



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1-1994

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CALIBRATION

Valid To: May 31, 2019

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 calibrations¹:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,3} (±)	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 μ V/V + 1.0 μ V 12 μ V/V + 2.0 μ V 14 μ V/V + 20 μ V 20 μ V/V + 0.15 mV 20 μ V/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	11 μ V/V + 0.32 μ V 5.9 μ V/V + 0.32 μ V 5.8 μ V/V + 0.51 μ V 9.5 μ V/V + 32 μ V 12 μ V/V + 0.10 μ V	Keysight 3458A, option 002
DC Current – Generate	(0 to 330) μ A (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 μ A 0.012 % + 2.5 μ A 0.022 % + 40 μ A 0.042 % + 40 μ A 0.057 % + 0.50 mA 0.12 % + 0.75 mA	Fluke 5522A

Parameter/Equipment	Range	CMC ^{2,3} (±)	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	34 μ A/A + 0.81 nA 31 μ A/A + 5.1 nA 31 μ A/A + 51 nA 50 μ A/A + 0.51 μ A 0.014 % + 10 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	53 $\mu\Omega/\Omega$ + 0.0010 Ω 34 $\mu\Omega/\Omega$ + 0.0015 Ω 32 $\mu\Omega/\Omega$ + 0.0014 Ω 31 $\mu\Omega/\Omega$ + 0.0020 Ω 31 $\mu\Omega/\Omega$ + 0.0020 Ω 31 $\mu\Omega/\Omega$ + 0.020 Ω 31 $\mu\Omega/\Omega$ + 0.020 Ω 31 $\mu\Omega/\Omega$ + 0.020 Ω 32 $\mu\Omega/\Omega$ + 0.20 Ω 31 $\mu\Omega/\Omega$ + 0.20 Ω 31 $\mu\Omega/\Omega$ + 0.20 Ω 36 $\mu\Omega/\Omega$ + 2.0 Ω 37 $\mu\Omega/\Omega$ + 2.0 Ω 69 $\mu\Omega/\Omega$ + 30 Ω 0.014 % + 50 Ω 0.028 % + 2.5 k Ω 0.059 % + 3.0 k Ω 0.33 % + 0.10 M Ω 1.6 % + 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	20 $\mu\Omega/\Omega$ + 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 15 $\mu\Omega/\Omega$ + 51 m Ω 20 $\mu\Omega/\Omega$ + 2.2 Ω 59 $\mu\Omega/\Omega$ + 0.10 k Ω 0.068 % + 1.0 k Ω	Keysight 3458A, option 002

Parameter/Range	Frequency	CMC ^{2,3} (±)	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	0.089 % + 6.0 μV 0.023 % + 6.0 μV 0.026 % + 6.0 μV 0.11 % + 6.0 μV 0.38 % + 12 μV 0.88 % + 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	0.033 % + 8.0 μV 0.016 % + 8.0 μV 0.018 % + 8.0 μV 0.040 % + 8.0 μV 0.088 % + 32 μV 0.23 % + 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	0.033 % + 50 μV 0.017 % + 60 μV 0.021 % + 60 μV 0.033 % + 50 μV 0.077 % + 0.13 mV 0.27 % + 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	0.033 % + 0.65 mV 0.017 % + 0.60 mV 0.027 % + 0.60 mV 0.039 % + 0.60 mV 0.099 % + 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	0.021 % + 2.0 mV 0.022 % + 6.0 mV 0.028 % + 6.0 mV 0.036 % + 6.0 mV 0.22 % + 50 mV	
(330 to 1000) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.034 % + 10 mV 0.058 % + 10 mV 0.046 % + 10 mV	

Parameter/Range	Frequency	CMC ^{2,3} (±)	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	0.045 % + 2.3 μV 0.052 % + 2.3 μV 0.12 % + 2.3 μV 0.55 % + 2.3 μV 4.4 % + 2.8 μV 1.4 % + 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	0.012 % + 2.0 μV 0.019 % + 2.0 μV 0.034 % + 2.0 μV 0.10 % + 2.0 μV 0.34 % + 10 μV 1.1 % + 10 μV 4.4 % + 70 μV 4.4 % + 80 μV 16 % + 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 0.019 % + 20 μV 0.037 % + 20 μV 0.091 % + 20 μV 0.33 % + 0.10 mV 1.1 % + 0.10 mV 4.4 % + 0.70 mV 4.4 % + 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	0.012 % + 0.40 mV 0.011 % + 0.20 mV 0.018 % + 0.20 mV 0.037 % + 0.20 mV 0.089 % + 0.20 mV 1.1 % + 1.0 mV 3.7 % + 1.0 mV 5.5 % + 1.0 mV 4.4 % + 7.0 mV 4.5 % + 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	0.025 % + 2.0 mV 0.028 % + 2.0 mV 0.043 % + 2.0 mV 0.14 % + 2.0 mV 0.43 % + 10 mV	

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
AC Voltage – Measure (cont) (100 to 700) V	40 Hz to 1 kHz (1 to 20) kHz	0.046 % + 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 0.16 % + 0.10 µA 0.14 % + 0.10 µA 0.33 % + 0.15 µA 0.88 % + 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 0.55 % + 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 0.050 % + 2.0 µA 0.097 % + 2.0 µA 0.22 % + 3.0 µA 0.44 % + 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 0.045 % + 20 µA 0.11 % + 50 µA 0.22 % + 0.10 mA 0.44 % + 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 0.058 % + 0.10 mA 0.66 % + 1.0 mA 2.7 % + 5.0 mA	

Parameter/Range	Frequency	CMC ^{2,3} (±)	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	0.20 % + 0.10 mA 0.077 % + 0.10 mA 0.66 % + 1.0 mA 2.7 % + 5.0 mA	Fluke 5522A
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.069 % + 2.0 mA 0.11 % + 2.0 mA 3.5 % + 2.0 mA	
(11 to 20) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.15 % + 5.0 mA 0.17 % + 5.0 mA 3.3 % + 5.0 mA	
AC Current – Measure			
(0 to 100) μA	100 Hz to 5 kHz	0.079 % + 30 nA	Keysight 3458A, option 002
(0.1 to 1) mA	100 Hz to 5 kHz	0.037 % + 0.20 μA	
(1 to 10) mA	100 Hz to 5 kHz	0.042 % + 2.0 μA	
(10 to 100) mA	100 Hz to 5 kHz	0.042 % + 20 μA	
(0.1 to 1) A	100 Hz to 5 kHz	0.11 % + 0.20 mA	

Parameter/Equipment	Range	CMC ² (±)	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	0.40 °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	

II. Mechanical

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Gauge Pressure – Generate			
Pneumatic Pressure and Vacuum	(-5 to 5) psi (-14.7 to 50) psi (15 to 500) psi	0.022 % 0.029 % 0.034 %	CEC 6-201
Hydraulic Pressure	(60 to 30 000) psi	0.046 %	Ruska 2481

¹ This laboratory offers commercial 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 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.

⁴ In the statement of CMC, the value is defined as the percentage of reading.



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 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSL 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 8 January 2009).



Presented this 26th day of June 2017.

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

President and CEO
For the Accreditation Council
Certificate Number 3449.01
Valid to May 31, 2019

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