



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

TRESCAL, INC.
2 Mars Court
Boonton, NJ 07005
Nathan Thrasher Phone: 414 716 0344

CALIBRATION

Valid To: March 31, 2024

Certificate Number: 2353.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 8}:

I. Dimensional

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Dial & Digital Indicators	Up to 1 in	14 µin + 4.1 µin/in	Gage blocks
Micrometers Spindle Linearity Anvil Flatness Parallelism	Up to 40 in 50 µin 50 µin	7.2 µin + 7.7 µin/in 9.5 µin 6.2 µin	Gage blocks Optical flat
Height Gages	Up to 40 in	24 µin + 7.4 µin/in	Gage blocks, surface plate
Depth Gages	Up to 40 in	24 µin + 7.4 µin/in	Gage blocks, surface plate
Calipers Outside Diameter Inside Diameter Step & Depth	Up to 40 in 1.0 in Up to 40 in	7.2 µin + 7.8 µin/in 31 µin 24 µin + 7.4 µin/in	Gage blocks Ring gages Gage blocks, surface plate
Rulers	Up to 36 in	0.0014 in + 62 µin/in	Gage blocks, master rule
Pin Gages	(0 to 2) in	13 µin + 9.3 µin/in	ULM, gage blocks

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 4, 5, 6} (±)	Comments
DC Voltage – Generate	Up to 220 mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	0.49 μ V + 7.2 nV/mV 0.8 μ V + 5 μ V/V 2.9 μ V + 3.5 μ V/V 4.3 μ V + 3.5 μ V/V 43 μ V + 5 μ V/V 0.42 mV + 6.5 μ V/V	Fluke 5720A
Fixed Point	10.0 V	42 μ V	Fluke 732A
DC Voltage ³ – Measure	(0 to 0.1) V (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1100) V	0.33 μ V + 17 nV/mV 0.52 μ V + 8 μ V/V 8.8 μ V + 8.1 μ V/V 35 μ V + 10 μ V/V 1.2 mV + 11 μ V/V	Agilent 3458A
DC High Voltage ³ – Measure	(1 to 45) kV (45 to 160) kV	0.13 % 0.13 %	Ross VD45 w/Fluke 187 Ross VMP200 w/Fluke 187
DC Current ³ – Generate	Up to 220 μ A (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A (2.2 to 11) A	6 nA + 40 pA/ μ A 7.1 nA + 35 nA/mA 41 nA + 35 nA/mA 0.73 μ A + 50 nA/mA 12 μ A + 0.13 mA/A 0.49 mA + 0.36 mA/A	Fluke 5720A
Clamp-On Only ³	(11 to 20.5) A (10 to 16.5) A (16.5 to 150) A (150 to 1025) A	12 mA + 1 mA/A 50 mA + 6.5 mA/A 0.18 A + 3.4 mA/A 0.83 A + 3.3 mA/A	w/5725A Fluke 5520A Fluke 5520A w/coil
DC Current ³ – Measure	(0 to 100) nA (0.1 to 1) μ A (0.1 to 10) μ A (0.1 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	41 pA + 89 fA/nA 70 pA + 21 pA/ μ A 0.7 nA + 18 pA/ μ A 5.8 nA + 9.2 pA/ μ A 58 nA + 9.7 nA/mA 0.58 μ A + 8 nA/mA 5.8 μ A + 17 nA/mA 59 μ A + 81 μ A/A	Agilent 3458A
	(1 to 20) A	0.0069 %	w/Fluke Y5020
Resistance – Measure	1 m Ω 10 m Ω 100 m Ω	0.0024 % 0.0024 % 0.0031 %	Current transfer using L&N shunts, Agilent 3458A

