



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Martin Calibration, Inc.
11965 12th Avenue South
Burnsville, MN 55337

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



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 LLC

11965 12th Avenue South

Burnsville, MN 55337

Jordan Arnold 952-882-1528

CALIBRATION AND DIMENSIONAL MEASUREMENT

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

Certificate Number: **ACT-1265**

Certificate Expiry Date: **06 July 2027**

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Level – Fixed Points	(94, 104, 114) dB	0.2 dB	Comparison to Briel & Kjaer Sound Pressure Calibrator
Sound Level – Linearity	(50 to 143) dB	0.13 dB	Comparison to Briel & Kjaer Sound Pressure Calibrator
Sound Level – Frequency	(0.031 to 16) kHz	1 % of reading	Comparison to Briel & Kjaer Sound Pressure Calibrator
Sound Level – Distortion	(25 to 123) dB (0.031 to 16) kHz	0.14 dB	Comparison to Briel & Kjaer Sound Pressure Calibrator
Accelerometers	(5 to 9) Hz (10 to 99) Hz 100 Hz (101 to 920) Hz 921 Hz to 5 kHz (5 to 8) kHz (8 to 10) kHz (10 to 15) kHz	2.6 % of reading 1.6 % of reading 0.75 % of reading 1.3 % of reading 2.2 % of reading 3.8 % of reading 4.8 % of reading 8.6 % of reading	Comparison to PCB Shaker Table with PCB Reference Accelerometer

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conductivity Meters ¹	(0.86 to 10) $\mu\text{S/cm}$ (10 to 100) $\mu\text{S/cm}$ (100 to 1 500) $\mu\text{S/cm}$ 12 800 $\mu\text{S/cm}$	0.42 $\mu\text{S/cm}$ 0.89 $\mu\text{S/cm}$ 0.42 % of reading 0.42 % of reading	Comparison to Accredited Conductivity Standards
Refractometers	0 Brix 10 Brix 40 Brix 70 Brix	0.000 6 Brix 0.018 Brix 0.019 Brix 0.03 Brix	Comparison to Accredited Calibration Solutions
pH Meters ¹	4 pH 7 pH 10 pH	0.016 pH 0.016 pH 0.016 pH	Comparison to Accredited pH Buffer Solutions

