



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

JM TEST SYSTEMS, INC.
 3947 Lincoln Ave., Ste. B
 Groves, TX 77619
 Jerry Kraus Phone: 432 580 7040

CALIBRATION

Valid To: February 29, 2020

Certificate Number: 1995.05

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 (0.33 to 33) V (3.3 to 33) V (33 to 330) V (330 to 1020) V	74 μV/V + 3 μV 59 μV/V + 5 μV 59 μV/V + 50 μV 65 μV/V + 500 μV 65 μV/V + 1500 μV	Fluke 5502A
DC Current – Generate	Up to 330 μA (0.33 to 3.3) mA (3.3 to 33) mA (33 to 330) mA (0.33 to 1.1) A (1.1 to 3) A (3 to 11) A (11 to 20.5) A (10 to 16.5) A (16.5 to 150) A (150 to 1025) A	0.017 % + 0.02 μA 0.015 % + 0.05 μA 0.012 % + 0.25 μA 0.015 % + 2.5 μA 0.044 % + 44 μA 0.045 % + 44 μA 0.073 % + 0.5 mA 0.12 % + 0.75 mA 0.25 % + 0.002 A 0.26 % + 0.015 A 0.28 % + 0.05 A	Fluke 5502A Fluke 5502A, 50 turn coil

Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
Resistance – Generate	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ (0.33 to 1.1) MΩ (1.1 to 33) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (330 to 1100) MΩ	0.015 % + 0.001 Ω 0.014 % + 0.0015 Ω 0.01 % + 0.0014 Ω 0.01 % + 0.002 Ω 0.01 % + 0.002 Ω 0.01 % + 0.02 Ω 0.01 % + 0.02 Ω 0.01 % + 0.2 Ω 0.013 % + 0.2 Ω 0.014 % + 2 Ω 0.017 % + 2 Ω 0.017 % + 30 Ω 0.069 % + 50 Ω 0.12 % + 2.5 kΩ 0.58 % + 3 kΩ 0.58 % + 0.1 MΩ 1.7 % + 0.5 MΩ	Fluke 5502A
DC Power – Generate	Up to 109 μW (0.109 to 1.09) mW (1.09 to 10.9) mW (10.9 to 109) mW (0.109 to 1.09) W (1.09 to 10.9) W (10.9 to 109) W (109 to 337) W (337 to 990) W (0.99 to 3.06) kW (3.06 to 11.2) kW (11.2 to 20.9) kW	0.25 % 0.018 % 0.015 % 0.014 % 0.014 % 0.014 % 0.014 % 0.017 % 0.047 % 0.047 % 0.078 % 0.12 %	Fluke 5502A

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
AC Voltage – Generate			
Up 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	0.17 % + 20 μV 0.12 % + 20 μV 0.17 % + 20 μV 0.23 % + 20 μV 0.4 % + 33 μV 1.2 % + 60 μV	Fluke 5502A
(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	0.058 % + 20 μV 0.035 % + 20 μV 0.081 % + 20 μV 0.12 % + 20 μV 0.27 % + 40 μV 0.58 % + 170 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	0.058 % + 60 μV 0.035 % + 60 μV 0.081 % + 60 μV 0.12 % + 60 μV 0.27 % + 0.2 mV 0.58 % + 0.9 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	0.058 % + 0.8 mV 0.035 % + 0.6 mV 0.081 % + 0.6 mV 0.12 % + 0.6 mV 0.27 % + 0.2 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	0.058 % + 3 mV 0.092 % + 9 mV 0.1 % + 9 mV 0.14 % + 9 mV 0.28 % + 80 mV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.058 % + 20 mV 0.092 % + 20 mV 0.1 % + 20 mV	

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
AC Current – Generate			
Up 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	0.23 % + 0.1 µA 0.17 % + 0.1 µA 0.14 % + 0.1 µA 0.35 % + 0.15 µA 0.92 % + 0.2 µA 1.8 % + 0.4 µA	Fluke 5502A
(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	0.23 % + 0.15 µA 0.14 % + 0.15 µA 0.12 % + 0.15 µA 0.23 % + 0.2 µA 0.58 % + 0.3 µA 1.2 % + 0.6 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	0.21 % + 2 µA 0.1 % + 2 µA 0.046 % + 2 µA 0.092 % + 2 µA 0.23 % + 3 µA 0.46 % + 4 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	0.21 % + 20 µA 0.1 % + 20 µA 0.046 % + 20 µA 0.12 % + 50 µA 0.23 % + 0.1 mA 0.46 % + 0.2 mA	
(0.33 to 1.1) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.21 % + 0.1 mA 0.058 % + 0.1 mA 0.069 % + 1 mA 2.9 % + 5 mA	
(1.1 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.21 % + 0.1 mA 0.058 % + 0.1 mA 0.069 % + 1 mA 2.9 % + 5 mA	
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.21 % + 0.1 mA 0.058 % + 0.1 mA 0.069 % + 1 mA	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.21 % + 0.1 mA 0.058 % + 0.1 mA 0.069 % + 1 mA	

