



# CERTIFICATE OF ACCREDITATION

## The ANSI National Accreditation Board

Hereby attests that

### **Martin Calibration dba Precision Technical Services**

**2400 West Southern Avenue, Suite 104  
Tempe, AZ 85282**

Fulfills the requirements of

### **ISO/IEC 17025:2017**

and national standard

**ANSI/NCSL Z540.3-2006 (R2013)**

In the fields of

## **CALIBRATION and DIMENSIONAL MEASUREMENT**

This certificate is valid only when accompanied by a current scope of accreditation document.  
The current scope of accreditation can be verified at [www.anab.org](http://www.anab.org).

A handwritten signature in black ink, appearing to read 'R. Douglas Leonard Jr.', is positioned above a horizontal line.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 30 December 2024

Certificate Number: L2272



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.  
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).

**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017  
AND ANSI/NCSL Z540.3-2006 (R2013)**

**Martin Calibration dba Precision Technical Services**

2400 West Southern Avenue, Suite 104  
Tempe, AZ 85282  
General Manager: Cherry Kelley 480-921-1021

**CALIBRATION AND DIMENSIONAL MEASUREMENT**

Valid to: **December 30, 2024**

Certificate Number: **L2272**

**CALIBRATION**

**Electrical – DC/Low Frequency**

<b>Parameter/Equipment</b>	<b>Range</b>	<b>Expanded Uncertainty of Measurement (+/-)</b>	<b>Reference Standard, Method, and/or Equipment</b>
DC Voltage Measure <sup>1</sup>	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV	12 $\mu$ V/V + 0.3 $\mu$ V 10 $\mu$ V/V + 0.3 $\mu$ V 10 $\mu$ V/V + 0.5 $\mu$ V 13 $\mu$ V/V + 30 $\mu$ V 13 $\mu$ V/V + 100 $\mu$ V	Keysight 3458A Multimeter
DC Current Measure <sup>1</sup>	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV	12 $\mu$ V/V + 0.3 $\mu$ V 10 $\mu$ V/V + 0.3 $\mu$ V 10 $\mu$ V/V + 0.5 $\mu$ V 13 $\mu$ V/V + 30 $\mu$ V 13 $\mu$ V/V + 100 $\mu$ V	Keysight 3458A Multimeter
DC Voltage – Source <sup>1</sup>	Up to 330 mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (330 to 1 020) V	21 $\mu$ V/V + 1 $\mu$ V 11 $\mu$ V/V + 2 $\mu$ V 13 $\mu$ V/V + 20 $\mu$ V 18 $\mu$ V/V + 150 $\mu$ V 18 $\mu$ V/V + 1.5 mV	5520A Multi Product Calibrator
DC Current – Source <sup>1</sup>	Up to 330 $\mu$ A 330 $\mu$ A to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20) A	151 $\mu$ A/A + 20 nA 101 $\mu$ A/A + 50 nA 101 $\mu$ A/A + 250 nA 102 $\mu$ A/A + 2.5 $\mu$ A 201 $\mu$ A/A + 40 $\mu$ A 386 $\mu$ A/A + 40 $\mu$ A 504 $\mu$ A/A + 0.5 mA 1 mA/A + 0.75 mA	5520A Multi Product Calibrator

