynamic

Parameter/Equipment	Range	CMC[2, 5, 6, 8] (±)	Comments
Infrared Temperature – Measuring Equipment	(-15 to 12) °C (-12 to -9) °C (-9 to -6) °C (-6 to -2) °C (-2 to 0) °C (0 to 120) °C (35 to 500) °C	0.51 °C 0.5 °C 0.49 °C 0.48 °C 0.47 °C 0.6 °C + 0.0017 °C/°C 0.54 °C + $\Delta T_{\text{Change from 35 °C}}$ x 0.0042	Fluke 4180 Fluke 4181 Emissivity = 0.95 Wavelength (8 to 14) µm
Temperature – Measure	(-196 to 661) °C	0.011 °C + 0.000 019 x $\Delta T_{\text{Change from -197}}$	Fluke 2560, 5628 PRT
Temperature Measuring Equipment	(-80 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 660) °C	0.018 °C + 0.000 013 x $\Delta T_{\text{Change from -40}}$ 0.020 °C + 0.000 079 x $\Delta T_{\text{Change from 100}}$ 0.032 °C + 0.0001 x $\Delta T_{\text{Change from 300}}$ 0.078 °C + 0.000 034 x $\Delta T_{\text{Change from 400}}$	Fluke 5628 w/reference baths/blocks
Relative Humidity – Measuring Equipment	(15 to 90) % RH	0.63 % RH	Thunder Scientific 2500LT
Relative Humidity Measuring Equipment – Calibration of Humidity Probes[3]	(10 to 70) % RH (> 70 to 100) % RH	1.9 % RH 3.5 % RH	Fluke DewK 1620

VII. Time & Frequency

Parameter/Equipment	Range	CMC[2, 5, 8] (±)	Comments
Frequency – Generate	100 µHz to 15 MHz	0.0024 %	HP 33120A function generator
Frequency – Measure	1 Hz to 225 MHz	0.000 59 %	HP 53132A counter
Stopwatches & Timers[3]	0 s to 24 hr	0.047 s	Witschi QT6000
Optical Tachometers[3]	(1 to 100 000) rpm	0.000 35 rpm + 0.000 038 rpm/rpm	Fluke 5520A, LED

SATELLITE LOCATION

TRESCAL, INC.
100 N. Babcock St
Melbourne, FL 32935
Deborah McLaren Phone: 321 622 7748

I. Device Specific Parameters

Parameter/Equipment	Range	CMC[2, 5, 6, 8] (±)	Comments
Ionizing Fans, Blowers & Guns			
Ion Balance	Up to 50 V	0.28 V	Ion System 210 charge plate monitor, HP 34401A
Discharge Time	Up to 30 sec	0.039 s	
Electrostatic Discharge			
Mats – Resistance	Up to 1 GΩ	12 %	Desco 19787 surface resistance meter
Soldering Systems – Measure			
Leak Voltage	Up to 40 mV	0.7 mV	Hakko FG-101 solder tester
Tip-to-Ground Ω	Up to 40 Ω	0.7 Ω	
Temperature Stability	(32 to 1300) °F	7 °F	

II. Dimensional

Parameter/Equipment	Range	CMC[2] (±)	Comments
Micrometers[3]			
Spindle Linearity	Up to 20 in	30 µin + 5.3 µin/in	Gage blocks
Anvil Flatness	50 µin	6.2 µin	Optical flat
Parallelism	50 µin	11 µin	Optical flat
Depth Micrometer Base Flatness	Up to 200 µin	31 µin	Gage blocks
Calipers[3]			
Outside Diameter	Up to 20 in	30 µin + 5.2 µin/in	Gage blocks
Inside Diameter	Up to 20 in	34 µin + 5.1 µin/in	
Step & Depth	Up to 20 in	31 µin + 5.2 µin/in	
Height Gages[3]			
Low Resolution	Up to 24 in	290 µin + 1.6 µin/in	Gage blocks
High Resolution	Up to 24 in	12 µin + 5.9 µin/in	
Length & Plain Diameter[3] (Length Standards, Cylindrical Plugs & Pins, Feeler Gages)	Up to 4 in		
Steel		34 µin + 1.2 µin/in	Trimos TULM210 length measuring instrument
Aluminum		34 µin + 1.4 µin/in	
Length Standards[3]	Up to 20 in	33 µin + 4.2 µin/in	Gage blocks, Tesa TT-80 electronic length measuring instrument

