



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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CALIBRATION

Valid To: April 30, 2019

Certificate Number: 1607.01

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 ⁴	CMC ^{2,5} (±)	Comments
DC Voltage ³ – Generate	Up to 329.9999 mV 330 mV to 3.299 999 V (3.3 to 32.9999) V (33 to 329.9999) V (330 to 1000) V	81 μV/V + 3 μV 61 μV/V + 5 μV 120 μV/V + 50 μV 1.0 mV/V + 500 μV 2.8 mV/V + 1.5 mV	Fluke 5500A
DC Voltage ³ – Measure	Up to 200 mV 200 mV to 2 V (2 to 20) V (20 to 200) V (200 to 1000) V	6.1 μV/V + 0.1 μV 4.2 μV/V + 0.4 μV 4.2 μV/V + 4 μV 6.6 μV/V + 40 μV 14 μV/V + 500 μV	Fluke 8508A
DC Current ³ – Generate	(0.3 to 3.29) mA (3.3 to 32.9) mA (33 to 329.9) mA 330 mA to 2 A (2 to 10) A	0.016 % + 0.05 μA 0.013 % + 0.25 μA 0.059 % + 3.3 μA 0.066 % + 44 μA 0.11 % + 330 μA	Fluke 5500A

Parameter/Equipment	Range ⁴	CMC ^{2, 5} (±)	Comments
DC Current ³ – Measure	Up to 200 μ A 200 μ A to 2 mA (2 to 20) mA (20 to 200) mA 200 mA to 2 A (2 to 20) A	15 μ A/A + 0.4 nA 16 μ A/A + 4.0 nA 18 μ A/A + 40.0 nA 60 μ A/A + 800 nA 0.022 % + 16 μ A 0.047 % + 400 μ A	Fluke 8508A
Capacitance ³ – Generate	(0.33 to 11) nF 11 nF to 1.1 μ F (1.1 to 11) μ F (11 to 33) μ F (33 to 110) μ F (110 to 330) μ F 330 μ F to 1 mF	0.6 % + 0.01 nF 0.3 % + 0.1 nF 0.5 % + 10 nF 0.47 % + 30 nF 0.6 % + 100 nF 0.9 % + 300 nF 1.2 % + 300 nF	Fluke 5500A
Resistance ³ – Generate	Up to 10.99 Ω (11 to 32.99) Ω (33 to 109.9) Ω (110 to 329.9) Ω 330 Ω to 1.09 k Ω (1.1 to 3.29) k Ω (3.3 to 10.9) k Ω (11 to 32.9) k Ω (33 to 109.9) k Ω (110 to 329.9) k Ω 330 k Ω to 1.09 M Ω (1.1 to 3.29) M Ω (3.3 to 10.9) M Ω (11 to 32.9) M Ω (33 to 109.9) M Ω (110 to 330) M Ω	0.08 % + 8 m Ω 0.053 % + 15 m Ω 0.03 % + 15 m Ω 0.015 % + 15 m Ω 0.017 % + 0.06 Ω 0.013 % + 0.06 Ω 0.018 % + 0.6 Ω 0.013 % + 0.6 Ω 0.02 % + 6 Ω 0.017 % + 6 Ω 0.024 % + 55 Ω 0.02 % + 55 Ω 0.076 % + 550 Ω 0.12 % + 550 Ω 0.6 % + 5.5 k Ω 0.6 % + 17 k Ω	Fluke 5500A
Resistance ³ – Measure	(0 to 2) Ω (2 to 20) Ω (20 to 200) Ω 200 Ω to 2 k Ω (2 to 20) k Ω (20 to 200) k Ω 200 k Ω to 2 M Ω (2 to 20) M Ω (20 to 200) M Ω 200 M Ω to 2 G Ω	23 $\mu\Omega/\Omega$ + 4 $\mu\Omega$ 13 $\mu\Omega/\Omega$ + 14 $\mu\Omega$ 9.3 $\mu\Omega/\Omega$ + 50 $\mu\Omega$ 9.3 $\mu\Omega/\Omega$ + 500 $\mu\Omega$ 9.3 $\mu\Omega/\Omega$ + 5 m Ω 9.3 $\mu\Omega/\Omega$ + 50 m Ω 11 $\mu\Omega/\Omega$ + 1 Ω 27 $\mu\Omega/\Omega$ + 100 Ω 0.018 % + 10 k Ω 0.19 % + 1 M Ω	Fluke 8508A



Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Resistance ³ – Measure (cont)			
High Voltage	(0 to 20) MΩ (20 to 200) MΩ 200 MΩ to 2 GΩ (2 to 20) GΩ	20 μΩ/Ω + 10 Ω 76 μΩ/Ω + 1 kΩ 0.025 % + 100 kΩ 0.21 % + 10 MΩ	Fluke 8508A

Parameter/Range ⁴	Frequency	CMC ^{2, 5} (±)	Comments
AC Voltage ³ – Generate			
(1 to 33) mV	45 Hz to 10 kHz (10 to 50) kHz (50 to 100) kHz	0.2 % + 20 μV 0.3 % + 20 μV 0.4 % + 33 μV	Fluke 5500A
(33 to 330) mV	45 Hz to 10 kHz (10 to 50) kHz (50 to 100) kHz	0.1 % + 20 μV 0.2 % + 20 μV 0.3 % + 170 μV	
330 mV to 3.3 V	45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.05 % + 60 μV 0.12 % + 60 μV 0.18 % + 300 μV 0.3 % + 1.7 mV	
(3.3 to 33) V	45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.04 % + 600 μV 0.1 % + 2.6 mV 0.22 % + 5 mV 0.3 % + 17 mV	
(33 to 330) V	45 Hz to 20 kHz	0.15 % + 33 μV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 10) kHz	0.08 % + 80 μV 0.25 % + 500 μV	



Parameter/Range ⁴	Frequency	CMC ^{2, 5} (\pm)	Comments
AC Voltage ³ – Measure			
(0 to 200) mV	10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.018 % + 4 μ V 0.04 % + 8 μ V 0.09 % + 20 μ V	Fluke 8508A
200 mV to 2 V	10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.013 % + 20 μ V 0.026 % + 40 μ V 0.07 % + 200 μ V 0.45 % + 2 mV 2.2 % + 20 mV	
(2 to 20) V	10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.013 % + 200 μ V 0.026 % + 400 μ V 0.07 % + 2 mV 0.45 % + 20 mV 2.2 % + 200 mV	
(20 to 200) V	10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.013 % + 2 mV 0.026 % + 4 mV 0.07 % + 20 mV 0.45 % + 200 mV 2.2 % + 2 V	
(200 to 1000) V	10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.06 % + 20 mV 0.07 % + 40 mV 0.1 % + 200 mV	



Parameter/Range ⁴	Frequency	CMC ^{2, 5} (\pm)	Comments
AC Current ³ – Generate			
(0.029 to 0.329) mA	20 Hz to 5 kHz	0.47 % + 0.15 μ A	Fluke 5500A
(0.33 to 3.29) mA	20 Hz to 5 kHz	0.23 % + 0.3 μ A	
(3.3 to 32.9) mA	20 Hz to 1 kHz (1 to 5) kHz	0.12 % + 3 μ A 0.23 % + 3 μ A	
(33 to 329.9) mA	20 Hz to 1 kHz (1 to 5) kHz	0.13 % + 30 μ A 0.24 % + 30 μ A	
330 mA to 2.2 A	45 Hz to 1 kHz (1 to 5) kHz	0.14 % + 300 μ A 0.89 % + 300 μ A	
(2.2 to 11) A	(45 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz	0.094 % + 2 mA 0.14 % + 2 mA 0.41 % + 2 mA	
AC Current ³ – Measure			
(0 to 200) μ A	10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.07 % + 20 nA 0.09 % + 20 nA 0.53 % + 20 nA	Fluke 8508A
200 μ A to 2 mA	10 Hz to 10 kHz (10 to 100) kHz	0.045 % + 200 nA 0.55 % + 200 nA	
(2 to 20) mA	10 Hz to 10 kHz (10 to 100) kHz	0.045 % + 2 μ A 0.55 % + 2 μ A	
(20 to 200) mA	10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.07 % + 20 μ A 0.083 % + 20 μ A 0.6 % + 20 μ A	
200 mA to 2 A	10 Hz to 30 kHz	0.087 % + 200 μ A	
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	0.1 % + 2 mA 0.4 % + 2 mA	



