CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Martin Calibration, Inc.
dba RMS Quality Services, Inc.
1500 S. Sylvania Ave., Suite 115
Sturtevant, WI 53177

Fulfills the requirements of

ISO/IEC 17025:2017

and national standard

ANSI/NCSL Z540-1-1994 (R2002)

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.

Jason Stine, Vice President

Expiry Date: 06 July 2027

Certificate Number: ACT-1265.01

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 Z540-1-1994 (R2002)

Martin Calibration, Inc.
dba RMS Quality Services, Inc.

1500 S. Sylvania Ave., Suite 115
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CALIBRATION AND DIMENSIONAL MEASUREMENT

ISO/IEC 17025 Accreditation Granted: **06 July 2025**

Certificate Number: **ACT-1265.01** Certificate Expiry Date: **06 July 2027**

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conductivity Meters [1]	(0.86 to 10) µS/cm (10 to 100) µS/cm (100 to 10 000) µS/cm	0.42 µS/cm 0.89 µS/cm 0.42 % of reading	Comparison to Conductivity Standards
pH Meters [1]	4 pH 7 pH 10 pH	0.016 pH 0.016 pH 0.016 pH	Comparison to Buffer Solutions

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source	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 µV/V + 1 µV 11 µV/V + 2 µV 13 µV/V + 20 µV 18 µV/V + 150 µV 18 µV/V + 1.5 mV	Comparison to Fluke 5522A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV	12 µV/V + 0.3 µV 10 µV/V + 0.3 µV 10 µV/V + 0.5 µV 12 µV/V + 30 µV 13 µV/V + 100 µV	Comparison to Keysight 3458A Multimeter
DC Current – Source	Up to 330 µA 330 µA 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 µA/A + 20 nA 101 µA/A + 50 nA 101 µA/A + 250 nA 102 µA/A + 2.5 µA 201 µA/A + 40 µA 386 µA/A + 40 µA 504 µA/A + 0.5 mA 1 mA/A + 0.75 mA	Comparison to Fluke 5522A Multiproduct Calibrator
DC Current – Measure	(10 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	29 µA/A + 0.8 nA 27 µA/A + 5 nA 28 µA/A + 50 nA 46 µA/A + 0.5 µA 121 µA/A + 10 µA	Comparison to Keysight 3458A Multimeter
AC Voltage – Source	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 (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 330 mV 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	 806 µV/V + 6 µV 176 µV/V + 6 µV 220 µV/V + 6 µV 12 mV/V + 6 µV 3.5 mV/V + 12 µV 8 mV/V + 50 µV 302 µV/V + 8 µV 148 µV/V + 8 µV 163 µV/V + 8 µV 353 µV/V + 8 µV 804 µV/V + 32 µV 2 mV/V + 70 µV 302 µV/V + 50 µV 153 µV/V + 60 µV 192 µV/V + 60 µV 302 µV/V + 50 µV 703 µV/V + 125 µV 2.4 mV/V + 0.6 mV	Comparison to Fluke 5522A Multiproduct Calibrator