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments	
AC Current – Generate (cont)				
Up to 330 µA	(10 to 100) Hz 100 Hz to 1 kHz	0.29 % + 0.2 µA 0.69 % + 0.5 µA	Fluke 5502A with LCOMP on	
(0.33 to 3.3) mA	(10 to 100) Hz 100 Hz to 1 kHz	0.29 % + 0.3 µA 0.69 % + 0.8 µA		
(3.3 to 33) mA	(10 to 100) Hz 100 Hz to 1 kHz	0.29 % + 0.2 µA 0.69 % + 0.5 µA		
(33 to 330) mA	(10 to 100) Hz 100 Hz to 1 kHz	0.092 % + 40 µA 0.23 % + 10 µA		
(0.33 to 3) A	(10 to 100) Hz (100 to 400) Hz	0.14 % + 0.2 µA 0.35 % + 1 mA		
(3 to 20.5) A	(10 to 100) Hz (100 to 400) Hz	0.14 % + 2 mA 1.2 % + 5 mA		
(10 to 16.5) A	(45 to 65) Hz (65 to 440) Hz	0.029 % + 0.003 A 0.083 % + 0.003 A		Fluke 5502A, 50 turn coil
(16.5 to 150) A	(45 to 65) Hz (65 to 440) Hz	0.32 % + 0.025 A 0.87 % + 0.027 A		
(150 to 1025) A	(45 to 65) Hz (65 to 440) Hz	0.32 % + 0.09 A 1.5 % + 0.1 A		
AC Power – Generate (PF=1)			Fluke 5502A	
Up to 10.9 µW (10.9 to 109 µW (0.109 to 1.09) mW (1.09 to 10.9) mW (10.9 to 109) mW (0.109 to 1.09) W (1.09 to 10.9) W (10.9 to 37) W (37 to 337) W (0.337 to 1.12) kW (1.12 to 3.06) kW (3.06 to 11.2) kW (11.2 to 20.9) kW	(45 to 65) Hz	0.25 % 0.18 % 0.13 % 0.066 % 0.064 % 0.064 % 0.064 % 0.077 % 0.079 % 0.090 % 0.094 % 0.11 % 0.17 %		

Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
Capacitance – 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 (0.33 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 (0.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	0.58 % + 0.01 nF 0.58 % + 0.01 nF 0.58 % + 0.01 nF 0.29 % + 0.01 nF 0.29 % + 0.1 nF 0.29 % + 0.1 nF 0.29 % + 0.3 nF 0.29 % + 1 nF 0.29 % + 3 nF 0.29 % + 10 nF 0.46 % + 30 nF 0.52 % + 0.1 μF 0.52 % + 0.3 μF 0.52 % + 1 μF 0.52 % + 3 μF 0.52 % + 10 μF 0.87 % + 30 μF 1.2 % + 100 μF	Fluke 5502A
Electrical Calibration of Thermocouple Indicators – Generate & Measure			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.59 °C 0.23 °C 0.21 °C 0.23 °C 0.28 °C	Fluke 5502A
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.34 °C 0.23 °C 0.21 °C 0.24 °C 0.30 °C	

Parameter/Equipment	Range	CMC ^{2,3,4} (±)	Comments
Electrical Calibration of Thermocouple Indicators – Generate & Measure (cont)			
Type K	(-200 to -100) °C	0.38 °C	Fluke 5502A
	(-100 to -25) °C	0.25 °C	
	(-25 to 120) °C	0.23 °C	
Type T	(120 to 1000) °C	0.33 °C	
	(1000 to 1372) °C	0.48 °C	
	(-250 to -150) °C	0.74 °C	
	(-150 to 0) °C	0.31 °C	
	(0 to 120) °C	0.23 °C	
	(120 to 400) °C	0.21 °C	
Electrical Calibration of RTD Indicators – Generate			
Pt 385, 100 Ω	(-200 to -80) °C	0.06 °C	Fluke 5502A
	(-80 to 0) °C	0.06 °C	
	(0 to 100) °C	0.08 °C	
	(100 to 300) °C	0.11 °C	
	(300 to 400) °C	0.12 °C	
	(400 to 630) °C	0.14 °C	
	(630 to 800) °C	0.27 °C	
DC Voltage – Measure	(0 to 100) mV	16 μV/V + 0.3 μV	Agilent 3458A
	(0.10 to 1.0) V	12 μV/V + 0.3 μV	
	(1.0 to 10) V	11 μV/V + 0.5 μV	
	(10 to 100) V	14 μV/V + 30 μV	
	(100 to 1000) V	15 μV/V + 100 μV	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Resistance – Measure	Up 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	28 μΩ/Ω + 50 μΩ 18 μΩ/Ω + 0.5 mΩ 16 μΩ/Ω + 0.5 mΩ 16 μΩ/Ω + 5 mΩ 18 μΩ/Ω + 50 mΩ 27 μΩ/Ω + 2 Ω 77 μΩ/Ω + 100 Ω 0.060 % + 1 kΩ	Agilent 3458A
DC Current – Measure	Up to 100 μA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 1000) A	33 μA/A + 0.8 nA 29 μA/A + 5 nA 35 μA/A + 50 nA 49 μA/A + 0.5 μA 0.015 % + 10 μA 0.30 %	Agilent 3458A Agilent 3458A, standard shunts

