



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

JM TEST SYSTEMS, INC.
738 S. Main Street
Clute, TX 77531
Jerry Kraus Phone: 979 388 9668

CALIBRATION

Valid To: December 31, 2018

Certificate Number: 1995.03

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, 4, 6} (±)	Comments
DC Voltage ³ – Generate	(0 to 330) mV (0.33 to 33) V (3.3 to 33) V (33 to 330) V (330 to 1020) V	24 μV/V + 1 μV 13 μV/V + 2 μV 15 μV/V + 20 μV 21 μV/V + 0.15 mV 21 μV/V + 1.5 mV	Fluke 5522A
DC Current ³ – 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 0.012 % + 0.05 μA 0.012 % + 0.25 μA 0.012 % + 2.5 μA 0.023 % + 40 μA 0.044 % + 40 μA 0.059 % + 0.5 mA 0.12 % + 0.75 mA 0.25 % + 0.002 A 0.26 % + 0.015 A 0.28 % + 0.05 A	Fluke 5522A Fluke 5522A, 50 turn coil

Parameter/Equipment	Range	CMC ^{2, 4, 6} (\pm)	Comments
Resistance ³ – Generate	Up 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 33) 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	51 $\mu\Omega/\Omega + 0.001 \Omega$ 35 $\mu\Omega/\Omega + 0.0015 \Omega$ 33 $\mu\Omega/\Omega + 0.0014 \Omega$ 33 $\mu\Omega/\Omega + 0.002 \Omega$ 33 $\mu\Omega/\Omega + 0.002 \Omega$ 33 $\mu\Omega/\Omega + 0.02 \Omega$ 33 $\mu\Omega/\Omega + 0.02 \Omega$ 33 $\mu\Omega/\Omega + 0.2 \Omega$ 33 $\mu\Omega/\Omega + 0.2 \Omega$ 37 $\mu\Omega/\Omega + 2 \Omega$ 38 $\mu\Omega/\Omega + 2 \Omega$ 70 $\mu\Omega/\Omega + 30 \Omega$ 0.015 % + 50 Ω 0.029 % + 2.5 k Ω 0.060 % + 3 k Ω 0.35 % + 0.1 M Ω 1.7 % + 0.5 M Ω	Fluke 5522A
DC Power ³ – Generate	Up to 109 μ W (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	0.023 % 0.014 % 0.013 % 0.013 % 0.013 % 0.013 % 0.013 % 0.013 % 0.013 % 0.027 % 0.045 % 0.064 % 0.12 %	Fluke 5522A



Parameter/Equipment	Frequency	CMC ^{2,4,6} (\pm)	Comments
AC Voltage ³ – 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	0.095 % + 6 μ V 0.019 % + 6 μ V 0.024 % + 6 μ V 0.12 % + 6 μ V 0.4 % + 12 μ V 0.93 % + 50 μ V	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	0.035 % + 8 μ V 0.017 % + 8 μ V 0.019 % + 8 μ V 0.041 % + 8 μ V 0.093 % + 32 μ V 0.23 % + 70 μ V	
(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	0.035 % + 50 μ V 0.017 % + 60 μ V 0.022 % + 60 μ V 0.035 % + 50 μ V 0.081 % + 0.13 mV 0.28 % + 0.6 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	0.035 % + 0.65 mV 0.017 % + 0.6 mV 0.028 % + 0.6 mV 0.04 % + 0.6 mV 0.1 % + 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	0.022 % + 2 mV 0.023 % + 6 mV 0.029 % + 6 mV 0.035 % + 6 mV 0.23 % + 50 mV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.035 % + 10 mV 0.029 % + 10 mV 0.035 % + 10 mV	