Parameter/Equipment	Range	CMC ^{2, 4, 5} (±)	Comments
Resistance ³ – Generate	(0 to 10.9999) Ω (11 to 32.9999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω (0.33 to 1.099 999) kΩ (1.1 to 3.299 999) kΩ (3.3 to 10.999 99) kΩ (11 to 32.999 99) kΩ (33 to 109.999) kΩ (110 to 329.999) kΩ (0.33 to 1.099 99) MΩ (1.1 to 3.299 00) MΩ (3.3 to 10.9999) MΩ (11 to 32.9999) MΩ (33 to 109.9999) MΩ (110 to 329.9999) MΩ (330 to 1100) MΩ	1.3 mΩ + 33 μΩ/Ω 1.8 mΩ + 30 μΩ/Ω 2.3 mΩ + 28 μΩ/Ω 5.1 mΩ + 28 μΩ/Ω 11 mΩ + 28 μΩ/Ω 51 mΩ + 28 μΩ/Ω 0.11 Ω + 28 μΩ/Ω 0.51 Ω + 28 μΩ/Ω 1.1 Ω + 28 μΩ/Ω 11 Ω + 32 μΩ/Ω 18 Ω + 32 μΩ/Ω 0.12 kΩ + 60 μΩ/Ω 0.5 kΩ + 0.13 mΩ/Ω 5.5 kΩ + 0.25 mΩ/Ω 20 kΩ + 0.5 mΩ/Ω 0.43 MΩ + 3 mΩ/Ω 5.5 MΩ + 15 mΩ/Ω	Fluke 5520A
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	50 μΩ 95 μΩ 0.18 mΩ 0.24 mΩ 0.44 mΩ 1 mΩ 1.9 mΩ 8.5 mΩ 16 mΩ 85 mΩ 0.16 Ω 1.1 Ω 2.1 Ω 20 Ω 40 Ω 0.4 kΩ 0.89 kΩ 10 kΩ	Fluke 5720A
	1 mΩ 10 mΩ 100 mΩ 100 Ω 1 kΩ 1 MΩ	23 nΩ 0.12 μΩ 1.2 μΩ 1.2 mΩ 12 mΩ 23 Ω	L&N shunts
Up to 100 V	10 MΩ 100 MΩ	1.2 kΩ 18 kΩ	IET VRS-100-11-1K- BP-10KV
Up to 1000 V	1 GΩ 10 GΩ 100 GΩ 1 TΩ 10 TΩ	7.1 MΩ 75 MΩ 1.5 GΩ 29 GΩ 0.72 TΩ	
Up to 5000 V	10 MΩ 100 MΩ 1 GΩ 10 GΩ 100 GΩ 1 TΩ 10 TΩ	54 kΩ 0.5 MΩ 8.7 MΩ 87 MΩ 1.5 GΩ 29 GΩ 0.76 TΩ	

Parameter/Equipment	Range	CMC ^{2, 4, 5} (±)	Comments
Resistance ³ – 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	Agilent 3458A

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
AC Voltage ³ – Generate			
Up 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	4 μV + 0.24 μV/mV 4 μV + 90 nV/mV 4 μV + 80 nV/mV 4 μV + 0.2 μV/mV 5 μV + 0.5 μV/mV 10 μV + 1.1 μV/mV 20 μV + 1.4 μV/mV 20 μV + 2.7 μV/mV	Fluke 5720A
(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	4.6 μV + 0.24 μV/mV 4.2 μV + 90 nV/mV 4.2 μV + 80 nV/mV 4.5 μV + 0.2 μV/mV 6.2 μV + 0.5 μV/mV 12 μV + 1.1 μV/mV 23 μV + 1.4 μV/mV 26 μV + 2.7 μV/mV	
(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	18 μV + 0.24 μV/mV 9.1 μV + 90 nV/mV 8.9 μV + 80 nV/mV 12 μV + 0.2 μV/mV 16 μV + 0.46 μV/mV 31 μV + 0.9 μV/mV 52 μV + 1.4 μV/mV 83 μV + 2.7 μV/mV	