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source	Up to 33 mV		5520A Multi Product Calibrator
	(10 to 45) Hz	806 $\mu\text{V/V} + 6 \mu\text{V}$	
	45 Hz to 10 kHz	176 $\mu\text{V/V} + 6 \mu\text{V}$	
	(10 to 20) kHz	220 $\mu\text{V/V} + 6 \mu\text{V}$	
	(20 to 50) kHz	1 mV/V + 6 $\mu\text{V}$	
	(50 to 100) kHz	3.5 mV/V + 12 $\mu\text{V}$	
	(100 to 500) kHz	8 mV/V + 50 $\mu\text{V}$	
	(33 to 330) mV		
	(10 to 45) Hz	302 $\mu\text{V/V} + 8 \mu\text{V}$	
	45 Hz to 10 kHz	148 $\mu\text{V/V} + 8 \mu\text{V}$	
	(10 to 20) kHz	163 $\mu\text{V/V} + 8 \mu\text{V}$	
	(20 to 50) kHz	353 $\mu\text{V/V} + 8 \mu\text{V}$	
	(50 to 100) kHz	804 $\mu\text{V/V} + 32 \mu\text{V}$	
	(100 to 500) kHz	2 mV/V + 70 $\mu\text{V}$	
	330 mV to 3.3 V		
	(10 to 45) Hz	302 $\mu\text{V/V} + 50 \mu\text{V}$	
	45 Hz to 10 kHz	153 $\mu\text{V/V} + 60 \mu\text{V}$	
	(10 to 20) kHz	192 $\mu\text{V/V} + 60 \mu\text{V}$	
	(20 to 50) kHz	302 $\mu\text{V/V} + 50 \mu\text{V}$	
	(50 to 100) kHz	703 $\mu\text{V/V} + 125 \mu\text{V}$	
	(100 to 500) kHz	2.4 mV/V + 0.6 mV	
	(3.3 to 33) V		
	(10 to 45) Hz	302 $\mu\text{V/V} + 650 \mu\text{V}$	
	45 Hz to 10 kHz	153 $\mu\text{V/V} + 600 \mu\text{V}$	
(10 to 20) kHz	242 $\mu\text{V/V} + 600 \mu\text{V}$		
(20 to 50) kHz	353 $\mu\text{V/V} + 600 \mu\text{V}$		
(50 to 100) kHz	903 $\mu\text{V/V} + 1.6 \text{ mV}$		
(33 to 330) V			
45 Hz to 1 kHz	194 $\mu\text{V/V} + 2 \text{ mV}$		
(1 to 10) kHz	204 $\mu\text{V/V} + 6 \text{ mV}$		
(10 to 20) kHz	253 $\mu\text{V/V} + 6 \text{ mV}$		
(20 to 50) kHz	314 $\mu\text{V/V} + 6 \text{ mV}$		
(50 to 100) kHz	2 mV/V + 50 mV		
(330 to 1020) V			
45 Hz to 1 kHz	302 $\mu\text{V/V} + 10 \text{ mV}$		
(1 to 5) kHz	252 $\mu\text{V/V} + 10 \text{ mV}$		
(5 to 10) kHz	302 $\mu\text{V/V} + 10 \text{ mV}$		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	Up to 10 mV		Keysight 3458A Multimeter
	(1 to 40) Hz	300 $\mu\text{V}/\text{V}$ + 3 $\mu\text{V}$	
	40 Hz to 1 kHz	219 $\mu\text{V}/\text{V}$ + 1.1 $\mu\text{V}$	
	(1 to 20) kHz	324 $\mu\text{V}/\text{V}$ + 1.1 $\mu\text{V}$	
	(20 to 50) kHz	1 mV/V + 6 $\mu\text{V}$	
	(50 to 100) kHz	5.1 mV/V + 1.1 $\mu\text{V}$	
	(100 to 300) kHz	41 mV/V + 2 $\mu\text{V}$	
	(10 to 100) mV		
	(1 to 40) Hz	70 $\mu\text{V}/\text{V}$ + 4 $\mu\text{V}$	
	40 Hz to 1 kHz	83.8 $\mu\text{V}/\text{V}$ + 2 $\mu\text{V}$	
	(1 to 20) kHz	157 $\mu\text{V}/\text{V}$ + 2 $\mu\text{V}$	
	(20 to 50) kHz	308 $\mu\text{V}/\text{V}$ + 2 $\mu\text{V}$	
	(50 to 100) kHz	878 $\mu\text{V}/\text{V}$ + 2 $\mu\text{V}$	
	(100 to 300) kHz	3.1 mV/V + 10 $\mu\text{V}$	
	300 kHz to 1 MHz	10 mV/V + 10 $\mu\text{V}$	
	(1 to 2) MHz	15 mV/V + 10 $\mu\text{V}$	
	100 mV to 1 V		
	(1 to 40) Hz	70 $\mu\text{V}/\text{V}$ + 40 $\mu\text{V}$	
	40 Hz to 1 kHz	80.7 $\mu\text{V}/\text{V}$ + 20 $\mu\text{V}$	
	(1 to 20) kHz	154 $\mu\text{V}/\text{V}$ + 20 $\mu\text{V}$	
	(20 to 50) kHz	327 $\mu\text{V}/\text{V}$ + 20 $\mu\text{V}$	
	(50 to 100) kHz	825 $\mu\text{V}/\text{V}$ + 20 $\mu\text{V}$	
	(100 to 300) kHz	3.1 mV/V + 0.1 mV	
	300 kHz to 1 MHz	10 mV/V + 0.1 mV	
(1 to 2) MHz	15 mV/V + 0.1 mV		
(1 to 10) V			
(1 to 40) Hz	77 $\mu\text{V}/\text{V}$ + 400 $\mu\text{V}$		
40 Hz to 1 kHz	81 $\mu\text{V}/\text{V}$ + 200 $\mu\text{V}$		
(1 to 20) kHz	154 $\mu\text{V}/\text{V}$ + 200 $\mu\text{V}$		
(20 to 50) kHz	324 $\mu\text{V}/\text{V}$ + 200 $\mu\text{V}$		
(50 to 100) kHz	816 $\mu\text{V}/\text{V}$ + 200 $\mu\text{V}$		
(100 to 300) kHz	3.1 mV/V + 1 mV		
300 kHz to 1 MHz	10 mV/V + 1 mV		
(1 to 2) MHz	15 mV/V + 1 mV		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	(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 (100 to 1 000) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	200 $\mu$ V/V + 4 mV 205 $\mu$ V/V + 2 mV 215 $\mu$ V/V + 2 mV 358 $\mu$ V/V + 2 mV 1.2 mV/V + 2 mV 4 mV/V + 2 mV 15 mV/V + 10 mV 400 $\mu$ V/V + 40 mV 405 $\mu$ V/V + 20 mV 600 $\mu$ V/V + 20 mV 1.2 mV/V + 20 mV 3 mV/V + 20 mV	Keysight 3458A Multimeter
AC Current – Measure	Up to 100 $\mu$ A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz 100 $\mu$ A to 1 mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz (1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	4 mA/A + 30 nA 1.5 mA/A + 30 nA 605 $\mu$ A/A + 30 nA 610 $\mu$ A/A + 30 nA 4 mA/A + 0.2 $\mu$ A 1.5 mA/A + 0.2 $\mu$ A 605 $\mu$ A/A + 0.2 $\mu$ A 325 $\mu$ A/A + 0.2 $\mu$ A 605 $\mu$ A/A + 0.2 $\mu$ A 4 mA/A + 0.4 $\mu$ A 5.5 mA/A + 1.5 $\mu$ A 4 mA/A + 2 $\mu$ A 1.5 mA/A + 2 $\mu$ A 605 $\mu$ A/A + 2 $\mu$ A 325 $\mu$ A/A + 2 $\mu$ A 605 $\mu$ A/A + 2 $\mu$ A 4 mA/A + 4 $\mu$ A 5.5 mA/A + 15 $\mu$ A	Keysight 3458A Multimeter