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source	(3.3 to 33) V		Comparison to Fluke 5522A Multiproduct Calibrator
	(10 to 45) Hz	302 µV/V + 650 µV	
	45 Hz to 10 kHz	153 µV/V + 600 µV	
	(10 to 20) kHz	242 µV/V + 600 µV	
	(20 to 50) kHz	353 µV/V + 600 µV	
	(50 to 100) kHz	903 µV/V + 1.6 mV	
	(33 to 330) V		
	45 Hz to 1 kHz	194 µV/V + 2 mV	
	(1 to 10) kHz	204 µV/V + 6 mV	
	(10 to 20) kHz	253 µV/V + 6 mV	
	(20 to 50) kHz	314 µV/V + 6 mV	
	(50 to 100) kHz	2 mV/V + 50 mV	
	(330 to 1 020) V		
	45 Hz to 1 kHz	302 µV/V + 10 mV	
	(1 to 5) kHz	252 µV/V + 10 mV	
	(5 to 10) kHz	302 µV/V + 10 mV	
AC Voltage – Measure	Up to 10 mV		Comparison to Keysight 3458A Multimeter
	(1 to 40) Hz	300 µV/V + 3 µV	
	40 Hz to 1 kHz	219 µV/V + 1.1 µV	
	(1 to 20) kHz	324 µV/V + 1.1 µV	
	(20 to 50) kHz	1.01 mV/V + 6 µV	
	(50 to 100) kHz	5.1 mV/V + 1.1 µV	
	(100 to 300) kHz	41 mV/V + 2 µV	
	(10 to 100) mV		
	(1 to 40) Hz	70 µV/V + 4 µV	
	40 Hz to 1 kHz	83.8 µV/V + 2 µV	
	(1 to 20) kHz	157 µV/V + 2 µV	
	(20 to 50) kHz	308 µV/V + 2 µV	
	(50 to 100) kHz	878 µV/V + 2 µV	
	(100 to 300) kHz	3.08 mV/V + 10 µV	
	300 kHz to 1 MHz	10 mV/V + 10 µV	
	(1 to 2) MHz	15 mV/V + 10 µV	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	100 mV to 1 V		Comparison to Keysight 3458A Multimeter
	(1 to 40) Hz	70 µV/V + 40 µV	
	40 Hz to 1 kHz	80.7 µV/V + 20 µV	
	(1 to 20) kHz	154 µV/V + 20 µV	
	(20 to 50) kHz	327 µV/V + 20 µV	
	(50 to 100) kHz	825 µV/V + 20 µV	
	(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 µV/V + 400 µV	
	40 Hz to 1 kHz	81 µV/V + 200 µV	
	(1 to 20) kHz	154 µV/V + 200 µV	
	(20 to 50) kHz	324 µV/V + 200 µV	
	(50 to 100) kHz	816 µV/V + 200 µV	
	(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	
	(10 to 100) V		
	(1 to 40) Hz	200 µV/V + 4 mV	
	40 Hz to 1 kHz	205 µV/V + 2 mV	
	(1 to 20) kHz	215 µV/V + 2 mV	
	(20 to 50) kHz	358 µV/V + 2 mV	
	(50 to 100) kHz	1.2 mV/V + 2 mV	
	(100 to 300) kHz	4 mV/V + 2 mV	
	300 kHz to 1 MHz	15 mV/V + 10 mV	
	(100 to 1 000) V		
	(1 to 40) Hz	400 µV/V + 40 mV	
	40 Hz to 1 kHz	405 µV/V + 20 mV	
	(1 to 20) kHz	600 µV/V + 20 mV	
	(20 to 50) kHz	1.2 mV/V + 20 mV	
	(50 to 100) kHz	3 mV/V + 20 mV	
AC Current – Measure	Up to 100 µA		Comparison to Keysight 3458A Multimeter
	(10 to 20) Hz	4 mA/A + 30 nA	
	(20 to 45) Hz	1.5 mA/A + 30 nA	
	(45 to 100) Hz	605 µA/A + 30 nA	
	100 Hz to 1 kHz	610 µA/A + 30 nA	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure	100 µA to 1 mA		Comparison to Keysight 3458A Multimeter
	(10 to 20) Hz	4 mA/A + 0.2 µA	
	(20 to 45) Hz	1.5 mA/A + 0.2 µA	
	(45 to 100) Hz	605 µA/A + 0.2 µA	
	100 Hz to 5 kHz	325 µA/A + 0.2 µA	
	(5 to 20) kHz	605 µA/A + 0.2 µA	
	(20 to 50) kHz	4 mA/A + 0.4 µA	
	(50 to 100) kHz	5.5 mA/A + 1.5 µA	
	(1 to 10) mA		