Parameter/Range	Frequency	CMC ^{2,4,5} (±)	Comments
AC Voltage ³ – Generate (cont)			
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	94 μV + 0.24 mV/V 36 μV + 89 μV/V 19 μV + 45 μV/V 27 μV + 75 μV/V 55 μV + 0.1 mV/V 0.17 mV + 0.42 mV/V 0.58 mV + 0.94 mV/V 0.68 mV + 1.7 mV/V	Fluke 5720A
(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	0.94 mV + 0.24 mV/V 0.36 mV + 90 μV/V 0.16 mV + 45 μV/V 0.27 mV + 75 μV/V 0.43 mV + 0.1 mV/V 1.2 mV + 0.28 mV/V 4.2 mV + 1 mV/V 6.6 mV + 1.5 mV/V	
(22 to 220) V*	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	9.4 mV + 0.24 mV/V 3.6 mV + 90 μV/V 1.8 mV + 52 μV/V 3.6 mV + 77 μV/V 6.3 mV + 0.15 mV/V 36 mV + 0.9 mV/V 0.14 V + 4.4 mV/V 0.26 V + 8 mV/V	* 220 V range subject to 2.2E7 V- Hz limitation
(220 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	24 mV + 90 μV/V 43 mV + 0.17 mV/V 0.15 V + 0.6 mV/V	w/5725A
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.15 V + 0.6 mV/V 0.56 V + 2.3 mV/V	

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
AC Voltage ³ – Measure			
(0.1 to 10) mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	6.1 μV + 0.3 μV/mV 4.1 μV + 0.2 μV/mV 4.2 μV + 0.3 μV/mV 4.9 μV + 1 μV/mV 8.9 μV + 5 μV/mV 45 μV + 40 μV/mV	Agilent 3458A
(10 to 100) mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (1 to 2) MHz	12 μV + 70 nV/mV 2.7 μV + 70 nV/mV 11 μV + 0.14 μV/mV 12 μV + 0.3 μV/mV 17 μV + 0.8 μV/mV 47 μV + 3 μV/mV 0.12 mV + 10 μV/mV 3.8 mV + 15 μV/mV	
100 mV to 1 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (1 to 2) MHz	0.12 mV + 70 μV/V 0.1 mV + 70 μV/V 0.11 mV + 0.14 mV/V 0.12 mV + 0.3 mV/V 0.17mV + 0.8 mV/V 0.47 mV + 3 mV/V 1.2 mV + 10 mV/V 38 mV + 15 mV/V	
(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	1.2 mV + 70 μV/V 1 mV + 70 μV/V 1.1 mV + 0.14 mV/V 1.2 mV + 0.3 mV/V 1.7 mV + 0.8 mV/V 4.7 mV + 3 mV/V 12 mV + 10 mV/V 0.38 V + 15 mV/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	13 mV + 0.2 mV/V 11 mV + 0.2 mV/V 11 mV + 0.2 mV/V 13 mV + 0.35 mV/V 21 mV + 1.2 mV/V 57 mV + 4 mV/V 0.17 V + 15 mV/V	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 6} (±)	Comments
AC Voltage ³ – Measure (cont) (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	99 mV + 0.4 mV/V 85 mV + 0.4 mV/V 99 mV + 0.6 mV/V 0.14 V + 1.2 mV/V 0.26 V + 3 mV/V	Agilent 3458A
AC High Voltage ³ – Measure (1 to 30) kV (30 to 100) kV	60 Hz 60 Hz	0.59 % 0.59 %	Ross VD45 w/Fluke 187 Ross VD200 w/Fluke 187
AC Current ³ – Generate Up to 220 µA (0.22 to 2.2) mA (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 (10 to 30) kHz (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	63 nA + 0.14 nA/µA 12 nA + 0.14 nA/µA 9.3 nA + 0.14 nA/µA 15 nA + 0.14 nA/µA 77 nA + 0.14 nA/µA 0.87 µA + 16 nA/µA 97 nA + 0.25 µA/mA 72 nA + 0.16 µA/mA 62 nA + 0.12 µA/mA 0.16 µA + 0.2 µA/mA 0.9 µA + 1.1 µA/mA 4.1 µA + 10 µA/mA 0.96 µA + 0.25 µA/mA 0.73 µA + 0.16 µA/mA 0.62 µA + 0.12 µA/mA 1 µA + 0.2 µA/mA 7.4 µA + 1.1 µA/mA 17 µA + 4 µA/mA	Fluke 5720A w/5725A Fluke 5520A Fluke 5720A w/5725A Fluke 5520A Fluke 5720A w/5725A Fluke 5520A