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure	(10 to 100) mA		Keysight 3458A Multimeter
	(10 to 20) Hz	4 mA/A + 20 $\mu$ A	
	(20 to 45) Hz	1.5 mA/A + 20 $\mu$ A	
	(45 to 100) Hz	605 $\mu$ A/A + 20 $\mu$ A	
	100 Hz to 5 kHz	325 $\mu$ A/A + 20 $\mu$ A	
	(5 to 20) kHz	605 $\mu$ A/A + 20 $\mu$ A	
	(20 to 50) kHz	4 mA/A + 40 $\mu$ A	
	(50 to 100) kHz	5.5 mA/A + 150 $\mu$ A	
	100 mA to 1 A		
	(10 to 20) Hz	4 mA/A + 0.2 mA	
	(20 to 45) Hz	1.6 mA/A + 0.2 mA	
	(45 to 100) Hz	805 $\mu$ A/A + 0.2 mA	
	100 Hz to 5 kHz	1 mA/A + 0.2 mA	
	(5 to 20) kHz	3 mA/A + 0.2 mA	
(20 to 50) kHz	10 mA/A + 0.4 mA		
AC Current – Source	(29 to 330) $\mu$ A		5520A Multi Product Calibrator
	(10 to 20) Hz	2 mA/A + 0.1 $\mu$ A	
	(20 to 45) Hz	1.5 mA/A + 0.1 $\mu$ A	
	45 Hz to 1 kHz	1.3 mA/A + 0.1 $\mu$ A	
	(1 to 5) kHz	3 mA/A + 0.15 $\mu$ A	
	(5 to 10) kHz	8 mA/A + 0.2 $\mu$ A	
	(10 to 30) kHz	16 mA/A + 0.4 $\mu$ A	
	(0.33 to 3.3) mA		
	(10 to 20) Hz	2 mA/A + 0.15 $\mu$ A	
	(20 to 45) Hz	1.3 mA/A + 0.15 $\mu$ A	
	45 Hz to 1 kHz	1 mA/A + 0.15 $\mu$ A	
	(1 to 5) kHz	2 mA/A + 0.2 $\mu$ A	
	(5 to 10) kHz	5.1 mA/A + 0.3 $\mu$ A	
	(10 to 30) kHz	10 mA/A + 0.6 $\mu$ A	
	(3.3 to 33) mA		
	(10 to 20) Hz	1.8 mA/A + 2 $\mu$ A	
	(20 to 45) Hz	910 $\mu$ A/A + 2 $\mu$ A	
	45 Hz to 1 kHz	423 $\mu$ A/A + 2 $\mu$ A	
(1 to 5) kHz	813 $\mu$ A/A + 2 $\mu$ A		
(5 to 10) kHz	2 mA/A + 3 $\mu$ A		
(10 to 30) kHz	4.1 mA/A + 4 $\mu$ A		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source	(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 (0.33 to 1.1) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (1.1 to 3) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (3 to 11) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz (11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	1.8 mA/A + 20 $\mu$ A 909 $\mu$ A/A + 20 $\mu$ A 417 $\mu$ A/A + 20 $\mu$ A 1 mA/A + 50 $\mu$ A 2 mA/A + 100 $\mu$ A 4.1 mA/A + 200 $\mu$ A 1.8 mA/A + 100 $\mu$ A 512 $\mu$ A/A + 100 $\mu$ A 6 mA/A + 1 mA 25 mA/A + 5 mA 1.8 mA/A + 100 $\mu$ A 664 $\mu$ A/A + 100 $\mu$ A 6 mA/A + 1 mA 25 mA/A + 5 mA 1.8 mA/A + 100 $\mu$ A 664 $\mu$ A/A + 100 $\mu$ A 6 mA/A + 1 mA 1.2 mA/A + 5 mA 1.5 mA/A + 5 mA 30 mA/A + 5 mA	5520A Multi Product Calibrator
Resistance – Source <sup>1</sup>	Up to 11 $\Omega$ (11 to 33) $\Omega$ (33 to 110) $\Omega$ (110 to 330) $\Omega$ 330 $\Omega$ to 1.1 k $\Omega$ (1.1 to 3.3) k $\Omega$ (3.3 to 11) k $\Omega$ (11 to 33) k $\Omega$ (33 to 110) k $\Omega$ (110 to 330) k $\Omega$ 330 k $\Omega$ to 1.1 M $\Omega$ (1.1 to 3.3) M $\Omega$ (3.3 to 11) M $\Omega$ (11 to 33) M $\Omega$	36 $\mu\Omega/\Omega$ 26 $\mu\Omega/\Omega$ 23 $\mu\Omega/\Omega$ 23 $\mu\Omega/\Omega$ 23 $\mu\Omega/\Omega$ 23 $\mu\Omega/\Omega$ 23 $\mu\Omega/\Omega$ 23 $\mu\Omega/\Omega$ 24 $\mu\Omega/\Omega$ 26 $\mu\Omega/\Omega$ 26 $\mu\Omega/\Omega$ 42 $\mu\Omega/\Omega$ 110 $\mu\Omega/\Omega$ 201 $\mu\Omega/\Omega$	5520A Multi Product Calibrator