Parameter/Equipment	Range	CMC[2] (±)	Comments
Dial & Digital Indicators[3]	Up to 1 in (1 to 2) in	39 µin 31 µin + 3.4 µin/in	Itall 700 dial indicator calibrator Gage blocks
Threaded Plug Gages, Go & NoGo[3] 60° Pitch Diameter Major Diameter	 Up to 4 in (4.5 to 80 TPI) Up to 4 in	 82 µin 34 µin + 1.2 µin/in	 Trimos TULM210 length measuring instrument, Vermont gage thread wire set
Protractors[3]	(0 to 180)°	0.0077°	Sine bar, gage blocks, surface plate
Crimpers – Go/NoGo[3]	(0.0072 to 0.144) in	26 µin	Standard pins

III. Dimensional Testing/Calibration

Parameter/Equipment	Range	CMC[2] (±)	Comments
Dimensional Measurements[3]– Checking Angle Plates, V-Blocks, Fixtures & Workpieces	 Flatness: Up to 2000 µin Parallelism: Up to 2000 µin	 33 µin + 3 µin/in 33 µin + 3 µin/in	 Tesa TT-80 electronic length measuring instrument, surface plate

IV. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4, 5, 6] (±)	Comments
DC Voltage – Generate[3]	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (330 to 1000) V	0.8 µV + 16 nV/mV 17 µV + 5 µV/V 88 µV + 7 µV/V 0.56 mV + 14 µV/V 2.7 mV + 14 µV/V	Fluke 5520A
DC Voltage – Measure	Up to 100 mV (0 to 1) V (0 to 10) V (0 to 100) V (0 to 1000) V	0.33 µV + 17 µV/V 0.52 µV + 8 µV/V 8.8 µV + 8.1 µV/V 35 µV + 10 µV/V 1.2 mV + 11 µV/V	Agilent 3458A
DC Current – Generate	(0 to 330) µA 330 µA to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3.0) A (3 to 11) A (11 to 20.5) A	16 nA + 0.12 nA/µA 41 nA + 80 nA/mA 0.21 µA + 80 nA/mA 2.1 µA + 80 nA/mA 33 µA + 0.16 mA/A 0.37 mA + 0.13 mA/A 0.49 mA + 0.39 mA/A 9.4 mA + 0.8 mA/A	Fluke 5520A
DC Current – Measure	(0 to 100) nA (0.1 to 1) µA (1 to 10) µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 200) A (200 to 1000) A	41 pA + 89 µA/A 70 pA + 21 µA/A 0.7 nA + 18 µA/A 5.8 nA + 9.2 µA/A 58 nA + 9.7 µA/A 0.58 µA + 8 µA/A 5.8 µA + 17 µA/A 59 µA + 81 µA/A 0.0046 % 0.18 %	HP 3458A Ohm-Lab CS-200 shunt, HP 34401A Empro B-1000-100 shunt, HP 34401A