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
AC Current ³ – Generate (cont)			
(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 (10 to 30) kHz	9.7 µA + 0.25 µA/mA 7.2 µA + 0.16 µA/mA 5.2 µA + 0.12 µA/mA 8 µA + 0.2 µA/mA 34 µA + 1.1 µA/mA 0.33 mA + 4 µA/mA	Fluke 5720A w/5725A
(0.22 to 2.2) A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	93 µA + 0.26 mA/A 0.18 mA + 0.45 mA/A 1.7 mA + 7 mA/A	Fluke 5520A Fluke 5720A
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.2 mA + 0.46 mA/A 2.5 mA + 0.95 mA/A 8.7 mA + 3.6 mA/A	Fluke 5720A w/5725A
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	18 mA + 1.2 mA/A 22 mA + 1.5 mA/A 0.34 A + 30 mA/A	Fluke 5520A
Clamp-On Only ³			
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 5520A w/coil
(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	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 6} (±)	Comments
AC Current ³ – Measure			
(5 to 100) μA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz	57 nA + 4 nA/μA 45 nA + 1.5 nA/μA 41 nA + 0.64 nA/μA	Agilent 3458A
(0.05 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 + 4.1 μA/mA 0.31 μA + 1.6 μA/mA 0.26 μA + 0.67 μA/mA 0.25 μA + 0.37 μA/mA 0.26 μA + 0.67 μA/mA 0.63 μA + 4.1 μA/mA 1.8 μA + 5.6 μA/mA	
(0.05 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 + 4.1 μA/mA 2.3 μA + 1.6 μA/mA 2.3 μA + 0.67 μA/mA 2.3 μA + 0.37 μA/mA 2.3 μA + 0.67 μA/mA 4.5 μA + 4.1 μA/mA 16 μA + 5.6 μA/mA	
(5 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 + 4.1 μA/mA 30 μA + 1.6 μA/mA 25 μA + 0.6 μA/mA 24 μA + 0.37 μA/mA 25 μA + 0.6 μA/mA 62 μA + 4 μA/mA 0.18 mA + 5.5 μA/mA	
(0.05 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 + 4.1 mA/A 0.3 mA + 1.7 mA/A 0.26 mA + 0.9 mA/A 0.27 mA + 1.1 mA/A 0.378 mA + 3.1 mA/A 0.92 mA + 10 mA/A	
	Up to 50 Hz 100 Hz to 1 kHz (1 to 4) kHz (4 to 5) kHz	0.02 % 0.016 % 0.021 % 0.032 %	w/Fluke Y5020

