



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

M & M METROLOGY, INC.
254 South Military Trail
Deerfield Beach, FL 33442
Timothy McLoughlin Phone: 954 426 0111

CALIBRATION

Valid To: June 30, 2020

Certificate Number: 5352.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1,7}:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,6} (\pm)	Comments
DC Voltage – Measure ^{3,8}	100 mV 1 V 10 V 100 V 1000 V	0.38 μ V 2 μ V 16 μ V 180 μ V 1.9 mV	HP 3458A digital multimeter
DC Current – Measure ^{3,8}	100 μ A 1 mA 10 mA 100 mA 1 A	0.97 nA 8.7 nA 65 nA 0.74 μ A 30 μ A	HP 3458A digital multimeter
DC Voltage – Generate ³	220 mV 2.2 V 11 V 22 V 220 V 1100 V	0.48 μ V 0.67 μ V 2.5 μ V 4 μ V 41 μ V 430 μ V	Fluke 5730A multifunction calibrator

Parameter/Equipment	Range	CMC ^{2,6} (\pm)	Comments
DC Current – Generate ³	220 μ A 2.2 mA 22 mA 220 mA 2.2 A	5.4 nA 15 nA 150 nA 860 nA 22 μ A	Fluke 5730A multifunction calibrator
	(1.1 to 3) A (0 to 11) A (11 to 20) A	32 μ A 380 μ A 7.2 mA	Fluke 5522A multifunction calibrator
4 Wire Resistance – Measure ^{3,8}	10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω	120 $\mu\Omega$ 1.2 m Ω 2.4 m Ω 24 m Ω 240 m Ω 6.3 Ω 670 Ω	HP 3458A digital multimeter
Resistance – Generate ³	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω	12 $\mu\Omega$ 420 $\mu\Omega$ 960 $\mu\Omega$ 1.8 m Ω	Fluke 5522A multifunction calibrator
	(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 (.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 (300 to 1 100) M Ω	6.8 m Ω 12 m Ω 65 m Ω 120 m Ω 800 m Ω 1.9 Ω 12 Ω 32 Ω 380 Ω 860 Ω 10 k Ω 280 k Ω 1.4 M Ω	Fluke 5730A multifunction calibrator

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Capacitance ³ – Generate	(220 to 400) pF (0.4 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF (.33 to 1.1) μF (1.1 to 3.3) μF (3.3 to 11) μF (11 to 33) μF (33 to 110) μF (110 to 330) μF (.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	9.8 pF 10 pF 13 pF 15 pF 32 pF 87 pF 280 pF 1.5 nF 4.7 nF 15 nF 60 nF 210 nF 620 nF 1.9 μF 6.2 μF 20 μF 87 μF 360 μF	Fluke 5522A multifunction calibrator

Parameter/Range	Frequency	CMC ^{2,6} (±)	Comments
AC Voltage – Measure ^{3,8}			
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 300 kHz to 1 MHz (1 to 2) MHz	4.7 μV 2.5 μV 0.82 μV 4.2 μV 9.5 μV 37 μV 120 μV 170 μV	HP 3458A digital multimeter
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 300 kHz to 1 MHz (1 to 2) MHz	59 μV 44 μV 46 μV 55 μV 100 μV 370 μV 1.2 mV 1.7 mV	

Parameter/Range	Frequency	CMC ^{2,6} (±)	Comments
AC Voltage – Measure ^{3,8} (cont)			
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	470 μV 250 μV 280 μV 420 μV 950 μV 3.7 mV 12 mV 17 mV	HP 3458A digital multimeter
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 300 kHz to 1 MHz	6.1 mV 3.3 mV 3.3 mV 4.7 mV 15 mV 48 mV 170 mV	
1000 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	320 mV 320 mV 330 mV 350 mV 470 mV	
AC Voltage – Generate ³			
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 to 1 MHz	4.2 μV 4.2 μV 4.2 μV 4.2 μV 5.3 μV 9.6 μV 20 μV 20 μV	Fluke 5730A multifunction calibrator
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 to 1 MHz	4.7 μV 4.4 μV 4.4 μV 4.7 μV 6.3 μV 12 μV 24 μV 27 μV	

