

Scope of Accreditation For Southwest Metrology, Inc.

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In recognition of a successful assessment to ISO/IEC 17025:2005 and ANSI/NCSL Z540-1: 1994 (R2002), to the following Calibration and Measurement Capabilities, accreditation has been granted to **Southwest Metrology, Inc.** for the following:

Accreditation granted through: **June 3, 2018**

Calibration

Electrical – Current ¹

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
DC Current Source	(0.01 to 220) μ A (0.22 to 2.2) mA (2.2 to 22 mA) (22 to 220) mA (0.22 to 2.2) A	74 μ A / A + 11 nA 76 μ A / A + 11 nA 77 μ A / A + 110 nA 96 μ A / A + 0.73 μ A 163 μ A / A + 14 μ A	Fluke 5700A
AC Current Source 40 Hz to 1 kHz	(0.01 to 220) μ A (0.22 to 2.2) mA (2.2 to 22 mA) (22 to 220) mA (0.22 to 2.2) A	208 μ A / A + 23 nA 215 μ A / A + 44 nA 215 μ A / A + 436 nA 236 μ A / A + 4 μ A 875 μ A / A + 46 μ A	Fluke 5700A
DC Current Measure	(0.1 to 100) mA (0.1 to 1) A	57 μ A / A + 0.48 μ A 171 μ A / A + 9.7 μ A	Agilent 3458A

Electrical – Resistance ^{1,2}

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Resistance Measure	(1 to 10) Ω (10 to 100) Ω (0.1 to 1) k Ω (1 to 10) k Ω (10 to 100) k Ω (0.1 to 1) M Ω (1 to 10) M Ω	310 $\mu\Omega$ 2.9 m Ω 17 m Ω 170 m Ω 1.7 Ω 26 Ω 780 Ω	Agilent 3458A 4 Wire
Resistance Measure	100M Ω	73 k Ω	Agilent 3458A 2 Wire

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Resistance Generate	0 Ω	69 μΩ	Fluke 5700A 4 Wire
	1 Ω	140 μΩ	
	1.9 Ω	260 μΩ	
	10 Ω	540 μΩ	
	19 Ω	990 μΩ	
	100 Ω	4.3 mΩ	
	190 Ω	8.2 mΩ	
	1 kΩ	41 mΩ	
	1.9 kΩ	77 mΩ	
	10 kΩ	400 mΩ	
	19 kΩ	760 mΩ	
	100 kΩ	4.1 Ω	
	190 kΩ	7.8 Ω	
	1 MΩ	46 Ω	
1.9 MΩ	88 Ω		
10 MΩ	650 Ω	Fluke 5700A 2 Wire	
19 MΩ	1.5 kΩ		
Resistance Generate	100 MΩ	18 kΩ	Fluke 5700A 2 Wire
Resistance Simulation of RTD PT DIN 100Ω	(-200 to 650) °C	(0.33 + 0.00018X) °C	Multifunction Calibrator

Electrical – Voltage ¹

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
DC Voltage Source	(0.01 to 220) mV	1 μV + 0.01 μV/V	Fluke 5700A
	(0.22 to 2.2) V	1.9 μV + 9 μV/V	
	(2.2 to 11) V	4.9 μV + 9.2 μV/V	
	(11 to 22) V	17 μV + 9 μV/V	
	(22 to 220) V	160 μV + 11 μV/V	
AC Voltage Source	(220 to 1 100) V	1.8 mV + 12 μV/V	Fluke 5700A
	<u>40 Hz to 20 kHz</u>		
	(0.01 to 2.2) mV	270 μV / V + 6 μV	
	(2.2 to 22) mV	200 μV / V + 6 μV	
	(22 to 220) mV	160 μV / V + 8 μV	
	(0.22 to 2.2) V	95 μV / V + 17 μV	
	(2.2 to 22) V	110 μV / V + 1.1 mV	
<u>(20 to 50) kHz</u>			
(22 to 220) V	300 μV / V + 4.6 mV	Agilent 3458A	
<u>50 Hz to 1 kHz</u>			
(220 to 1 100) V	111 μV / V + 4.4 mV	Agilent 3458A	
<u>0.1 to 10 mV</u>			
AC Voltage Measure	(40 Hz to 20 kHz)	5.7 μV	Agilent 3458A
	(20 kHz to 100 kHz)	61 μV	
AC Voltage Measure	<u>10 to 100 mV</u>		Agilent 3458A
	(40 Hz to 1 kHz)	12 μV	
	(1 kHz to 20 kHz)	21 μV	
	(20 kHz to 100 kHz)	100 μV	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
	<u>100 mV to 1 V</u> (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz)	120 μ V 210 μ V 390 μ V 980 μ V	
	<u>1 V to 10 V</u> (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz)	1.3 mV 2.1 mV 4 mV 9.7 mV	
	<u>10 V to 100 V</u> (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz)	27 mV 29 mV 46 mV 150 mV	
	<u>100 to 1 000 V</u> (40 Hz to 1 kHz)	500 mV	
DCV Measure	(0.01 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1 000) V	28 μ V / V + 0.2 μ V 12 μ V / V + 1.1 μ V 11 μ V / V + 2.1 μ V 14 μ V / V + 31 μ V 22 μ V / V + 63 μ V	Agilent 3458A
Thermocouple Millivolt Simulation Type K Type J Type T Type E	(-200 to 1 372) $^{\circ}$ C (-200 to 1 200) $^{\circ}$ C (-200 to 400) $^{\circ}$ C (-234 to 1 000) $^{\circ}$ C	0.37 $^{\circ}$ C 0.37 $^{\circ}$ C 0.37 $^{\circ}$ C 0.37 $^{\circ}$ C	Multifunction Calibrator