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
Capacitance ³ – Generate			Fluke 5520A
(0.19 to 0.3999) nF	10 Hz to 10 kHz	11 pF + 5 pF/nF	
(0.4 to 1.0999) nF	10 Hz to 10 kHz	12 pF + 5 pF/nF	
(1.1 to 3.299) nF	10 Hz to 3 kHz	16 pF + 5 pF/nF	
(3.3 to 10.999) nF	(10 to 1000) Hz	19 pF + 2.5 pF/nF	
(11 to 32.9999) nF	(10 to 1000) Hz	0.13 nF + 2.5 pF/nF	
(33 to 109.999) nF	(10 to 1000) Hz	0.18 nF + 2.5 pF/nF	
(110 to 329.99) nF	(10 to 1000) Hz	0.58 nF + 2.5 pF/nF	
(0.33 to 1.0999) μF	(10 to 600) Hz	1.8 nF + 2.6 nF/μF	
(1.1 to 3.2999) μF	(10 to 300) Hz	5.8 nF + 2.5 nF/μF	
(3.3 to 10.999) μF	(10 to 150) Hz	18 nF + 2.5 nF/μF	
(11 to 32.999) μF	(10 to 120) Hz	74 nF + 4 nF/μF	
(33 to 109.99) μF	(10 to 80) Hz	0.25 μF + 4.5 nF/μF	
(110 to 329.99) μF	Up to 50 Hz	0.8 μF + 4.5 nF/μF	
(0.33 to 1.0999) mF	Up to 20 Hz	2.5 μF + 4.5 μF/mF	
(1.1 to 3.2999) mF	Up to 6 Hz	8.5 μF + 4.4 μF/mF	
(3.3 to 10.999) mF	Up to 2 Hz	41 μF + 3.5 μF/mF	
(11 to 32.999) mF	Up to 0.6 Hz	0.11 mF + 7.5 μF/mF	
(33 to 110) mF	Up to 0.2 Hz	0.46 mF + 11 μF/mF	
Fixed Points			
1 pF	1 kHz	0.56 fF	Agilent 16380A
10 pF		3.7 fF	
100 pF		35 fF	
1000 pF		0.35 pF	
10 nF		1.4 pF	Agilent 16380AC
100 nF		7.7 pF	
1 μF		0.45 nF	

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
Inductance ³ – Generate, Fixed Points			
100 μH	100 Hz 200 Hz 400 Hz 1 kHz 10 kHz	0.48 μH 0.18 μH 74 nH 95 nH 76 nH	GenRad 1482 series
1 mH	100 Hz 200 Hz 400 Hz 1 kHz 10 kHz	0.27 μH 0.72 μH 0.49 μH 0.6 μH 0.47 μH	
10 mH	100 Hz 200 Hz 400 Hz 1 kHz 10 kHz	0.77 μH 0.82 μH 0.49 μH 0.46 μH 0.57 μH	
100 mH	100 Hz, 200 Hz 400 Hz, 1 kHz, 10 kHz	3.8 μH 3.7 μH	
1 H	100 Hz, 200 Hz, 400 Hz, 1 kHz	37 μH	
10 H	100 Hz, 200 Hz, 400 Hz, 1 kHz	68 μH	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of RTDs ³ – 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	0.051 °C 0.051 °C 0.071 °C 0.091 °C 0.1 °C 0.12 °C 0.23 °C	Fluke 5520A

Parameter/Equipment	Range	CMC ^{2, 4, 5, 6} (±)	Comments
Thermocouple ³ – Indicating Systems & Measure			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.5 °C 0.16 °C 0.14 °C 0.16 °C 0.21 °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	0.27 °C 0.16 °C 0.14 °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 1372) °C	0.33 °C 0.18 °C 0.16 °C 0.26 °C 0.4 °C	
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 0.4 °C	
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 0.25 °C 0.18 °C 0.16 °C	
AC Power – Measuring Equipment ³			
PF = 1, (45 to 65) Hz	Up to 1020 V		Fluke 5520A
(3.3 to 32.999) mA	Up to 33 W	0.13 %	
(33 to 329.99) mA	(33 to 330) W	0.078 %	
330 mA to 1.099 99 A	(0.33 to 1.1) kW	0.09 %	
(1.1 to 2.9999) A	(1.1 to 3) kW	0.094 %	
(3 to 10.9999) A	(3 to 11) kW	0.11 %	
(11 to 20.5) A	(11 to 20.9) kW	0.18 %	

Parameter/Equipment	Range	CMC ^{2, 4, 5, 6} (±)	Comments
DC Power – Measuring Equipment (0.33 to 3.2999) mA (3.3 to 32.999) mA (33 to 329.99) mA 330 mA to 2.9999 A (3 to 20.5) A	Up to 1020 V Up to 3 W (3 to 30) W (30 to 300) W (0.3 to 3) kW (3 to 20.9) kW	 0.019 % 0.016 % 0.02 % 0.04 % 0.11 %	Fluke 5520A
Phase ³ – (10 to 65) Hz, PF (0 to 1)	(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° 0.25° 0.5° 2.5° 5° 10°	Fluke 5520A
Phase Angle ³ – Measure (0 to 359.9) °	(10 to 50) Hz 50 Hz to 10 kHz (10 to 50) kHz (50 to 500) kHz	0.42° 0.13° 0.99° 1°	Dranetz 305C