Parameter/Equipment	Range	CMC ^{2, 4, 6} (\pm)	Comments
AC Current ³ – Generate			
Up to 330 μ A	(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 μ A 0.17 % + 0.1 μ A 0.14 % + 0.1 μ A 0.35 % + 0.15 μ A 0.92 % + 0.2 μ A 1.8 % + 0.4 μ A	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	0.23 % + 0.15 μ A 0.14 % + 0.15 μ A 0.12 % + 0.15 μ A 0.23 % + 0.2 μ A 0.58 % + 0.3 μ A 1.2 % + 0.6 μ A	
(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 μ A 0.1 % + 2 μ A 0.046 % + 2 μ A 0.092 % + 2 μ A 0.23 % + 3 μ A 0.46 % + 4 μ A	
(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 μ A 0.1 % + 20 μ A 0.046 % + 20 μ A 0.12 % + 50 μ A 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 0.069 % + 0.1 mA 0.69 % + 1 mA 2.9 % + 5 mA	
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.069 % + 2 mA 0.12 % + 2 mA 3.5 % + 2 mA	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.14 % + 5 mA 0.17 % + 5 mA 3.5 % + 5 mA	

Parameter/Range	Frequency	CMC ^{2, 4, 6} (\pm)	Comments	
AC Current ³ – Generate (cont)				
Up to 330 μ A	(10 to 100) Hz 100 Hz to 1 kHz	0.29 % + 0.2 μ A 0.69 % + 0.5 μ A	Fluke 5522A with LCOMP on	
(0.33 to 3.3) mA	(10 to 100) Hz 100 Hz to 1 kHz	0.29 % + 0.3 μ A 0.69 % + 0.8 μ A		
(3.3 to 33) mA	(10 to 100) Hz 100 Hz to 1 kHz	0.092 % + 4 μ A 0.23 % + 10 μ A		
(33 to 330) mA	(10 to 100) Hz 100 Hz to 1 kHz	0.092 % + 40 μ A 0.23 % + 0.1 mA		
(0.33 to 3) A	(10 to 100) Hz (100 to 400) Hz	0.14 % + 0.2 μ A 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 5522A, 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 ³ – Generate (45 to 65 Hz, PF=1)	Up to 10.9 μ W (10.9 to 109 μ W (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	0.17 % 0.13 % 0.06 % 0.056 % 0.055 % 0.055 % 0.055 % 0.058 % 0.063 % 0.076 % 0.081 % 0.09 % 0.17 %	Fluke 5522A	

Parameter/Equipment	Range	CMC ^{2,4,6} (±)	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 (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 5522A
Electrical Calibration of Thermocouple Indicators ³ – 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 5522A
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 ^{2,4} (±)	Comments
Electrical Calibration of Thermocouple Indicators ³ – Generate & Measure (cont)			
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.38 °C 0.25 °C 0.23 °C 0.33 °C 0.48 °C	Fluke 5522A
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.74 °C 0.31 °C 0.23 °C 0.21 °C	
Electrical Calibration of RTD Indicators ³ – Generate			
Pt 385, 100 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.06 °C 0.06 °C 0.08 °C 0.11 °C 0.12 °C 0.14 °C 0.27 °C	Fluke 5522A
Electrical Calibration of Phase Indicators ³ – Generate	(10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.12° phase 0.3° phase 0.6° phase 2.9° phase 6° phase 12° phase	Fluke 5522A

Parameter/Range	Frequency	CMC ^{2,5,6} (±)	Comments
AC Voltage ³ – Measure (continued)			
(0.1 to 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	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	Agilent 3458A
(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	0.01 % + 0.4 mV 0.012 % + 0.2 mV 0.02 % + 0.2 mV 0.04 % + 0.2 mV 0.1 % + 0.2 mV 0.37 % + 1 mV 1.2 % + 1 mV	
(10 to 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	0.025 % + 4 mV 0.025 % + 2 mV 0.03 % + 2 mV 0.05 % + 2 mV 0.15 % + 2 mV 0.47 % + 10 mV 1.7 % + 10 mV	
(100 to 700) V	(1 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 0.07 % + 20 mV 0.14 % + 20 mV 0.35 % + 20 mV	