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source <sup>1</sup>	(33 to 110) MΩ (110 to 330) MΩ 330 MΩ to 1.1 GΩ	400 μΩ/Ω 2.5 mΩ/Ω 12 mΩ/Ω	5520A Multi Product Calibrator
Resistance – Measure <sup>1</sup>	100 μΩ to 10 Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ	20 μΩ/Ω + 50 μΩ 17 μΩ/Ω + 5 μΩ 15 μΩ/Ω + 500 μΩ 15 μΩ/Ω + 5 mΩ 15 μΩ/Ω + 50 mΩ 20 μΩ/Ω + 2 Ω 83 μΩ/Ω + 100 Ω 820 μΩ/Ω + 1 kΩ	Keysight 3458A Multimeter
Capacitance – Source	10 Hz to 10 kHz (220 to 400) pF (0.4 to 1.1) nF 10 Hz to 3 kHz (1.1 to 3.3) nF 10 Hz to 1 kHz (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF (10 to 600) Hz (0.33 to 1.1) μF (10 to 300) Hz (1.1 to 3.3) μF (10 to 150) Hz (3.3 to 11) μF	6.4 mF/F + 10 pF 5.3 mF/F + 10 pF 5.1 mF/F + 10 pF 2.6 mF/F + 10 pF 2.6 mF/F + 100 pF 2.6 mF/F + 100 pF 2.6 mF/F + 300 pF 2.6 mF/F + 1 nF 2.6 mF/F + 3 nF 2.6 mF/F + 10 nF	5522A Multi Product Calibrator
Capacitance – Source	(10 to 120) Hz (11 to 33) μF (10 to 80) Hz (33 to 110) μF (0 to 50) Hz (110 to 330) μF (0 to 20) Hz (0.33 to 1.1) mF (0 to 6) Hz (1.1 to 3.3) mF (0 to 2) Hz (3.3 to 11) mF	4.1 mF/F + 30 nF 4.7 mF/F + 0.1 μF 4.6 mF/F + 0.3 μF 4.6 mF/F + 1 μF 4.5 mF/F + 3 μF 4.5 mF/F + 10 μF	5520A Multi Product Calibrator