Parameter/Equipment	Range	CMC[2, 4, 6] (±)	Comments
Resistance – Generate	(0 to 10.9999) Ω (11 to 32.9999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω (330 to 1099.999) Ω (1.1 to 3.299 999) kΩ (3.3 to 10.999 99) kΩ (11 to 32.999 99) kΩ (33 to 109.9999) kΩ (110 to 329.9999) kΩ (330 to 1099.999) kΩ (1.1 to 3.299 999) MΩ (3.3 to 10.999 99) MΩ (11 to 32.999 99) MΩ (33 to 109.9999) MΩ (110 to 329.9999) MΩ (330 to 1100) MΩ	1.2 mΩ + 24 μΩ/Ω 1.5 mΩ + 24 μΩ/Ω 1.9 mΩ + 22 μΩ/Ω 4.1 mΩ + 22 μΩ/Ω 9.1 mΩ + 22 μΩ/Ω 41 mΩ + 22 μΩ/Ω 92 mΩ + 22 μΩ/Ω 0.41 Ω + 22 μΩ/Ω 0.9 Ω + 22 μΩ/Ω 8.4 Ω + 26 μΩ/Ω 14 Ω + 26 μΩ/Ω 93 Ω + 48 μΩ/Ω 0.4 kΩ + 0.1 mΩ/Ω 4.4 kΩ + 0.2 mΩ/Ω 16 kΩ + 0.4 mΩ/Ω 0.35 MΩ + 2.4 mΩ/Ω 4.4 MΩ + 12 mΩ/Ω	Fluke 5520A
Resistance – Measure	(0 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ	55 μΩ + 15 μΩ/Ω 0.52 mΩ + 13 μΩ/Ω 0.53 mΩ + 10 μΩ/Ω 5.3 mΩ + 10 μΩ/Ω 53 mΩ + 11 μΩ/Ω 2.3 Ω + 17 μΩ/Ω 0.1 kΩ + 55 μΩ/Ω 1 kΩ + 0.52 mΩ/Ω 10 kΩ + 5.1 mΩ/Ω	HP 3458A

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Voltage – Generate[3]			
(1 to 33) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 200) kHz (200 to 500) kHz	5.5 µV + 0.64 µV/mV 5 µV + 0.12 µV/mV 5 µV + 0.16 µV/mV 5.6 µV + 0.8 µV/mV 12 µV + 2.8 µV/mV 47 µV + 6.4 µV/mV 47 µV + 6.4 µV/mV	Fluke 5520A
(33 to 330) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 200) kHz (200 to 500) kHz	14 µV + 0.24 µV/mV 24 µV + 87 nV/mV 11 µV + 0.13 µV/mV 35 µV + 0.28 µV/mV 47 µV + 0.64 µV/mV 0.11 mV + 1.6 µV/mV 0.11 mV + 1.6 µV/mV	
330 mV to 3.3 V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 200) kHz (200 to 500) kHz	0.12 mV + 0.24 mV/V 88 µV + 0.12 mV/V 99 µV + 0.15 mV/V 0.12 mV + 0.24 mV/V 0.29 mV + 0.56 mV/V 1.1 mV + 1.9 mV/V 1.1 mV + 1.9 mV/V	
(3.3 to 33) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	1.3 mV + 0.24 mV/V 0.94 mV + 0.12 mV/V 1.6 mV + 0.18 mV/V 1.4 mV + 0.28 mV/V 3.7 mV + 0.72 mV/V	
(33 to 330) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	6.8 mV + 0.15 mV/V 10 mV + 0.16 mV/V 12 mV + 0.2 mV/V 13 mV + 0.24 mV/V 93 mV + 1.6 mV/V	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	87 mV + 0.24 mV/V 74 mV + 0.2 mV/V 88 mV + 0.24 mV/V	

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Voltage[3] – Measure			
Up 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	6.1 µV + 0.0003 mV/mV 4.1 µV + 0.0002 mV/mV 4.2 µV + 0.0003 mV/mV 4.9 µV + 0.001 mV/mV 9 µV + 0.005 mV/mV 45 µV + 0.04 mV/mV	Agilent 3458A
(0.1 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 (0.3 to 1) MHz (1 to 2) MHz	12 µV + 0.000 07 mV/mV 2.7 µV + 0.000 07 mV/mV 11 µV + 0.000 14 mV/mV 0.12 µV + 0.0003 mV/mV 17 µV + 0.0008 mV/mV 47 µV mV + 0.003 mV/mV 0.12 mV + 0.01 mV/mV 3.8 mV + 0.01 mV/mV	
(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 (0.3 to 1) MHz (1 to 2) MHz	0.12 mV + 0.000 07 V/V 0.1 mV + 0.000 07 V/V 0.11 mV + 0.000 14 V/V 0.12 mV + 0.0003 V/V 0.17 mV + 0.0008 V/V 0.47 mV + 0.003 V/V 1.2 mV + 0.01 V/V 38 mV + 0.015 V/V	
(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 (0.3 to 1) MHz (1 to 2) MHz	1.2 mV + 0.000 07 V/V 1 mV + 0.000 07 V/V 1 mV + 0.000 14 V/V 1.2 mV + 0.0003 V/V 1.7 mV + 0.0008 V/V 4.7 mV + 0.003 V/V 12 mV + 0.01 V/V 0.38 V + 0.015 V/V	
(100 to 1000) 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 (0.3 to 1) MHz (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	13 mV + 0.0002 V/V 11 mV + 0.0002 V/V 11 mV + 0.0002 V/V 13 mV + 0.000 35 V/V 21 mV + 0.0012 V/V 57 mV + 0.004 V/V 0.17 V + 0.015 V/V 98 mV + 0.0004 V/V 84 mV + 0.0004 V/V 98 mV V + 0.0006 V/V 0.14 V + 0.0012 V/V 0.27 V + 0.003 V/V	