	(10 to 20) Hz	4 mA/A + 2 µA	
	(20 to 45) Hz	1.5 mA/A + 2 µA	
	(45 to 100) Hz	605 µA/A + 2 µA	
	100 Hz to 5 kHz	325 µA/A + 2 µA	
	(5 to 20) kHz	605 µA/A + 2 µA	
	(20 to 50) kHz	4 mA/A + 4 µA	
	(50 to 100) kHz	5.5 mA/A + 15 µA	
	(10 to 100) mA		
	(10 to 20) Hz	4 mA/A + 20 µA	
	(20 to 45) Hz	1.5 mA/A + 20 µA	
	(45 to 100) Hz	605 µA/A + 20 µA	
	100 Hz to 5 kHz	325 µA/A + 20 µA	
	(5 to 20) kHz	605 µA/A + 20 µA	
	(20 to 50) kHz	4 mA/A + 40 µA	
	(50 to 100) kHz	5.5 mA/A + 150 µA	
	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 µA/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	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source	(29 to 330) µA		Comparison to Fluke 5522A Multiproduct Calibrator
	(10 to 20) Hz	2 mA/A + 0.1 µA	
	(20 to 45) Hz	1.5 mA/A + 0.1 µA	
	45 Hz to 1 kHz	1.3 mA/A + 0.1 µA	
	(1 to 5) kHz	3 mA/A + 0.15 µA	
	(5 to 10) kHz	8 mA/A + 0.2 µA	
	(10 to 30) kHz	16 mA/A + 0.4 µA	
	(0.33 to 3.3) mA		
	(10 to 20) Hz	2 mA/A + 0.15 µA	
	(20 to 45) Hz	1.3 mA/A + 0.15 µA	
	45 Hz to 1 kHz	1 mA/A + 0.15 µA	
	(1 to 5) kHz	2 mA/A + 0.2 µA	
	(5 to 10) kHz	5.1 mA/A + 0.3 µA	
	(10 to 30) kHz	10 mA/A + 0.6 µA	
	(3.3 to 33) mA		
	(10 to 20) Hz	1.8 mA/A + 2 µA	
	(20 to 45) Hz	910 µA/A + 2 µA	
	45 Hz to 1 kHz	423 µA/A + 2 µA	
	(1 to 5) kHz	813 µA/A + 2 µA	
	(5 to 10) kHz	2 mA/A + 3 µA	
	(10 to 30) kHz	4.1 mA/A + 4 µA	
	(33 to 330) mA		
	(10 to 20) Hz	1.8 mA/A + 20 µA	
	(20 to 45) Hz	909 µA/A + 20 µA	
	45 Hz to 1 kHz	417 µA/A + 20 µA	
	(1 to 5) kHz	1 mA/A + 50 µA	
	(5 to 10) kHz	2 mA/A + 100 µA	
	(10 to 30) kHz	4.1 mA/A + 200 µA	
	(0.33 to 1.1) A		
	(10 to 45) Hz	1.8 mA/A + 100 µA	
	45 Hz to 1 kHz	512 µA/A + 100 µA	
	(1 to 5) kHz	6 mA/A + 1 mA	
	(5 to 10) kHz	25 mA/A + 5 mA	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source	(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 + 100 µA 664 µA/A + 100 µA 6 mA/A + 1 mA 25 mA/A + 5 mA 1.8 mA/A + 100 µA 664 µA/A + 100 µA 6 mA/A + 1 mA 1 mA/A + 5 mA 1.5 mA/A + 5 mA 30 mA/A + 5 mA	Comparison to Fluke 5522A Multiproduct Calibrator
Resistance – Source	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω 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 330 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ 330 MΩ to 1.1 GΩ	36 µΩ/Ω 26 µΩ/Ω 23 µΩ/Ω 23 µΩ/Ω 23 µΩ/Ω 23 µΩ/Ω 23 µΩ/Ω 23 µΩ/Ω 24 µΩ/Ω 26 µΩ/Ω 26 µΩ/Ω 42 µΩ/Ω 110 µΩ/Ω 201 µΩ/Ω 400 µΩ/Ω 2.5 mΩ/Ω 12 mΩ/Ω	Comparison to Fluke 5522A Multiproduct Calibrator
Resistance – Measure	(2 to 12) Ω (12 to 120) Ω (120 to 1 200) Ω (1.2 to 12) kΩ (12 to 120) kΩ (120 to 1 200) kΩ (1.2 to 12) MΩ (12 to 120) MΩ (120 to 1 200) Ω	20 µΩ/Ω 18 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 18 µΩ/Ω 61 µΩ/Ω 510 µΩ/Ω 5 mΩ/Ω	Comparison to Keysight 3458A Multimeter