**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source	(0 to 0.6) Hz (11 to 33) mF	7.5 mF/F + 30 $\mu$ F	5520A Multi Product Calibrator
	(0 to 0.2) Hz (33 to 110) mF	11 mF/F + 100 $\mu$ F	
Electrical Simulation of Thermocouple Indicating Devices – Source <sup>1</sup>	Type B (600 to 800) °C	0.44 °C	5520A Multi Product Calibrator
	(800 to 1 000) °C	0.34 °C	
	(1 000 to 1 550) °C	0.3 °C	
	(1 550 to 1 820) °C	0.33 °C	
	Type C (0 to 150) °C	0.3 °C	
	(150 to 650) °C	0.26 °C	
	(650 to 1 000) °C	0.31 °C	
	(1 000 to 1 800) °C	0.5 °C	
	(1 800 to 2 316) °C	0.84 °C	
	Type E (-250 to -100) °C	0.5 °C	
	(-100 to -25) °C	0.16 °C	
	(-25 to 350) °C	0.14 °C	
	(350 to 650) °C	0.16 °C	
	(650 to 1 000) °C	0.21 °C	
	Type J (-210 to -100) °C	0.27 °C	
	(-100 to -30) °C	0.16 °C	
	(-30 to 150) °C	0.14 °C	
	(150 to 760) °C	0.17 °C	
	(760 to 1 200) °C	0.23 °C	
	Type K (-200 to -100) °C	0.33 °C	
	(-100 to -25) °C	0.18 °C	
	(-25 to 120) °C	0.16 °C	
(120 to 1 000) °C	0.26 °C		
(1 000 to 1 372) °C	0.4 °C		
Type L (-200 to -100) °C	0.37 °C		
(-100 to 800) °C	0.26 °C		
(800 to 900) °C	0.17 °C		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Measure <sup>1</sup>	Type N (-200 to -100) °C (-100 to - 25) °C (-25 to 120) °C (120 to 410) °C (410 to 1 300) °C Type R (0 to 250) °C (250 to 400) °C (400 to 1 000) °C (1 000 to 1 767) °C Type S (0 to 250) °C (250 to 400) °C (400 to 1 000) °C (1 000 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C Type U (-200 to 0) °C (0 to 600) °C	0.4 °C 0.22 °C 0.19 °C 0.18 °C 0.27 °C 0.57 °C 0.35 °C 0.33 °C 0.4 °C 0.47 °C 0.36 °C 0.37 °C 0.46 °C 0.63 °C 0.24 °C 0.16 °C 0.14 °C 0.56 °C 0.27 °C	5520A Multi Product Calibrator
Electrical Simulation of RTD Indicators <sup>1</sup>	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 Pt 3926, 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	0.05 °C 0.05 °C 0.07 °C 0.09 °C 0.1 °C 0.12 °C 0.23 °C 0.05 °C 0.05 °C 0.07 °C 0.09 °C 0.1 °C 0.12 °C	5520A Multi Product Calibrator