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Current – Generate[3]			
(29 to 329.99) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.13 µA + 1.6 nA/µA 0.12 µA + 1.2 nA/µA 0.11 µA + 1 nA/µA 0.19 µA + 2.4 nA/µA 0.35 µA + 6.4 nA/µA 0.70 µA + 13 nA/µA	Fluke 5520A
330 µA to 3.2999 mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.65 µA + 1.6 µA/mA 0.45 µA + 1 µA/mA 0.39 µA + 0.8 µA/mA 0.69 µA + 1.6 µA/mA 2.9 µA + 1.6 µA/mA 3.4 µA + 8 µA/mA	
(3.3 to 32.999) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	6.4 µA + 1.4 µA/mA 4 µA + 0.72 µA/mA 2.7 µA + 0.32 µA/mA 3.7 µA + 0.64 µA/mA 7.7 + 1.6 µA/mA 14 µA + 3.2 µA/mA	
(33 to 329.99) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	65 µA + 1.4 µA/mA 42 µA + 0.72 µA/mA 29 µA + 0.31 µA/mA 68 µA + 0.8 µA/mA 0.13 mA + 1.6 µA/mA 0.27 mA + 3.2 µA/mA	
330 mA to 1.099 99 A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.56 mA + 1.4 mA/A 0.22 mA + 0.4 mA/A 2.4 mA + 4.8 mA/A 11 mA + 20 mA/A	
(1.1 to 2.999 99) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.7 mA + 1.4 mA/A 0.61 mA + 0.48 mA/A 6.1 mA + 4.8 mA/A 26 mA + 20 mA/A	
(3 to 10.9999) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	3.1 mA + 0.48 mA/A 4 mA + 0.8 mA/A 74 mA + 24 mA/A	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	15 mA + 0.96 mA/A 17 mA + 1.2 mA/A 0.27 A + 24 mA/A	

Parameter/Range	Frequency	CMC[2, 5, 6] (±)	Comments
AC Current[3] – Measure			
(5 to 100) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 5 kHz	57 nA + 4 mA/A 45 nA + 1.5 mA/A 40 nA + 0.64 mA/A	Agilent 3458A
(0.1 to 1) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.43 µA + 0.0041 mA/mA 0.31 µA + 0.0016 mA/mA 0.26 µA + 0.000 67 mA/mA 0.25 µA + 0.000 37 mA/mA 0.26 µA + 0.000 67 mA/mA 0.63 µA + 0.0042 mA/mA 1.8 µA + 0.0056 mA/mA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	2.4 µA + 0.0041 mA/mA 2.3 µA + 0.0016 mA/mA 2.3 µA + 0.000 67 mA/mA 2.3 µA + 0.000 37 mA/mA 2.3 µA + 0.000 67 mA/mA 4.5 µA + 0.0041 mA/mA 16 µA + 0.0056 mA/mA	
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	42 µA + 0.004 mA/mA 30 µA + 0.0015 mA/mA 25 µA + 0.0006 mA/mA 24 µA + 0.0003 mA/mA 25 µA + 0.0006 mA/mA 62 µA + 0.004 mA/mA 0.18 mA + 0.0055 mA/mA	
(0.1 to 1) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz (5 to 20) kHz (20 to 50) kHz	0.42 mA + 0.0041 A/A 0.3 mA + 0.0017 A/A 0.26 mA + 0.0009 A/A 0.27 mA + 0.0011 A/A 0.37 mA + 0.0031 A/A 0.92 mA + 0.01 A/A	