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
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 (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 (0 to 0.6) Hz (11 to 33) mF (0 to 0.2) Hz (33 to 110) mF	 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 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 7.5 mF/F + 30 µF 11 mF/F + 100 µF	Comparison to Fluke 5522A Multiproduct Calibrator
Electrical Simulation of Thermocouple Indicators [1] Source and Measure	Type B (600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °C	 0.44 °C 0.34 °C 0.3 °C 0.33 °C	Comparison to Fluke 5522A Multiproduct Calibrator

1899 L Street NW, Suite 1100-A, Washington, DC 20036
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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicators [1] Source and Measure	Type C		Comparison to Fluke 5522A Multiproduct Calibrator
	(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 N		
	(-200 to -100) °C	0.4 °C	
	(-100 to -25) °C	0.22 °C	
	(-25 to 120) °C	0.19 °C	
	(120 to 410) °C	0.18 °C	
	(410 to 1 300) °C	0.27 °C	
	Type R		
	(0 to 250) °C	0.57 °C	
	(250 to 400) °C	0.35 °C	
	(400 to 1 000) °C	0.33 °C	
	(1 000 to 1 767) °C	0.4 °C	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicators [1] Source and Measure	Type S		Comparison to Fluke 5522A Multiproduct Calibrator
	(0 to 250) °C	0.47 °C	
	(250 to 400) °C	0.36 °C	
	(400 to 1 000) °C	0.37 °C	
	(1 000 to 1 767) °C	0.46 °C	
	Type T		
	(-250 to -150) °C	0.63 °C	
	(-150 to 0) °C	0.24 °C	
	(0 to 120) °C	0.16 °C	
	(120 to 400) °C	0.14 °C	
	Type U		
	(-200 to 0) °C	0.56 °C	
	(0 to 600) °C	0.27 °C	
Electrical Simulation of RTD Indicators [1]	Pt 385, 100 Ω		Comparison to Fluke 5522A Multiproduct Calibrator
	(-200 to -80) °C	0.05 °C	
	(-80 to 0) °C	0.05 °C	
	(0 to 100) °C	0.07 °C	
	(100 to 300) °C	0.09 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 630) °C	0.12 °C	
	(630 to 800) °C	0.23 °C	
	Pt 3926, 100 Ω		
	(-200 to -80) °C	0.05 °C	
	(-80 to 0) °C	0.05 °C	
	(0 to 100) °C	0.07 °C	
	(100 to 300) °C	0.09 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 630) °C	0.12 °C	
	Pt 3916, 100 Ω		
	(-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	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicators [1]	Pt 385, 200 Ω		Comparison to Fluke 5522A Multiproduct Calibrator
	(-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, 1000 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	
	(600 to 630) °C	0.23 °C	
	PtNi 385, 120 Ω, (Ni120)		
	(-80 to 0) °C	0.08 °C	
	(0 to 100) °C	0.08 °C	
	(100 to 260) °C	0.14 °C	
	Cu 427, 10 Ω		
	(100 to 260) °C	0.3 °C	
Oscilloscopes Square Wave Signal, 1 kHz in to 50 Ω – Source	(1 to 25) mV	2.5 mV/V + 40 µV	Comparison to Fluke 5522A / SC1100 Multiproduct Calibrator
	(25 to 110) mV	2.5 mV/V + 40 µV	
	110 mV to 2.2 V	2.5 mV/V + 40 µV	
	(2.2 to 6.6) V	2.5 mV/V + 40 µV	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes			Comparison to Fluke 5522A / SC1100 Multiproduct Calibrator
Square Wave Signal, 1 kHz in to 1 MΩ – Source	(1 to 25) mV	1.1 mV/V + 40 µV	
	(25 to 110) mV	1 mV/V + 40 µV	
	110 mV to 2.2 V	1 mV/V + 40 µV	
	(2.2 to 11) V	1 mV/V + 40 µV	
	(11 to 130) V	1 mV/V + 40 µV	
Leveled Sine Wave Amplitude	50 kHz REF	20 mV/V + 300 µV	
	50 kHz to 100 MHz	35 mV/V + 300 µV	
	(100 to 300) MHz	40 mV/V + 300 µV	
	(300 to 600) MHz	60 mV/V + 300 µV	
	600 MHz to 1.1 GHz	70 mV/V + 300 µV	
Leveled Sine Wave Flatness (relative to 50 kHz)	50 kHz to 100 MHz	17mV/V + 100 µV	
	(100 to 300) MHz	22 mV/V + 100 µV	
	(300 to 600) MHz	41mV/V + 100 µV	
	600 MHz to 1.1 GHz	51 mV/V + 100 µV	
Time Marker (in to 50 Ω)	5 ns to 20 ms	2.5 µs/s	
	50 ms to 5 s	1 ms/s + 25 µs	
Rise Time	< 300 ps	+ 0 / - 100 ps	