Parameter/Range	Frequency	CMC ^{2, 5, 6} (±)	Comments
Distortion ³ (THD) (-60 to 0) dB	20 Hz to 20 kHz (20 to 100) kHz	1.2 dB 2.3 dB	Agilent 8903B
(-145 to 0) dB (-147 to 0) dB (-143 to 0) dB (-140 to 0) dB (-136 to 0) dB (-139 to 0) dB (-127 to 0) dB	100 kHz to 2.9 GHz (2.9 to 6.46) GHz (6.46 to 13.2) GHz (13.2 to 22) GHz (22 to 26.5) GHz (26.5 to 31.15) GHz (31.15 to 50) GHz	2.3 dB 2.7 dB 3.3 dB 3.6 dB 3.3 dB 4 dB 4.1 dB	HP 8565EC

Parameter/Equipment	Range	CMC ^{2, 4, 5, 6} (±)	Comments
Oscilloscopes ³ –			
Squarewave Signal 50 Ω 1 MΩ	1 mV _{p-p} to 6.6 V _{p-p} 10 Hz to 10 kHz	91 μV + 4.4 mV/V	Fluke 5520A/SC1100
	1 mV _{p-p} to 130 V _{p-p} 10 Hz to 1 kHz (1 to 10) kHz	0.2 mV + 0.8 mV/V 0.24 mV + 2 mV/V	
DC Signal 50 Ω 1 MΩ	(0 to ± 6.6) V (0 to ± 130) V	33 μV + 2 mV/V 33 μV + 0.39 mV/V	
Leveled Sine Wave Amplitude – Range: 5 mV to 5.5 V _{p-p}	50 kHz reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) 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	
	(600 to 1100) MHz	0.58 mV + 67 mV/V	
Time Marker into 50 Ω	5 s to 50 ms 20 ms to 1 ns	0.000 63 % + t x 0.1 % 0.000 52 %	
Edge into 50 Ω	(200 to 300) ps 100 kHz to 2 MHz	82 ps	
	(200 to 350) ps (2 to 10) MHz	82 ps	

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2, 5, 6} (±)	Comments
Power Meter – Power Reference, @ 1 mW	50 MHz	1.1 %	Agilent 432A w/478A, 3458A

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments		
Relative Power (Tuned RF Level) – Measure					
(0 to -10) dB	100 kHz to 1.3 GHz	0.047 dB	8902A		
(-10 to -20) dB		0.06 dB			
(-20 to -30) dB		0.074 dB			
(-30 to -40) dB		0.087 dB			
(-40 to -50) dB		0.1 dB			
(-50 to -60) dB		0.096 dB			
(-60 to -70) dB		0.11 dB			
(-70 to -80) dB		0.12 dB			
(-80 to -90) dB		0.13 dB			
(-90 to -100) dB		0.15 dB			
(-100 to -110) dB		0.15 dB			
(-110 to -120) dB		0.28 dB			
(-120 to -127) dB		0.29 dB			
(0 to -10) dB		(1.3 to 26.5) GHz		0.066 dB	w/Sensor
(-10 to -20) dB				0.06 dB	
(-20 to -30) dB	0.074 dB				
(-30 to -40) dB	0.087 dB				
(-40 to -50) dB	0.1 dB				
(-50 to -60) dB	0.096 dB				
(-60 to -70) dB	0.11 dB				
(-70 to -80) dB	0.12 dB				
(-80 to -90) dB	0.13 dB				
(-90 to -100) dB	0.15 dB				
(-100 to -110) dB	0.15 dB				
(-110 to -120) dB	0.28 dB				
(-120 to -127) dB	0.29 dB				
Frequency Modulation – Measure					
Rate: 20 Hz to 10 kHz Dev.: ≤ 40 kHz Peak	250 kHz to 10 MHz		33 Hz + 16 Hz/kHz	HP 8902A	
Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz Peak	10 MHz to 1.3 GHz	0.34 kHz + 8 Hz/kHz			
Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz Peak	10 MHz to 1.3 GHz	1.6 kHz + 39 Hz/kHz			
Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz Peak	(1.3 to 26.5) GHz	0.34 kHz + 8 Hz/kHz			
Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz Peak	(1.3 to 26.5) GHz	1.6 kHz + 39 Hz/kHz			