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicators <sup>1</sup>	Pt 3916, 100 Ω		5520A Multi Product Calibrator
	(-200 to -190) °C	0.25 °C	
	(-190 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.05 °C	
	(0 to 100) °C	0.06 °C	
	(100 to 260) °C	0.07 °C	
	(260 to 300) °C	0.08 °C	
	(300 to 400) °C	0.09 °C	
	(400 to 600) °C	0.1 °C	
	(600 to 630) °C	0.23 °C	
	Pt 385, 200 Ω		
	(-200 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.04 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.12 °C	
	(300 to 400) °C	0.13 °C	
	(400 to 600) °C	0.14 °C	
	(600 to 630) °C	0.16 °C	
	Pt 385, 500 Ω		
	(-200 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.05 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 260) °C	0.06 °C	
	(260 to 300) °C	0.08 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 600) °C	0.09 °C	
	(600 to 630) °C	0.11 °C	
Pt 385, 1 000 Ω			
(-200 to -80) °C	0.03 °C		
(-80 to 0) °C	0.03 °C		
(0 to 100) °C	0.04 °C		
(100 to 260) °C	0.05 °C		
(260 to 300) °C	0.06 °C		
(300 to 400) °C	0.07 °C		
(400 to 600) °C	0.07 °C		
Pt 385, 1 000 Ω			
(600 to 630) °C	0.23 °C		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicators <sup>1</sup>	PtNi 385, 120 Ω (Ni120) (-80 to 0) °C (0 to 100) °C (100 to 260) °C Cu 427, 10 Ω (100 to 260) °C	0.08 °C 0.08 °C 0.14 °C 0.3 °C	5520A Multi Product Calibrator

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks <sup>2</sup>	(0.004 to 20) in	(1.4 + 1.4L) μin	Comparison to Master Blocks, ULM
External Diameters	(0.002 to 12) in	(3 + 3L) μin	Labmaster
Internal Diameters	(0.040 to 13) in	(3 + 3L) μin	Labmaster
Thread Rings (Adjustable) Pitch Diameter Tactile Fit (Set to Plug)	Up to 4 in	See footnote <sup>5</sup>	Thread Setting Plugs
Thread Plugs <sup>1,2</sup> Pitch Diameter Major Diameter	Up to 8 in Pitch (0.2 to 5) mm Up to 8 in Pitch 90 – 4 TPI	(87 + 1.9L) μin 43 μin	Horizontal Measuring Machine Thread Wires
Calipers <sup>1,2</sup>	Up to 60 in	(5+8L) μin	Gage Blocks
Outside Micrometer <sup>1,2</sup> Length Anvil Flatness	Up to 60 in (0 to 50) μin	(5+8L) μin 4 μin	Gage Blocks Optical Parallels
Micrometer Head Travel	Up to 4 in	(8+4L) μin	Horizontal Measuring System-Gage Blocks
Height Measuring Devices <sup>1,2</sup>	Up to 36 in (36 to 48) in	(45 + 2L) μin (7 + 3L) μin	Gage Blocks
Depth Micrometers <sup>1</sup>	(0 to 12) in	90 μin	Gage Blocks
Inside Micrometers <sup>2</sup>	(0.5 to 8) in (8 to 24) in	(6 + 1.7L) μin (3 + 2.5L) μin	Mitutoyo LH-600D Linear Height Gage, ULM

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Indicators <sup>1,2</sup>	(0.000 1 to 6) in	(5+4L) μin	Horizontal Measuring Machine
Bore Gages <sup>2</sup> 2-point	(0.24 to 9) in	(4.3 + 4.7L) μin + 0.6R	Horizontal Measuring Machine
Bore Gages <sup>2</sup> 3-point	(0.24 to 9) in	(85 + 7L) μin + 0.6R	Cylindrical Rings
Crimp Tools <sup>1</sup>	(0.011 to 1.00) in	182 μin	Crimp Height Micrometer
Crimp Tools <sup>1</sup>	(0.011 to 1.00) in	224 μin	Plug Gages
Surface Roughness	Up to 118 μin (118.1 to 500) μin	0.5 μin + 1 % of nominal 0.6 μin + 1.1 % of nominal	Profilometer, Master Patch
Profilometers	Up to 500 μin	0.7 μin + 1.1 % of nominal	Master Patch
Length Standards	(1 to 24) in	(3.4 + 3.5L) μin	Mitutoyo LH-600D Linear Height Gage, ULM
Feeler/Thickness Gages <sup>2</sup>	Up to 1.0 in	8 μin	Horizontal Measuring System
Graduated Scales	Up to 72 in	1 600 μin	Master and Eye Lupe
Thickness Gages Dial Digital	Up to 1 in	410 μin + 0.6R 44 μin+ 0.6R	Gage Blocks
VMMs	Linearity	(32 + 4.1L) μin	Glass Scales
CMMs <sup>1,2</sup> Linearity Volumetric Repeatability	(0.100 to 20) in (1 to 24) in (0.5 to 2) in	(22 + 3L) μin 66 μin 45 μin	Gage Blocks Ball Bar CMM Sphere