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks [2]	(0.01 to 1) in	(1.4 + 1.3*L*) µin	Comparison to Gage Blocks Gage Block Comparator
	(2 to 3) in	(1 + 1.3*L*) µin	
	4 in	6.1 µin	
Gage Blocks [2]	(5 to 12) in	(5 + 2*L*) µin	Comparison to Horizontal Measuring Machine
	(12 to 20) in	(2 + 2.8*L*) µin	
Indicators [1,2,4]	(0.000 1 to 4) in	(11 + 2*L*) µin	Comparison to Horizontal Measuring Machine
Calipers [1,2,4]	Up to 60 in	(5 + 8*L*) µin	Comparison to Gage Blocks
	(60 to 80) in	(410 + 2*L*)	

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Micrometers [1,2,4] Anvil Flatness	Up to 12 in (12 to 24) in Up to 1 in*D* (0 to 84) µin	(5 + 8*L*) µin (34 + 4.6*L*) 4µin	Comparison to Gage Blocks, Optical Parallels
Height Measuring Devices [1,2,4]	Up to 36 in	(60 + 1*L*) µin	Comparison to Gage Blocks
External Diameter [1,2]	(0.000 1 to 12) in	(3 + 3*L*) µin	Comparison to Horizontal Measuring Machine
Internal Diameter [1,2]	(0.04 to 13) in	(3 + 3*L*) µin	Comparison to Horizontal Measuring Machine
Thread Rings (Adjustable) Pitch Diameter Tactile Fit (Set to Plug)	Up to 4 in	See footnote[3]	Comparison to Thread Setting Plug
Thread Rings Pitch Diameter	Up to 4 in	50 µin	Comparison to Horizontal Measuring Machine
Thread Rings Minor Diameter	Up to 4 in	50 µin	Comparison to Horizontal Measuring Machine
Thread Plugs [1,2] Pitch Diameter Major Diameter	Up to 8 in Pitch (0.2 to 5) mm Pitch 90 – 4 TPI Up to 8 in	(84 + 2*L*) µin (52 + 1*L*) µin	Comparison to Horizontal Measuring Machine Thread Measuring Wires
Optical Comparators [1,2] Linear Accuracy Magnification	Up to 6 in 6 to 12 in (5 to 100) X	(43 + 11*L*) µin (30 + 7.5*L*) µin 350 µin	Comparison to Glass Scale Glass Scale (Sphere)
Surface Plates [1,2] Overall Flatness Local Area Flatness	Up to 238 in*DL* Up to 238 in*DL*	(25 + 2.9*L*) µin 34 µin	Comparison to Laser System Repeat-O-Meter
Surface Finish Artifacts	Up to 500 µin	2.4 µin	Comparison to Profilometer, Master Patch
Profilometers [1]	Up to 500 µin	3.1 µin	Comparison to Master Patch