Parameter/Range	Frequency	CMC ^{2,4,5} (\pm)	Comments
Amplitude Modulation – Measure			
Rate: 50 Hz to 10 kHz Depths: (5 to 99) %	150 kHz to 10 MHz	0.14 % depth + 0.024 % depth/% depth	HP 8902A
Rate: 20 Hz to 10 kHz Depths: Up to 99 %	150 kHz to 10 MHz	0.11 % depth + 0.023 % depth/% depth	
Rate: 50 Hz to 50 kHz Depths: (5 to 99) %	10 MHz to 1.3 GHz	0.15 % depth + 0.01 % depth/% depth	
Rate: 20 Hz to 100 kHz Depths: Up to 99 %	10 MHz to 1.3 GHz	0.11 % depth + 0.023 % depth/% depth	
Rate: 50 Hz to 50 kHz Depths: (5 to 99) %	(1.3 to 26.5) GHz	1.2 % depth + 0.004 % depth/% depth	
Rate: 20 Hz to 100 kHz Depths: Up to 99 %	(1.3 to 26.5) GHz	1.2 % depth + 0.015 % depth/% depth	
Phase Modulation – Measure	Carrier:		
Rate: 200 Hz to 10 kHz (0 to 100) rad	$150 \text{ kHz} \leq fc < 10 \text{ MHz}$	36 mrad + 37 mrad/rad	HP 8902A
Rate: 200 Hz to 20 kHz (0 to 100) rad	$10 \text{ MHz} \leq fc < 1.3 \text{ GHz}$	36 mrad + 37 mrad/rad	
Rate: 200 Hz to 20 kHz (0 to 100) rad	$10 \text{ MHz} \leq fc < 26.5 \text{ GHz}$	36 mrad + 37 mrad/rad	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 6} (±)	Comments
Absolute Power – Measure			Agilent 437B / E4418B:
(-30 to +20) dBm	100 kHz to 4.2 GHz (4.2 to 18) GHz (18 to 26.5) GHz (26.5 to 34) GHz (34 to 38) GHz (38 to 50) GHz	3.6 % 3.7 % 3.9 % 4 % 4.1 % 4.5 %	8482A 8481A 8485A 8487A
(-70 to -30) dBm	10 MHz to 18 GHz (18 to 20) GHz (20 to 26) GHz (26 to 28) GHz (28 to 34) GHz (34 to 38) GHz (38 to 42) GHz (42 to 49) GHz (49 to 50) GHz	4.3 % 4.7 % 4.9 % 5.1 % 6.6 % 7.7 % 9.4 % 10 % 12 %	8487D
(-30 to +20) dBm – 75 Ω	100 kHz to 2 GHz	3.7 %	8483A

IV. Mechanical

Parameter/Equipment	Range	CMC ^{2, 5, 6} (±)	Comments
Accelerometers ³ Voltage Sensitivity – Frequency Response (100 mV/g)			
(1 to 10) g	(5 to < 10) Hz (10 to < 100) Hz 100 Hz (ref) > 100 Hz to 1 kHz (> 1 to 5) kHz (> 5 to 10) kHz	3.4 % 2 % 1.5 % 1.7 % 2.2 % 2.6 %	9155C vibration calibration system
Balance & Scales ³ – For Equipment With Resolutions From 100 mg to 10 g	1 mg to 55 kg Up to 4800 lbs	1.2R 1.2R	Class 1 & 3 weights Class 6 & F weights <i>R = Unit Under Test Resolution</i>
Force Gages ³	Up to 4800 lbf	0.012 %	Class 6 & F weights

