



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

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CALIBRATION

Valid To: May 31, 2023

Certificate Number: 3449.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 5}:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
DC Voltage – Generate	(0 to 330) mV (0 to 3.3) V (0 to 33) V (30 to 330) V (100 to 1000) V	23 μV/V + 1.0 μV 13 μV/V + 2.0 μV 14 μV/V + 20 μV 20 μV/V + 0.15 mV 20 μV/V + 1.5 mV	Fluke 5522A
DC Voltage – Measure	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	9 μV/V + 0.32 μV 5.6 μV/V + 0.32 μV 5.6 μV/V + 0.51 μV 7.4 μV/V + 32 μV 11 μV/V + 0.10 μV	Keysight 3458A, option 002
DC Current – Generate	(0 to 330) μA (0 to 3.3) mA (0 to 33) mA (0 to 330) mA (0 to 1.1) A (1.1 to 3) A (0 to 11) A (11 to 20.5) A	0.017 % + 20 nA 0.011 % + 50 nA 0.012 % + 0.25 μA 0.011 % + 2.5 μA 0.023 % + 40 μA 0.043 % + 40 μA 0.055 % + 0.50 mA 0.11 % + 0.75 mA	Fluke 5522A

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
DC Current – Measure	(0 to 100) μ A (0 to 1.0) mA (0 to 10) mA (0 to 100) mA (0 to 1.0) A	31 μ A/A + 0.81 nA 26 μ A/A + 5.1 nA 28 μ A/A + 51 nA 67 μ A/A + 0.51 μ A 0.013 % + 1 μ A	Keysight 3458A, option 002
Resistance – Generate	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) k Ω (1.1 to 3.3) k Ω (3.3 to 11) k Ω (11 to 33) k Ω (33 to 110) k Ω (110 to 330) k Ω (0.33 to 1.1) M Ω (1.1 to 3.3) M Ω (3.3 to 11) M Ω (11 to 33) M Ω (33 to 110) M Ω (110 to 330) M Ω (330 to 1100) M Ω	54 $\mu\Omega/\Omega$ + 0.0010 Ω 35 $\mu\Omega/\Omega$ + 0.0015 Ω 32 $\mu\Omega/\Omega$ + 0.0014 Ω 32 $\mu\Omega/\Omega$ + 0.0020 Ω 32 $\mu\Omega/\Omega$ + 0.0020 Ω 33 $\mu\Omega/\Omega$ + 0.020 Ω 32 $\mu\Omega/\Omega$ + 0.020 Ω 34 $\mu\Omega/\Omega$ + 0.20 Ω 33 $\mu\Omega/\Omega$ + 0.20 Ω 37 $\mu\Omega/\Omega$ + 2.0 Ω 37 $\mu\Omega/\Omega$ + 2.0 Ω 110 $\mu\Omega/\Omega$ + 30 Ω 0.029 % + 5 k Ω 0.12 % + 2.5 k Ω 0.68 % + 3.0 k Ω 0.38 % + 0.10 M Ω 1.8 % + 0.50 M Ω	Fluke 5522A
Resistance – Measure	(0 to 10) Ω (10 to 100) Ω (0.10 to 1) k Ω (1 to 10) k Ω (10 to 100) k Ω (0.10 to 1) M Ω (1 to 10) M Ω (10 to 100) M Ω	21 $\mu\Omega/\Omega$ + 51 $\mu\Omega$ 18 $\mu\Omega/\Omega$ + 0.51 m Ω 15 $\mu\Omega/\Omega$ + 0.51 m Ω 15 $\mu\Omega/\Omega$ + 5.1 m Ω 17 $\mu\Omega/\Omega$ + 51 m Ω 20 $\mu\Omega/\Omega$ + 2.2 Ω 63 $\mu\Omega/\Omega$ + 0.10 k Ω 0.096 % + 1.0 k Ω	Keysight 3458A, option 002