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Measure (1 to 10) mV	(10 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.04 % + 3 μV 0.046 % + 1.1 μV 0.076 % + 1.1 μV 0.46 % + 1.1 μV 0.77 % + 1.1 μV 4.7 % + 2 μV	Agilent 3458A
(10 to 100) mV	(10 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	0.011 % + 4 μV 0.014 % + 2 μV 0.026 % + 2 μV 0.12 % + 2 μV 0.23 % + 2 μV 0.41 % + 10 μV 1.2 % + 10 μV	
(0.1 to 1) V	(10 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	0.011 % + 40 μV 0.015 % + 20 μV 0.023 % + 20 μV 0.042 % + 20 μV 0.11 % + 20 μV 0.36 % + 100 μV 1.2 % + 100 μV	



Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Measure (cont)			
(1 to 10) V	(10 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	95 µV/V + 0.4 mV 0.011 % + 0.2 mV 0.020 % + 0.2 mV 0.037 % + 0.2 mV 95 µV/V + 0.4 mV 0.36 % + 1 mV 1.2 % + 1 mV	Agilent 3458A
(10 to 100) V	(10 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	0.025 % + 4 mV 0.025 % + 2 mV 0.027 % + 2 mV 0.048 % + 2 mV 0.15 % + 2 mV 0.47 % + 10 mV 1.8 % + 10 mV	
(100 to 700) V	(10 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.048 % + 40 mV 0.048 % + 20 mV 0.070 % + 20 mV 0.14 % + 20 mV 0.35 % + 20 mV	
AC Current – Measure			
Up to 100 µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz	0.46 % + 0.03 µA 0.17 % + 0.03 µA 0.072 % + 0.03 µA 0.072 % + 0.03 µA	Agilent 3458A
(0.1 to 1) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz (5 to 10) kHz	0.46 % + 0.2 µA 0.17 % + 0.2 µA 0.073 % + 0.2 µA 0.041 % + 0.2 µA 0.069 % + 0.2 µA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz (5 to 10) kHz	0.46 % + 2 µA 0.17 % + 2 µA 0.073 % + 2 µA 0.041 % + 2 µA 0.069 % + 2 µA	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Current – Measure (cont)			
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz (5 to 10) kHz	0.46 % + 20 μA 0.17 % + 20 μA 0.073 % + 20 μA 0.041 % + 20 μA 0.069 % + 20 μA	Agilent 3458A
(0.1 to 1) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz (5 to 10) kHz	0.47 % + 200 μA 0.20 % + 200 μA 0.11 % + 200 μA 0.13 % + 200 μA 0.35 % + 200 μA	
(1 to 1000) A	(45 to 65) Hz	0.30 %	Agilent 3458A, Standard Shunts

II. Time & Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency – Measure	0.1 Hz to 225 MHz	8.9 parts in 10 ⁸	Fluke PM 6680B
Time Interval – Timers & Stop Watches			NIST SP 960-12
Time Base ⁵	(0 to 24) hours	0.0077 seconds/day	Fluke PM6680B
Totalize Method	(0 to 24) hours	0.039 seconds	Fluke PM6680B, function generator

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

² Calibration and Measurement Capability (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 Generate. Calibration and Measurement Capabilities 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 Fluke 5502A CMCs are based upon the temperature the standard was calibrated ($t_{cal} \pm 5 \text{ }^{\circ}\text{C}$) and assuming the instrument is zeroed at least every seven days or when the ambient temperature changes more than $5 \text{ }^{\circ}\text{C}$. For Resistance, a zero calibration is performed at least every 12 hours within $\pm 1 \text{ }^{\circ}\text{C}$ of use. For AC Current, CMCs are determined with the LCOMP off and ON. CMCs are also based upon 1-year floor specifications. CMCs are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.
- ⁴ Agilent 3458A CMCs are based upon the temperature the standard was calibrated ($t_{cal} \pm 5 \text{ }^{\circ}\text{C}$) and an auto calibration (ACAL) was performed within the previous 24 hours ($\pm 1 \text{ }^{\circ}\text{C}$ of ambient temperature.) CMCs are also based upon 1-year floor specifications. CMCs are expressed as either a specific value that covers the full range or as a combination of a percent or the fraction of the reading/output plus a range specification.
- ⁵ Applicable when the internal time base (oscillator) of the device under test is/can be measured directly by the frequency counter.



Accredited Laboratory

A2LA has accredited

JM TEST SYSTEMS, INC.

Groves, TX

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 23rd day of January 2018.

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

President and CEO
For the Accreditation Council
Certificate Number 1995.05
Valid to February 29, 2020

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