Parameter/Equipment	Range	CMC[2, 4, 6] (±)	Comments
Capacitance[3] – Generate			
(0.19 to 0.3999) nF	10 Hz to 10 kHz	8.8 pF + 4 pF/nF	Fluke 5520A
(0.4 to 1.0999) nF	10 Hz to 10 kHz	9.7 pF + 4 pF/nF	
(1.1 to 3.2999) nF	10 Hz to 3 kHz	13 pF + 4 pF/nF	
(3.3 to 10.9999) nF	10 Hz to 1 kHz	15 pF + 2 pF/nF	
(11 to 32.9999) nF	10 Hz to 1 kHz	0.1 nF + 2 pF/nF	
(33 to 109.999) nF	10 Hz to 1 kHz	0.15 nF + 2 pF/nF	
(110 to 329.999) nF	10 Hz to 1 kHz	0.46 nF + 2 pF/nF	
(0.33 to 1.099 99) µF	(10 to 600) Hz	1.5 nF + 2 nF/µF	
(1.1 to 3.299 99) µF	(10 to 300) Hz	4.6 nF + 2 nF/µF	
(3.3 to 10.9999) µF	(10 to 150) Hz	15 nF + 2 nF/µF	
(11 to 32.9999) µF	(10 to 120) Hz	59 nF + 3.2 nF/µF	
(33 to 109.999) µF	(10 to 80) Hz	0.2 µF + 3.6 nF/µF	
(110 to 329.999) µF	(0 to 50) Hz	0.64 µF + 3.6 nF/µF	
(0.33 to 1.099 99) mF	(0 to 20) Hz	2 µF + 3.6 µF/mF	
(1.1 to 3.299 99) mF	(0 to 6) Hz	7 µF + 3.5 µF/mF	
(3.3 to 10.9999) mF	(0 to 2) Hz	38 µF + 2.6 µF/mF	
(11 to 32.9999) mF	(0 to 0.6) Hz	90 µF + 6 µF/mF	
(33 to 110) mF	(0 to 0.2) Hz	0.37 mF + 8.8 µF/mF	
Electrical Simulation of Thermocouple –			
Type J	(-210 to -100) °C	0.21 °C	Fluke 5520A
	(-100 to -30) °C	0.13 °C	
	(-30 to 150) °C	0.12 °C	
	(150 to 760) °C	0.14 °C	
	(760 to 1200) °C	0.18 °C	
Type K	(-200 to -100) °C	0.26 °C	
	(-100 to -25) °C	0.15 °C	
	(-25 to 120) °C	0.13 °C	
	(120 to 1000) °C	0.21 °C	
	(1000 to 1372) °C	0.31 °C	
Type R	(0 to 250) °C	0.44 °C	
	(250 to 400) °C	0.28 °C	
	(400 to 1000) °C	0.26 °C	
	(1000 to 1767) °C	0.31 °C	
Type S	(0 to 250) °C	0.37 °C	
	(250 to 1000) °C	0.28 °C	
	(1000 to 1400) °C	0.29 °C	
	(1400 to 1767) °C	0.36 °C	

Parameter/Equipment	Range	CMC[2, 5, 6] (±)	Comments
Electrical Simulation of Thermocouple – (cont)			
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.49 °C 0.21 °C 0.15 °C 0.14 °C	Fluke 5520A
Oscilloscopes[3] –			
Volts – DC Signal			
Into 50 Ω	± 0 mV to 6.6 V	33 µV + 2 mV/V	Fluke 5520A
Into 1 MΩ	± 0 mV to 130 V	33 µV + 0.39 mV/V	SC1100
Volts – Squarewave			
Into 50 Ω	1 mVpp to 6.6 Vpp;	91 µV + 4.3 mV/V	
Into 1 MΩ	1 mVpp to 130 Vpp; 10 Hz to 1 kHz (1 to 100) kHz	0.2 mV + 0.8 mV/V 0.24 mV + 2 mV/V	
Edge into 50 Ω	≤ 300 ps (Up to 2 MHz) ≤ 350 ps (Above 2 MHz)	82 ps 82 ps	
Leveled Sine Wave	50 kHz Reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	0.33 mV + 17 mV/V 0.4 mV + 31 mV/V 0.43 mV + 36 mV/V 0.53 mV + 57 mV/V 0.58 mV + 67 mV/V	
Time Marker	5 s to 50 ms 50 ms to 1 ns	0.0021 % + (*T*/1000) % 0.000 36 %	*T = time in seconds*