Parameter/Range	Frequency	CMC ^{2, 5, 6} (\pm)	Comments
AC Current ³ – Measure			Agilent 3458A
Up to 100 μ A	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz (0.1 to 5) kHz	0.46 % + 0.03 μ A 0.17 % + 0.03 μ A 0.072 % + 0.03 μ A 0.072 % + 0.03 μ A	
(0.1 to 1) mA	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz (0.1 to 5) kHz (5 to 10) kHz	0.46 % + 0.2 μ A 0.17 % + 0.2 μ A 0.073 % + 0.2 μ A 0.041 % + 0.2 μ A 0.069 % + 0.2 μ A	
(0.1 to 10) mA	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz (0.1 to 5) kHz (5 to 10) kHz	0.46 % + 2 μ A 0.17 % + 2 μ A 0.072 % + 2 μ A 0.041 % + 2 μ A 0.069 % + 2 μ A	
(10 to 100) mA	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz (0.1 to 5) kHz (5 to 10) kHz	0.46 % + 20 μ A 0.17 % + 20 μ A 0.073 % + 20 μ A 0.041 % + 20 μ A 0.069 % + 20 μ A	
(0.1 to 1) A	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz (0.1 to 5) kHz (5 to 10) kHz	0.47 % + 200 μ A 0.2 % + 200 μ A 0.11 % + 200 μ A 0.13 % + 200 μ A 0.35 % + 200 μ A	

II. Mechanical

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Mass ³ – Masses Used with Piston Gauges	1 mg to 6.2 kg	0.005 % or 1 mg, whichever is greater	Single substitution
Absolute Pressure ³	(0 to 15) PSIA (0 to 50) PSIA	0.0032 PSIA 0.010 PSIA	Mensor 2320 DPG
Pressure – Hydraulic ³			
Effective Area Determination of High Accuracy Piston-Cylinder Unit (PCU)	(100 to 1500) psi (1000 to 15 000) psi	0.0045 % 0.0045 %	Direct cross-float method
Calibration of Transfer Standards and Pressure Devices	(100 to 1500) psi (1500 to 15 000) psi	0.0040% 0.0040%	
Pressure – Pneumatic ³			
Effective Area Determination of High Accuracy Piston-Cylinder Unit (PCU) or Ball-Nozzle Units (BNU)	(0.14 to 30) psi	0.0085 %	Direct cross-float method
Calibration of Transfer Standards and Pressure Devices	(0.14 to 300) psi	0.0081 %	
Torque Wrenches ³	(5 to 50) in·lbf (25 to 250) in·lbf (100 to 1000) in·lbf (25 to 250) ft·lbf (60 to 600) ft·lbf (100 to 1000) ft·lbf	0.60% 0.63% 0.70% 0.63% 0.60% 1.2%	CDI 501-I-DTT CDI 2505-I-DTT CDI 10002-I-ETT CDI 2503-F-ETT CDI 6004-F-ETT Proto 6189

III. Time & Frequency

Parameter/Equipment	Range	CMC ² (\pm)	Comments
Frequency ³ – Measure	0.1 Hz to 225 MHz	2.3 parts in 10^7	Fluke PM 6680B

¹ This laboratory offers commercial calibration service 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 Generate. 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. Field environmental conditions are limited to 15 °C to 30 °C and <80% relative humidity to 30 °C. All Field Service (calibrations) work is handled through the Baton Rouge location.

⁴ Fluke 5700A and 5500A series CMCs are based upon the temperature the standard was calibrated ($t_{cal} \pm 5$ °C) and assuming the instrument is zeroed at least every seven days or when the ambient temperature changes more than 5 °C. For Resistance, a zero calibration is performed at least every 12hours within ± 1 °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 percentage or fraction of the reading plus a fixed floor specification.

⁵ Agilent 3458A CMCs are based upon the temperature the standard was calibrated ($t_{cal} \pm 5$ °C) and an auto calibration (ACAL) was performed within the previous 24 hours (± 1 °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.

⁶ In the statement of CMC, percentages are percentages of reading, unless otherwise indicated.



Accredited Laboratory

A2LA has accredited

JM TEST SYSTEMS, INC.

Clute, 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/NCSLI Z540-1-1994 and any additional program requirements in the field of calibration. 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 15th day of June 2016.

A handwritten signature in black ink, appearing to read "L. S. ...", positioned above a horizontal line.

President and CEO
For the Accreditation Council
Certificate Number 1995.03
Valid to December 31, 2018
Revised November 20, 2018

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