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure <sup>1</sup>	(8.7 to 16) psia	0.002 2 psi	Pressure Calibrator

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure	(-14.5 to 1 000) psig (1 000 to 3 000) psig (3 000 to 10 000) psig (10 000 to 30 000) psig	0.01 psi + 0.01 % of reading 0.1 psi + 0.01 % of reading 0.25 psi + 0.01 % of reading 35 psi	Pressure Calibrator
Mass Flow (Gas)	(5 to 30 000) SCCM (30 000 to 50 000) SCCM	0.93 % of reading 1.2 % of reading	Mesa Flow System Alicat Flow Cell
Torque Tools <sup>1</sup>	(5 to 50) lbf-in (50 to 400) lbf-in (400 to 1 000) lbf-in (80 to 250) lbf-ft (250 to 600) lbf-ft (600 to 2 000) lbf-ft	0.4 % of reading 0.4 % of reading 0.4 % of reading 0.4 % of reading 0.4 % of reading 0.4 % of reading	Torque Tester
Force Source and Measure	(20 to 2 000) lb	1 % of applied value	Load Cell
Cable Tensiometers	(20 to 2 000) lb	1.3 % of applied value	Load Cells

**Thermodynamic**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity - Source and Measure	(10 to 65) %RH (65 to 95) %RH	1.1 %RH 1.1 %RH	Comparison to a Rotronic HF532 Indicator and Probe
Infrared Thermometers	50 °C (50 to 100) °C (100 to 200) °C (200 to 300) °C (300 to 400) °C (400 to 500) °C	0.73 °C 1.6 °C 3.2 °C 4.9 °C 6.6 °C 8.5 °C	Blackbody Calibrator (Flat-Plate) $\lambda = (8 \text{ to } 14) \mu\text{m}$ $\epsilon = 0.95$ (non-selectable)
Temperature Measure and Source	(-200 to 1 372) °C	1.3 °C	Process Calibrator and Thermocouple
Temperature Measure and Source	(0 to 400) °C	0.084 °C + 0.0013 °C / °C	Precision RTD and Readout
Temperature Uniformity Surveys	(-200 to 0) °C (0 to 1 093) °C (1 093 to 1 344) °C	1.2 °C 1.3 °C 2.1 °C	Datalogger and Thermocouples per AMS 2750F and BAC 5621

**Time and Frequency**

<b>Parameter/Equipment</b>	<b>Range</b>	<b>Expanded Uncertainty of Measurement (+/-)</b>	<b>Reference Standard, Method, and/or Equipment</b>
Frequency - Source	(0.01 to 120) Hz 120 Hz 120 kHz 120 kHz to 2 MHz 2 MHz to 1.1 GHz	2.66 $\mu$ Hz/Hz + 5 $\mu$ Hz 2.51 $\mu$ Hz/Hz + 5 $\mu$ Hz 2.54 $\mu$ Hz/Hz + 5 $\mu$ Hz 2.5 $\mu$ Hz/Hz	Fluke 5520A Multiproduct Calibrator
Time	(2 to 86 000) s/day	31 ms/day	Helmut Klein 4500 Timometer



## DIMENSIONAL MEASUREMENT

### Dimensional Measurement 2D

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Angle	(0.25 to 365)°	0.000 69° (12 μin/μin)	Gage Blocks, Gage Amplifier, Sine Bar
Angle	(0.25 to 365)°	0.004°	Coordinate Measuring Machine
Dimensional Inspection - Non-contact	(12 x 8 x 4)	(44 + 1L) μin	Vision System
Roundness/Concentricity	Up to 150 mm	0.02 mm	Rondcom41c Roundness Measuring Instrument
Surface Finish Analysis	Up to 118 μin (118.1 to 500) μin	0.05 μin + 1 % of nominal 0.6 μin + 1.1 % of nominal	Profilometer, Master Patch

### 3 Dimensional

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Dimensional Inspection - contact	(16 x 18 x 14) in	(209 + 1.2L) μin	Coordinate Measuring Machine

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. 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. On-site calibration service is available for this parameter, since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.
2.  $L$  = length in inches.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. L2272.



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