V. Electrical – RF/Microwave

Parameter/Equipment	Range	CMC[2, 5, 6, 8] (±)	Comments
RF Microwave, Absolute Power – Generate	0.05 to 10V pk-pk Up to 100 kHz 100 kHz to 1 MHz (1 to 15) MHz (-100 to 15) dBm 100 kHz to 3.2 GHz	 0.4 % 0.42 % 0.55 % 1.7 dB	HP 33120A HP 8648C
RF Microwave, Absolute Power – Measure[3] (-30 to +10) dBm (+10 to +20) dBm	100 kHz to 4.2 GHz	1.3 % 3.7 %	Agilent E4419B w/ HP 8482A
Distortion – Measure	20 Hz to 50 kHz (50 to 100) kHz 100 kHz to 2.9 GHz	1.2 dB 2.3 dB 2.7 dB	HP 8903B HP 8594E

VI. Mechanical

Parameter/Equipment	Range	CMC[2, 5, 6] (±)	Comments
Accelerometers (1 to 10) g	(0.5 to 1) Hz (> 1 to 10) Hz (11 to 99) Hz 100 Hz (101 to 920) Hz 921 Hz to 5 kHz (5 to 10) kHz	1.6 % 1.3 % 1.6 % 1.3 % 1.7 % 2 % 2.4 %	VR9500, PCB 301A11 reference sensor

Parameter/Equipment	Range	CMC[2, 5, 6, 8] (±)	Comments
Force– Measuring Equipment			
Crimpers/Banding Tools	Up to 120 lbf	0.62 lb	DMC PT-100A pull tester
Force Gages	Up to 100 lbf	0.0023 %	Class F weights
Pneumatic Pressure – Measuring Equipment	(> 0 to 5) psiv (> 0 to 60) psia (> 0 to 30) psig (> 0 to 100) psig (> 0 to 500) psig (> 0 to 250) inH_20 (> 0 to 500) mmHg	0.06 % 0.06 % 0.061 % 0.061 % 0.061 % 0.06 % 0.033 %	Ashcroft AQS & HQS pressure modules
Scales	Up to 200 lbs	0.82 x *R*	Class F weights
Torque Transducers	Up to 250 lbf-ft	0.012 %	Class F weights, calibration arms
Torque – Measuring Equipment	(1 to 10) ozf-in (10 to 50) ozf-in	1.2 % 0.58 %	AWS torque transducers & CDI torque calibration system
Snap-Action & Breakover Wrenches, Screwdrivers, Electronic, Digital & Dial Indicating	50 ozf-in to 400 lbf-in 400 lbf-in to 250 lbf-ft	0.31 % 1.2 %	

Parameter/Equipment	Range	CMC[2, 5, 6] (±)	Comments
Balances[3]	Up to 2 kg	Matrix value x *R*	Class S1 weights

	Unit Under Test Resolution					
	0.0001 g	0.001 g	0.01 g	0.1 g	1 g	10 g
Up to 100 mg	1.0					
(> 100 to 200) mg	1.1					
(> 200 to 500) mg	1.2					
> 500 mg to 1 g	1.4					
(> 1 to 2) g	1.7					
(> 2 to 5) g	2.2					
(> 5 to 10) g	3.3	0.87		0.82		
(> 10 to 20) g	4.1	0.91				
(> 20 to 50) g		1.1				
(> 50 to 100) g		1.4				
(> 100 to 200) g		2.5	0.85			
(> 200 to 300) g		3.6	0.89			
(> 300 to 500) g			1.0			
500 g to 1 kg			1.4			
(> 1 to 2) kg			2.5	0.85		