Length – Artifacts and Standards 1D^{1,2}

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Pin/Plug Gages	(0.01 to 1) in	(27 + 9.2L) μ in	Gage Blocks Measuring Machine
Pin Gages Class Z and ZZ	(0.01 to 1) in	(79 + 4L)	Micrometer
Step Gages	(0.1 to 1) in	(110 + 0.3L) μ in	Indicator
Feeler Gages	(0.001 to 0.05) in	76 μ in/in	Micrometer

Length – Hand Tools and Precision Gages 1D^{1,2}

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Micrometers, OD, Depth	(0 to 2) in (2 to 12) in	(38 + 6.6L) μ in (57 + 12) μ in	Gage Blocks
Calipers, Dial, Digital, & Vernier	(0 to 12) in	(340 + 4L) μ in	
Indicators Dial, Digital & Test	(0 to 4) in	(30 + 1.1L) μ in	
Height Gages	(0 to 24) in	(290 + 7.91L) μ in	Gage Blocks / Surface Plate

Mass – Pressure/Low Vacuum 1, 2

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Pressure Gauges, Sensors, Transducers	(-14.5 to 14.5) psi	(0.00085 + 0.00006P) psi	GE Druck CM2-B
	(0 to 1 000) psi	(0.0093 + 0.0003P) psi	Dead Weight Tester
	(1000 to 3 000) psi	(0.59 + 0.0001P) psi	GE Druck CM1
	(3000 to 10 000) psi	17 psi	Heise Pressure Gauge

Mass – Scale and Balances 1, 2

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Precision Balance (0.000 1 g Resolution)	(0 to 200) g	(0.14 + 0.0023W) mg	ASTM E617 Class 1 weights utilized as reference standards
Analytical Balance (0.001 g Resolution)	(0 to 420) g	(0.77 + 0.0017W) mg	
Analytical Balance (0.01 g Resolution)	(0 to 1.2) kg	(8.4 + 0.00057W) mg	
Balance (1 g Resolution)	(0 to 30) kg	(770 + 0.00018W) mg	

Mass – Torque 1, 2, 3

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Torque Wrenches/Drivers	(4 to 400) ozf · in (0.5 to 50) lbf · in (15 to 150) lbf · in (4 to 400) lbf · in (100 to 1 000) lbf · in (25 to 250) lbf · ft (60 to 600) lbf · ft	0.38% + 1.2 ozf · in 0.34% + 0.2 lbf · in 0.45% + 0.3 lbf · in 0.55% + 0.2 lbf · in 0.47% + 1.6 lbf · in 0.51% + 0.3 lbf · ft 0.09% + 3 lbf · ft	Torque Analyzer with Torque Transducers

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Torque Transducers/Meters	(5 to 400) ozf · in (10 to 1 000) lbf · in (5 to 250) lbf · ft	0.14% + 0.03 ozf · in 0.14% + 0.02 lbf · in 0.14% + 0.0003 lbf · ft	Weights, Torque Arms, and Wheels

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and remarks. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 (k=2), corresponding to a confidence level of approximately 95%.

Notes:

- 1) Laboratory offers calibration services at the laboratory's own facilities and at the client or other agreed upon facilities.
- 2) *L* = length in inches, *W* = mass in grams, *X* = indicated temperature in °C, *P* = pressure in psi.
- 3) % = percent of reading unless otherwise indicated.

Approved by: 
 R. Douglas Leonard
 Chief Technical Officer

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