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Generate			
(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 500) kHz	0.096 % + 6.0 μV 0.032 % + 6.0 μV 0.039 % + 6.0 μV 0.14 % + 6.0 μV 0.45 % + 12 μV 1.0 % + 50 μV	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 500) kHz	0.050 % + 8.0 μV 0.033 % + 8.0 μV 0.040 % + 8.0 μV 0.10 % + 8.0 μV 0.25 % + 32 μV 0.57 % + 70 μV	
(0.33 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 500) kHz	0.050 % + 50 μV 0.028 % + 60 μV 0.041 % + 60 μV 0.099 % + 50 μV 0.25 % + 0.13 mV 0.60 % + 0.60 mV	
(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	0.045 % + 0.65 mV 0.021 % + 0.60 mV 0.032 % + 0.60 mV 0.070 % + 0.60 mV 0.22 % + 1.6 mV	
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.024 % + 2.0 mV 0.030 % + 6.0 mV 0.047 % + 6.0 mV 0.13 % + 6.0 mV 0.25 % + 50 mV	
(330 to 1000) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.047 % + 10 mV 0.041 % + 10 mV 0.050 % + 10 mV	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Measure			
(0 to 10) mV	40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 100 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz	0.026 % + 2.3 μV 0.038 % + 2.3 μV 0.11 % + 2.3 μV 0.58 % + 2.3 μV 4.4 % + 2.8 μV 18 % + 5.4 μV 7.8 % + 7.3 μV 22 % + 8.2 μV	Keysight 3458A, option 002
(10 to 100) mV	40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.011 % + 2.0 μV 0.021 % + 2.0 μV 0.035 % + 2.0 μV 0.20 % + 2.0 μV 0.45 % + 10 μV 1.1 % + 10 μV 4.4 % + 70 μV 4.5 % + 80 μV 17 % + 0.10 mV	
(0.1 to 1) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.011 % + 20 μV 0.021 % + 20 μV 0.062 % + 20 μV 0.19 % + 20 μV 0.45 % + 0.10 mV 1.1 % + 0.10 mV 4.3 % + 0.70 mV 4.5 % + 0.80 mV 17 % + 1.0 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 300 kHz to 1 MHz (1 to 2) MHz (1 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.023 % + 0.40 mV 0.011 % + 0.20 mV 0.019 % + 0.20 mV 0.062 % + 0.20 mV 0.19 % + 0.20 mV 1.2 % + 1.0 mV 3.7 % + 1.0 mV 5.5 % + 1.0 mV 4.4 % + 7.0 mV 4.4 % + 8.0 mV 17 % + 10 mV	
(10 to 100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.023 % + 2.0 mV 0.029 % + 2.0 mV 0.072 % + 2.0 mV 0.23 % + 2.0 mV 0.47 % + 10 mV	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Measure (cont) (100 to 700) V	40 Hz to 1 kHz (1 to 20) kHz	0.047 % + 20 mV 0.067 % + 20 mV	Keysight 3458A, option 002
AC Current – Generate (30 to 330) 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	0.22 % + 0.10 µA 0.17 % + 0.10 µA 0.14 % + 0.10 µA 0.33 % + 0.15 µA 1.1 % + 0.20 µA 1.8 % + 0.40 µA	Fluke 5522A
(0.33 to 3.3) 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	0.22 % + 0.15 µA 0.14 % + 0.15 µA 0.11 % + 0.15 µA 0.22 % + 0.20 µA 0.56 % + 0.30 µA 1.1 % + 0.60 µA	
(3.3 to 33) 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	0.20 % + 2.0 µA 0.10 % + 2.0 µA 0.048 % + 2.0 µA 0.090 % + 2.0 µA 0.22 % + 3.0 µA 0.46 % + 4.0 µA	
(33 to 330) 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	0.20 % + 20 µA 0.10 % + 20 µA 0.047 % + 20 µA 0.11 % + 50 µA 0.22 % + 0.10 mA 0.45 % + 0.20 mA	
(0.33 to 1) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.20 % + 0.10 mA 0.057 % + 0.10 mA 0.66 % + 1.0 mA 2.7 % + 5.0 mA	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Current – Generate (cont)			
(1 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	5.3 % + 0.10 mA 5.9 % + 0.10 mA 2.7 % + 1.0 mA 6.4 % + 5.0 mA	Fluke 5522A
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.17 % + 2.0 mA 0.20 % + 2.0 mA 3.3 % + 2.0 mA	
(11 to 20) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.18 % + 5.0 mA 2.3 % + 5.0 mA 3.3 % + 5.0 mA	
AC Current – Measure			
(0 to 100) μA	100 Hz to 5 kHz	0.070 % + 30 nA	Keysight 3458A, option 002
(0.1 to 1) mA	100 Hz to 5 kHz	0.038 % + 0.20 μA	
(1 to 10) mA	100 Hz to 5 kHz	0.037 % + 2.0 μA	
(10 to 100) mA	100 Hz to 5 kHz	0.037 % + 20 μA	
(0.1 to 1) A	100 Hz to 5 kHz	0.11 % + 0.20 mA	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Electrical Simulation of Thermocouples – Generate and Measure			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.55 °C 0.18 °C 0.15 °C 0.18 °C 0.23 °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	0.30 °C 0.18 °C 0.16 °C 0.19 °C 0.26 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.37 °C 0.20 °C 0.18 °C 0.29 °C 0.44 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.44 °C 0.24 °C 0.21 °C 0.20 °C 0.30 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.63 °C 0.36 °C 0.17 °C 0.44 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.52 °C 0.40 °C 0.41 °C 0.51 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.69 °C 0.26 °C 0.18 °C 0.15 °C	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Electrical Simulation of Thermocouples – Generate ³			
Type J	(-210 to -100) °C (-100 to 800) °C (800 to 1200) °C	1.6 °C 1.6 °C 1.6 °C	Fluke753, AMS 2750
Type K	(-200 to -100) °C (-100 to 400) °C (400 To 1200) °C (1200 to 1372) °C	1.6 °C 1.6 °C 1.6 °C 1.6 °C	
Type N	(-200 to -100) °C (-100 to 900) °C (900 to 1300) °C	1.6 °C 1.6 °C 1.6 °C	
Type R	(-20 to 0) °C (0 to 100) °C (100 to 1767) °C	1.9 °C 1.8 °C 1.7 °C	
Type S	(-20 to 0) °C (0 to 200) °C (200 to 1400) °C (1400 to 1767) °C	1.9 °C 1.8 °C 1.7 °C 1.8 °C	
Type T	(-250 to -200) °C (-200 to 0) °C (0 to 400) °C	1.7 °C 1.6 °C 1.6 °C	
Type K	(-200 to 0) °C (0 to 1000) °C (1000 to 1372) °C	1.7 °C 1.6 °C 1.7 °C	
Type N	(-200 to 0) °C (0 to 1300) °C	1.8 °C 1.6 °C	