VII. Optical Quantities

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Luminance Meters	(0.5 to 1700) fL	2.6 %	Hoffman Engineering LS-65-8C

VIII. Thermodynamics

Parameter/Equipment	Range	CMC[2, 6, 8] (±)	Comments
Temperature – Measuring Equipment	(-80 to 350) °C	0.13 °C	Fluke 1523, 5626 PRT, calibration bath
	(-80 to 350) °C	0.14 °C + $\Delta T_{\text{Change from -80 °C}}$ x 0.0002	Fluke 1523, 5618B PRT, calibration bath

Parameter/Equipment	Range	CMC[2, 6, 8] (±)	Comments
Temperature – Measure	(-196 to 661) °C	0.015 °C + 0.000 6 x $\Delta T_{\text{Change from -196}}$	Fluke 1523, 5626 PRT
	(-196 to 500) °C	0.029 °C + $\Delta T_{\text{Change from -196 °C}}$ x 0.000 28	Fluke 1523, 5618B PRT
	(662 to 1000) °C	3.2 °C + $\Delta T_{\text{Change from 662 °C}}$ x 0.011	TC probe
Relative Humidity – Measure	(20 to 85) % RH (85 to 90) % RH	1.5 % RH 2.2 % RH	Vaisala M170 w/ HMP-77(B) probe
Temperature – Environmental Chambers, Temperature Uniformity Survey	(-50 to 100) °C	0.86 °C	Fluke 2635A Hydrabucket w/Type T SLE thermocouple

Radiation Thermometry Source using CI Systems & SBIR calibration standards & contact thermometry method		
	CI Systems SR800N, SR800R Sources	Santa Barbara IR Sources
Temperature	CMC[2, 6, 8] (±)	CMC[2, 6, 8] (±)
-40 °C -30 °C -20 °C -10 °C 0 °C 10 °C 20 °C 30 °C 40 °C 50 °C 60 °C 70 °C 80 °C 90 °C 100 °C 110 °C 120 °C 130 °C 140 °C 150 °C	0.024 °C 0.024 °C 0.024 °C 0.025 °C 0.025 °C 0.026 °C 0.026 °C 0.026 °C 0.027 °C 0.027 °C 0.028 °C 0.028 °C 0.028 °C 0.029 °C 0.029 °C 0.03 °C 0.03 °C 0.03 °C 0.031 °C 0.031 °C	0.019 °C 0.022 °C 0.025 °C 0.028 °C 0.03 °C 0.033 °C 0.036 °C 0.039 °C 0.042 °C 0.045 °C 0.048 °C

IX. Time & Frequency

Parameter/Equipment	Range	CMC[2, 6, 8] (±)	Comments
Frequency – Measuring Equipment			
Time Base	10 MHz	0.59 mHz	58305A GPS receiver, HP 53132A frequency counter

Parameter/Equipment	Range	CMC[2, 6, 8] (±)	Comments
Frequency – Measure	0.1 Hz to 225 MHz	5.9 µHz + 0.1 µHz/Hz	HP 53132A frequency counter
Frequency – Generate	Up to 15 MHz 100 kHz to 3.2 GHz	44 µHz + 0.12 µHz/Hz 5.8 Hz + 0.1 µHz/Hz	HP 33120A function generator HP 8648C signal generator
Stopwatch	Up to 24 Hr	0.039 s	58305A GPS receiver, HP 53132A frequency counter

[1] This laboratory offers commercial calibration services 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 uncertainty 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 uncertainty.

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

[5] In the statement of CMC, all percentages are percent of reading unless otherwise indicated. In the statement of CMC, R represents the resolution of the unit under test.

[6] Uncertainty components that can be reasonably attributed to the Unit Under Test have not been utilized in the calculation of the CMC value for this measurement parameter.

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

[8] The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.

Accredited Laboratory

A2LA has accredited

TRESCAL, INC.

Boca Raton, FL

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994, ANSI/NCSL 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 14th day of August 2024

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1877.02
Valid to November 30, 2026

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