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
CMMs [1,2]	(0 to 144) in (6 to 24) in (0.5 to 2) in	(25 + 2.4*L*) µin 66 µin 45 µin	Comparison to Laser Measuring System Ball Bar, CMM Sphere
VMMs [1,2]	Linearity	(32 + 4.1*L*) µin	Comparison to Glass Scales
Horizontal Measuring Systems [1,2]	Up to 8 in 8 to 48 in	(6 + 1.7*L*) µin (3 + 2.5*L*) µin	Comparison to Gage Blocks
Angle Artifacts [2]	(0.25 to 365) °	0.69 m° (12 µin/ in)	Comparison to Gage Blocks, Gage Amplifier, Sine Bar
Length Standards [2]	(1 to 60) in	(3.4 + 3.5*L*) µin	Comparison to Horizontal Measuring System
Tapered Plugs [2] - Pitch Diameter Major Diameter Step Height	(0.062 5 to 6) in	(136 + 4*L*) µin 280 µin	Comparison to Horizontal Measuring System, Sine Block Thread Wires Height Gage
Tapered Rings - Pitch Diameter Step Height	(0.0625 to 6) in	160 µin 48 µin	Comparison to NPT Master Plug, Electronic Amplifier with Probe Height Gage
Thread Wires	Up to 0.2 in	13 µin	Comparison to Horizontal Measuring Machine
Graduated Scales [1,2]	Up to 8 in 8 to 24 in	(147 + 2.5*L*) µin 3 500 µin	Comparison to VMM and Linear Measuring System
Optical Flats [2] Flatness Parallelism	Up to 2 in*D* (0 to 80) µin	3.5 µin 2.7 µin	Comparison to Gage Block Comparator, Master Flat

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pipettes [1]	Up to 1 µL (1 to 5) µL (5 to 10) µL (10 to 20) µL (20 to 50) µL (50 to 100) µL (100 to 200) µL (200 to 500) µL (500 to 1 000) µL (1 000 to 10 000) µL (10 to 20) mL	0.041 µL 0.033 µL 0.028 µL 0.034 µL 0.046 µL 0.061 µL 0.27µL 0.30µL 0.79 µL 2.7 µL 5.8 µL	Comparison to Pipette Calibration System
Pressure [1]	(-14.7 to 300) psig (0 to 300) psig (300 to 10 000) psig	0.096 psi 0.21 psi 5.8 psi	Comparison to Pressure Calibrator
Scales and Balances [1,4,5]	(0.001 to 0.2) lb (0.2 to 5 000) lb	0.017 % of reading 0.024 % of reading	Comparison to Class F Weights
Torque Transducers [1]	0.5 ozf·in to 1 000 lbf·ft	0.08 % of reading	Comparison to Dead Weight Torque Arms
Torque Tools [1]	(20 to 200) ozf·in (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 1 000) lbf·ft (1 000 to 2 000) lbf·ft	0.55 % of reading + 0.073 ozf·in 0.33 % of reading 0.36 % of reading 0.4 % of reading 0.28 % of reading 0.51 % of reading 0.75 % of reading 0.45 % of reading	Comparison to Torque Tester
Durometers Spring Force Types A, B, E, O Types C, D, and DO Types OO, OOO, OOO-S Indenter Angle Indenter Length Indenter Radius	 Up to 100 Duro Up to 100 Duro Up to 100 Duro (20 to 40) ° (0.049 to 0.198) in (0.05 to 0.1) in	 0.35 Duro 0.15 Duro 0.32 Duro 0.045 ° 220 µin 250 µin	Comparison to Shore Durometer Calibrator Balance VMM

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness Testers [1]	HRA Low HRA Middle HRA High HRBW Low HRBW Middle HRBW High HRC Low HRC Middle HRC High HREW Low HREW Middle HREW High HRMW Low HRMW Middle HRMW High HR15N Low HR15N Middle HR15N High HR15TW Low HR15TW Middle HR15TW High HR30N Low HR30N Middle HR30N High HR30TW Low HR30TW Middle HR30TW High HR45N Low HR45N Middle HR45N High	0.69 HRA 0.62 HRA 0.36 HRA 0.71 HRBW 0.53 HRBW 0.9 HRBW 0.54 HRC 0.7 HRC 0.38 HRC 0.49 HREW 0.39 HREW 0.88 HREW 0.65 HRMW 0.55 HRMW 0.65 HRMW 0.69 HR15N 0.69 HR15N 0.36 HR15N 0.87 HR15TW 0.72 HR15TW 0.72 HR15TW 0.87 HR30N 0.91 HR30N 0.36 HR30N 0.54 HR30TW 0.72 HR30TW 0.39 HR30TW 0.64 HR45N 1.2 HR45N 0.34 HR45N	Indirect Verification to Test Blocks