Parameter/Equipment	Range ⁴	CMC ² (±)	Comments
Thermocouple Simulation ³ –			
Type C	0 °C to 150 °C 150 °C to 650 °C 650 °C to 1000 °C 1000 °C to 1800 °C 1800 °C to 2316 °C	0.36 °C 0.31 °C 0.37 °C 0.59 °C 0.98 °C	Fluke 5500A
Type E	-25 °C to 350 °C 350 °C to 650 °C 650 °C to 1000 °C	0.17 °C 0.19 °C 0.25 °C	
Type J	-30 °C to 150 °C 150 °C to 760 °C	0.17 °C 0.20 °C	
Type K	-25 °C to 120 °C 120 °C to 1000 °C 1000 °C to 1372 °C	0.19 °C 0.30 °C 0.47 °C	
Type N	-25 °C to 120 °C 120 °C to 410 °C 410 °C to 1300 °C	0.3 °C 0.3 °C 0.4 °C	
Type R	0 °C to 250 °C 250 °C to 400 °C 400 °C to 1000 °C 1000 °C to 1767 °C	0.67 °C 0.41 °C 0.39 °C 0.47 °C	
Type S	0 °C to 250 °C 250 °C to 1400 °C 1400 °C to 1767 °C	0.55 °C 0.43 °C 0.54 °C	
Type T	-150 °C to 0 °C 0 °C to 120 °C 120 °C to 400 °C	0.28 °C 0.19 °C 0.17 °C	



Parameter/Equipment	Range ⁴	CMC ² (±)	Comments
RTD Simulation ³ – 10 Ω Copper 427 100 Ω Platinum 385 1000 Ω Platinum 385	-100 °C to 260 °C -200 °C to 0 °C 0 °C to 100 °C 100 °C to 300 °C 300 °C to 400 °C 400 °C to 630 °C 630 °C to 800 °C -200 °C to 100 °C 100 °C to 300 °C 300 °C to 600 °C 600 °C to 630 °C	0.35 °C 0.06 °C 0.09 °C 0.11 °C 0.12 °C 0.14 °C 0.27 °C 0.05 °C 0.07 °C 0.08 °C 0.26 °C	Fluke 5500A
RTD ³ – Measure	(2 to 20) Ω 20 Ω to 200 kΩ	13 μΩ/Ω 9.3 μΩ/Ω	Fluke 8508A

II. Thermodynamics

Parameter/Equipment	Range ⁴	CMC ² (±)	Comments
Temperature ³ – Measure	-10 °C to 150 °C 150 °C to 650 °C 650 °C to 1200 °C 1200 °C to 1450 °C	0.06 °C 0.12 °C 2.7 °C 3.3 °C	Hart 5626, Fluke 8508A Hart 5650, Fluke 8508A
Humidity ³ – Measure	(11 to 80) % RH	2.2 % RH	Vaisala HMP45A

III. Time & Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency ³ – Measure	1 Hz to 225 MHz	0.21 μHz/Hz	Agilent 53131A



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 and this laboratory meets A2LA R104 – *General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. 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 Where ranges overlap, the uncertainty for the overlapping specifications will be the lower of the two uncertainties.

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





Accredited Laboratory

A2LA has accredited

ELECTRO-LAB SERVICES, INC.

Evansville, IN

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 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 28th day of July 2017.

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

President and CEO
For the Accreditation Council
Certificate Number 1607.01
Valid to April 30, 2019

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