Parameter/Equipment	Range	CMC ^{2, 5, 6, 7} (±)	Comments
Torque Tools ³	(4 to 50) lbf·in (50 to 400) lbf·in (400 to 1000) lbf·in (83 to 250) lbf·ft (250 to 600) lbf·ft	0.32 % 0.35 % 0.31 % 0.32 % 0.3 %	CDI SureTest transducers & display
Pressure – Measuring Equipment ³ –			
Pneumatic	(> 0 to 115) psi (115 to 1015) psi (8 to 17) psia (-13.5 to < 0) psiv (> 0 to 100) psig (100 to 1000) psig (1000 to 5000) psig (0 to 1) inH ₂ O (0 to 10) inH ₂ O	0.0066 psi + 0.000 058 psi/psi 0.06 psi + 0.000 06 psi/psi 0.000 94 psi + 0.000 12 psi/psi 0.067 psi 0.069 psi 0.59 psi 4.6 psi 0.0064 inH ₂ O 0.037 inH ₂ O	Mensor CPC6050 Process calibrator w/: 700PD6 700PD6 700P08 700P30 700P01 700P00
Hydraulic	(10 to 500) psig (100 to 10 000) psig (0 to 1000) psig (1000 to 10 000) psig	0.024 % 0.023 % 0.24 psi + 0.000 048 psi/psi 2.5 psi + 0.000 018 psi/psi	Ametek DM-T-100 DWT Additel ADT672-1K Additel ADT672-10K

V. Thermodynamics

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Relative Humidity ³ – Measure	(10 to 90) % RH	1.4 % RH	Vaisala HM41/HMP46 & HM70/HMP77B
Temperature ³ – Measure	(-195 to < 0) °C (0 to 420) °C	0.27 °C 0.14 °C	Burns 12001 PRT w/ Fluke 2180A
Relative Humidity – Measuring Equipment	Approx. (11, 32, 52 & 75) % RH	1.4 % RH	Vaisala HM41/HMP46 & HM70/HMP77B w/salt solutions & chamber
Temperature – Measuring Equipment	0 °C	0.14 °C	Burns 12001 PRT w/ Fluke 2180A, ice bath

VI. Time & Frequency

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Frequency	10 MHz	10 µHz	GPS-controlled rubidium
Frequency – Measuring Equipment	1 µHz to 20 MHz 20 MHz to 50 GHz	0.58 µHz + 29 pHz/Hz 0.58 mHz + 1.2 pHz/Hz	GPS-controlled rubidium w/function or signal generator
Frequency – Measure	1 mHz to 225 MHz 225 MHz to 26.5 GHz (26.5 to 50) GHz	58 pHz + 59 pHz/Hz 1.3 Hz 2.4 Hz	GPS-controlled rubidium w/counter or spectrum analyzer
Tachometers – Optical	(1 to 100 000) rpm	0.000 54 rpm + 0.000 038 rpm/rpm	3325B w/LED

¹ This laboratory offers commercial calibration service and field calibration service.

- 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 The stated measured values are determined using the indicated instruments (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 CMC components that can be reasonably attributed to the Unit Under Test have not been utilized in the calculation of the CMC value of this measurement parameter.
- ⁶ In the statement of CMC, percentages are to be read as percent of reading unless indicated otherwise; R is the resolution of the unit under test.
- 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.
- ⁸ This scope meets A2LA's P112 *Flexible Scope Policy*.



Accredited Laboratory

A2LA has accredited

TRESCAL, INC.

Boonton, NJ

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 and the requirements of 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 this 14th day of September 2022.

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

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2353.01
Valid to March 31, 2024

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