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness Testers [1]	HR45TW Low HR45TW Middle HR45TW High	0.92 HR45TW 0.92 HR45TW 0.61 HR45TW	Indirect Verification to Test Blocks
Brinell Hardness Testers [1]	Repeatability at: 500 kgf ≤ 100 HBW ≥ 64 HBW 1 500 kgf ≤ 257 HBW ≥ 91 HBW 3 000 kgf ≤ 587 HBW ≥ 186 HBW	 0.025 mm 0.025 mm 0.025 mm 0.03 mm 0.025 mm 0.025 mm	Indirect Verification to Test Blocks
Force [1] Source and Measure	(0.035 to 16) ozf (1 to 10) lbf (>10 to 50) lbf (>50 to 500) lbf	0.018 % of reading + 0.21 µozf 0.018 % of reading + 0.33 µlbf 0.018 % of reading + 9.3 mlbf 0.036 % of reading + 5.3 mlbf	Comparison to Dead Weight
Force [1] Source and Measure	(500 to 50 000) lbf	0.29 % of reading	Comparison to Load Cells

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Radiation (Infrared) Thermometers	(35 to 100) ºC (100 to 200) ºC (200 to 350) ºC (350 to 500) ºC	0.69 ºC 1.1 ºC 1.6 ºC 2.4 ºC	Comparison to Fluke 4181 Black Body Calibrators λ = (8 to 14) µm Ɛ = (0.9 to 1.0)
Humidity- Measure [1]	(10 to 90) %RH (90 to 98) %RH	1.1 %RH 2 %RH	Comparison to Humidity Indicator
Temperature – Measure and Source [1]	(-200 to 420) °C	0.029 °C + 0.000 07 °C/°C	Comparison to Digital Temperature Gage and Drywell
Temperature – Measure Ovens and Chambers	(0 to 1 090) °C	0.53 °C	Comparison to Probe and Display

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Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency - Source	(0.01 to 120) Hz 120 Hz 120 kHz 120 kHz to 2 MHz 2 MHz to 1.1 GHz	2.66 µHz/Hz + 5 µHz 2.51 µHz/Hz + 5 µHz 2.54 µHz/Hz + 5 µHz 2.5 µHz/Hz	Comparison to Fluke 5522A Multiproduct Calibrator
Time	(2 to 86 000) s/day	31 ms/day	Comparison to Helmut Klein 4500 Timometer

DIMENSIONAL MEASUREMENT

2 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Surface Finish Analysis	Up to 500 µin	2.4 µin	Comparison to Profilometer, Master Patch
Angle Measurement	(0.25 to 365)°	0.69 m° (12 µin/in)	Comparison to Gage Blocks, Gage Amplifier, Sine Bar

3 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Non-contact [2]	(8 x 6 x 5) in	(147 + 2.5*L*) µin	Comparison to Vision System
Dimensional Inspection [2] Contact	(47 x 59 x 40)	(96 + 5.5*L*) µin	Comparison to 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%.

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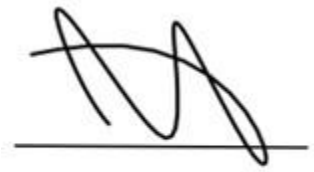
Notes:

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. The use of (*L*) represents Length in inches, the use of (*D*) represents Diameter in inches.
3. The tactile fit of an adjustable thread ring to a thread-setting plug is not a measurement of pitch diameter. The uncertainty for this pitch diameter setting is based on the contributors associated with the thread setting plug and environmental contributors only.
4. Uncertainties listed for Electromagnetic - DC/Low Frequency do not include possible contributions from a "best available" unit under test
5. The CMC for scales and balances are highly dependent upon the resolution of the unit under test. The uncertainties presented here does not include the resolution of the unit under test. The resolution will be included in the reported measurement uncertainty at the time of calibration.



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