Parameter/Range	Frequency	CMC ^{2,6} (±)	Comments
AC Voltage – Generate ³ (cont)			
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	20 µV 11 µV 10 µV 11 µV 25 µV 37 µV 60 µV 110 µV	Fluke 5730A multifunction calibrator
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	120 µV 39 µV 24 µV 29 µV 64 µV 150 µV 410 µV 690 µV	
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	1.2 mV 680 µV 610 µV 630 µV 700 µV 1.1 mV 1.4 mV 6.5 mV	
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	13 mV 6.3 mV 4.3 mV 4.8 mV 10 mV 36 mV 130 mV 250 mV	
1100 V	(15 to 50) Hz 50 Hz to 1 kHz	80 mV 27 mV	

Parameter/Range	Frequency	CMC ^{2,6} (±)	Comments
AC Current – Generate ³			
220 µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	20 nA 4 nA 8.3 nA 12 nA 63 nA	Fluke 5730A multifunction calibrator
2.2 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	140 nA 110 nA 100 nA 170 nA 850 nA	Fluke 5522A multifunction calibrator
22 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.6 µA 1.1 µA 1 µA 1.3 µA 7 µA	
220 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	6 µA 11 µA 10 µA 14 µA 35 µA	
2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	150 µA 210 µA 1.5 mA	
(1.1 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.6 mA 650 µA 5.9 mA 25 mA	
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	3.1 mA 4 mA 71 mA	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	14 mA 17 mA 260 mA	

II. Mechanical

Parameter/Equipment	Range	CMC ^{2,4} (\pm)	Comments
Pressure Gages ³	(1 to 10 000) psig	(0.0074 % of reading + 0.0013 <i>P</i>) psi	Ametek RK300 dead weight tester, Mensor CPB5800 dead weight tester, Heise HQS-2 module, Heise PTE-2 reader
Vacuum Gages ³	(0 to 29.5) inHg	0.004 inHg	Mensor CPG2500, Mensor CPR module, Heise HQS-2 module, Heise PTE-2 reader
Torque Analyzers and Transducers ³	2.5 lbf·in to 2000 lbf·ft	0.02 % of reading	Class 6 weights, test bars and wheels
Torque Wrenches, Watches and Drivers ³	(5 to 50) lbf·in (30 to 400) lbf·in (80 to 1000) lbf·in (20 to 250) lbf·ft (60 to 600) lbf·ft	0.28 % of reading 0.3 % of reading 0.3 % of reading 0.35 % of reading 0.28 % of reading	CDI 2800 multitest premiere tester; precision instruments TMH600F/1310 torque analyzer
Cable Tension Measurement	(30 to 600) lbf (200 to 2000) lbf	0.29 % of reading 0.29 % of reading	CDI 2800 multitest premiere tester

III. Thermodynamics

Parameter/Equipment	Range	CMC ² (\pm)	Comments
Temperature Liquid Filled, Bi-Metal and Digital Thermometers ³	(-100 to 155) °C	0.006 °C	Ametek/Jofra RTC-159 dry block calibrator
	(33 to 700) °C	0.006 °C	Ametek/Jofra RTC-700 dry block calibrator PRT

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
IR Thermometers ³	(35 to 550) °C	(0.25 % of reading + 0.19T) °C	Fluke 4181 IR thermometer calibrator

IV. Time & Frequency

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
Frequency – Measure ³	(1 to 40) Hz	0.0006 Hz	HP 3458A digital multimeter
	40 Hz to 10 MHz	0.005 Hz	
	10 MHz to 26.5 GHz	0.97 Hz	HP 53151A
Frequency – Generate ³	0.01 Hz to 2 MHz	0.0058 Hz	Fluke 5522A/5730A multifunction calibrators
	2 MHz to 6 GHz	0.47 Hz	Agilent N5181A signal generator
	(6 to 26.5) GHz	3.5 Hz	HP 8363B signal generator

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 In the statement of CMC, P is pressure in psi. T is temperature in degrees C.

⁵ 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.

⁶ 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.

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

⁸ The contributions from the "best existing device" are not included in the CMC claim.





Accredited Laboratory

A2LA has accredited

M & M METROLOGY, INC.

Deerfield Beach, FL

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 April 2017*).



Presented this 18th day of April 2019.

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

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 5352.01
Valid to June 30, 2020

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