II. Mechanical

Parameter/Equipment	Range	CMC ^{2, 4, 6} (±)	Comments
Gauge Pressure – Generate			
Pneumatic Pressure	(0.3 to 5) psi (1.5 to 50) psi (15 to 500) psi	0.031 % 0.021 % 0.029 %	CEC 6-201
Hydraulic Pressure	(87 to 870) psi (870 to 40 000) psi	0.018 % 0.017 %	Budenberg CPB3800HP

III. Thermodynamics

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
Ovens, Furnaces, Autoclaves, Freezers, Incubators, and Environmental Chambers ³ –			AMS 2750F
Uniformity Survey			
Type K & N	(0 to 392) °C (392 to 1093) °C (1093 to 1344) °C	1.6 °C 1.7 °C 2.7 °C	Fluke data acquisition, switch unit, special limits of error
System Accuracy Test			
Type K	(-200 to 0) °C (0 to 1093) °C (1093 to 1372) °C	1.8 °C 1.9 °C 2.7 °C	Fluke 753
	(-200 to 1000) °C (1000 to 1372) °C	1.9 °C 2.7 °C	Fluke 726
Type N	(-200 to -100) °C (-100 to 0) °C (0 to 1093) °C (1093 to 1300) °C	2.0 °C 1.8 °C 1.9 °C 2.7 °C	Fluke 753
	(-200 to 0) °C (0 to 1093) °C (1093 to 1300) °C	2.0 °C 1.9 °C 2.7 °C	Fluke 726

Parameter/Equipment	Range	CMC ^{2, 6, 7} (±)	Comments
Temperature – Measure	(-39 to 0) °C 0 °C (0 to 232) °C (232 to 420) °C (420 to 660) °C	0.016 °C 0.015 °C 0.029 °C 0.031 °C 0.040 °C	Fluke 1502A w/ Fluke 5628
Temperature – Measuring Equipment	(-25 to 0) °C 0 °C (0 to 80) °C (40 to 232) °C (232 to 420) °C (420 to 650) °C (-70 to 80) °C	0.16 °C 0.16 °C 0.19 °C 0.69 °C 0.69 °C 0.70 °C 0.28 °C	Fluke 1502A & 5628 w/ Kaye LTR-50 Fluke 1502A & 5628 w/ Wika CTD9100 Optica dew point monitor w/ Tenney UTRC-W4F-C environmental chamber
Relative Humidity – Measuring Equipment	(20 to 50) % RH 50 % RH (50 to 90) % RH	0.78 % RH 0.80 % RH 0.85 % RH	Optica dew point monitor w/ Tenney UTRC-W4F-C environmental chamber

¹ This laboratory offers commercial laboratory 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 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. CMCs 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 This scope meets A2LA's *P112 Flexible Scope Policy*.

⁶ In the statement of CMC, the percentage value is defined as the percentage of reading.

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.



Accredited Laboratory

A2LA has accredited

FLW SERVICE CORPORATION

Huntington Beach, CA

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/NCCL Z540-1-1994 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 21st day of May 2021.

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

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3449.01
Valid to May 31, 2023

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