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source ¹ (Fixed Artifact)	10 V	0.3 $\mu\text{V/V}$	Comparison to Fluke 732B Voltage Standards with Fluke Maps
DC Voltage – Source ¹	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	7.5 $\mu\text{V/V} + 0.4 \mu\text{V}$ 5 $\mu\text{V/V} + 0.7 \mu\text{V}$ 3.5 $\mu\text{V/V} + 2.5 \mu\text{V}$ 3.5 $\mu\text{V/V} + 4 \mu\text{V}$ 5 $\mu\text{V/V} + 40 \mu\text{V}$ 6.5 $\mu\text{V/V} + 0.4 \text{ mV}$	Comparison to Fluke 5730A Multiproduct Calibrator
DC Voltage – Measure ¹	0V Up to 1 mV (1 to 10) mV (10 to 100) mV (100 mV to 1) V (1 to 10) V (10 to 100) V (100 to 1 100) V	20 nV 100 nV 22 $\mu\text{V/V} + 25 \text{ nV}$ 5.3 $\mu\text{V/V}$ 0.5 $\mu\text{V/V}$ 0.31 $\mu\text{V/V}$ 0.35 $\mu\text{V/V}$ 1 $\mu\text{V/V}$	Comparison to Nano Voltmeter, Fluke 732B Voltage Standard with MI Potentiometer/ Divider
DC High Voltage – Measure ¹	(1.1 to 10) kV (10 to 30) kV (30 to 50) kV (50 to 70) kV (70 to 100) kV	0.05 % of reading 0.055 % of reading 0.079 % of reading 0.12 % of reading 0.83 % of reading	Comparison to Hipotronics KVM100-A High Voltage Meter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source/Measure ¹	0 A (0 to 200) pA (0.2 to 20) nA (20 to 100) nA	76 fA 1.9 % of reading + 10 fA 0.29 % of reading + 1 pA 8 μ A/A + 1.3 pA	Comparison to Electrometer
DC0 Current – Source/Measure ¹	(0.1 to 1) μ A (1 to 10) μ A (10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	30 μ A/A 6.8 μ A/A 6.2 μ A/A 4.1 μ A/A 4.2 μ A/A 3.9 μ A/A 17 μ A/A	Comparison to Standard Resistors with Digital Multimeter, Multiproduct Calibrator
DC Current – Measure ¹	(1 to 20) A (20 to 120) A	26 μ A/A 80 μ A/A + 4 mA	Comparison to Fluke 52120A Amplifier with shunts
DC Current – Source ¹	(0.2 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	40 μ A/A + 6 nA 35 μ A/A + 7 nA 35 μ A/A + 40 nA 45 μ A/A + 0.7 μ A 80 μ A/A + 12 μ A	Comparison to Fluke 5730A Multiproduct Calibrator
DC Current – Source ¹	Up to 2 A (2.2 to 11) A (2 to 20) A	0.036 % of reading + 0.48 mA 0.012 % of reading + 0.16 mA 0.012 % of reading + 1.6 mA	Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier
DC Current – Source ¹	(20 to 120) A	0.012 % of reading	Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 52120A Current Amplifier
DC Current – Source ¹	(100 to 150) A (150 to 1 025) A	5 mA/A + 20 mA 5.1 mA/A + 0.9 A	Comparison to Fluke 5520A Multiproduct Calibrator with 50-turn Current Coil
DC Power – Source	10.9 μ W to 10.9 mW 10.9 mW to 3.06 kW (3.06 to 20.9) kW	0.18 mW/W 0.17 mW/W 0.54 mW/W	Comparison to Fluke 5520A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Source (45 to 65) Hz	(45 to 65) Hz 109 μ W to 1.09 mW (1.09 to 297) μ W 297 μ W to 2.97 mW 2.97 mW to 337 W 337 W to 2.24 kW (2.24 to 20.9) kW	1.1 mW/W 0.93 mW/W 0.78 mW/W 0.62 mW/W 0.7 mW/W 0.78 mW/W	Comparison to Fluke 5520A Multiproduct Calibrator
AC Voltage – Source ¹	Up to 2.2 mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (2.2 to 22) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (22 to 220) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % of reading + 4 μ V 0.009 % of reading + 4 μ V 0.008 % of reading + 4 μ V 0.02 % of reading + 4 μ V 0.05 % of reading + 5 μ V 0.11 % of reading + 10 μ V 0.14 % of reading + 20 μ V 0.27 % of reading + 20 μ V 0.024 % of reading + 4 μ V 0.009 % of reading + 4 μ V 0.008 % of reading + 4 μ V 0.02 % of reading + 4 μ V 0.05 % of reading + 5 μ V 0.11 % of reading + 10 μ V 0.14 % of reading + 20 μ V 0.27 % of reading + 20 μ V 0.024 % of reading + 12 μ V 0.009 % of reading + 7 μ V 0.005 7 % of reading + 7 μ V 0.012 % of reading + 7 μ V 0.031 % of reading + 17 μ V 0.066 % of reading + 20 μ V 0.14 % of reading + 25 μ V 0.27 % of reading + 45 μ V	Comparison to Fluke 5730A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(0.22 to 2.2) V		Comparison to Fluke 5730A Multiproduct Calibrator
	(10 to 20) Hz	0.024 % of reading + 40 μ V	
	(20 to 40) Hz	0.009 % of reading + 15 μ V	
	40 Hz to 20 kHz	0.004 2 % of reading + 8 μ V	
	(20 to 50) kHz	0.006 7 % of reading + 10 μ V	
	(50 to 100) kHz	0.008 5 % of reading + 30 μ V	
	(100 to 300) kHz	0.034 % of reading + 80 μ V	
	(300 to 500) kHz	0.1 % of reading + 0.2 mV	
	500 kHz to 1 MHz	0.17 % of reading + 0.3 mV	
	(2.2 to 22) V		
	(10 to 20) Hz	0.024 % of reading + 0.4 mV	
	(20 to 40) Hz	0.009 % of reading + 0.15 mV	
	40 Hz to 20 kHz	0.004 2 % of reading + 50 μ V	
	(20 to 50) kHz	0.006 7 % of reading + 0.1 mV	
	(50 to 100) kHz	0.008 3 % of reading + 0.2 mV	
	(100 to 300) kHz	0.034 % of reading + 0.6 mV	
	(300 to 500) kHz	0.1 % of reading + 2 mV	
	500 kHz to 1 MHz	0.17 % of reading + 3.2 mV	
	(22 to 220) V		
	(10 to 20) Hz	0.024 % of reading + 4 mV	
	(20 to 40) Hz	0.009 % of reading + 1.5 mV	
AC Voltage – Source ¹	40 Hz to 20 kHz	0.005 2 % of reading + 0.6 mV	Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier
	(20 to 50) kHz	0.008 % of reading + 1 mV	
	(50 to 100) kHz	0.015 % of reading + 2.5 mV	
	(100 to 300) kHz	0.09 % of reading + 16 mV	
	(300 to 500) kHz	0.44 % of reading + 40 mV	
	500 kHz to 1 MHz	0.8 % of reading + 80 mV	
	(220 to 250) V		
	(15 to 50) Hz	0.03 % of reading + 16 mV	
	(250 to 1 100) V		
	50 Hz to 1 kHz	0.007 % of reading + 3.5 mV	
AC Voltage – Source ¹	(220 to 750) V		Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier
	(30 to 50) kHz	0.06 % of reading + 11 mV	
	(50 to 100) kHz	0.06 % of reading + 11 mV	
	(220 to 1 100) V		
	40 Hz to 1 kHz	0.009 % of reading + 4 mV	
	(1 to 20) kHz	0.017 % of reading + 6 mV	
	(20 to 30) kHz	0.23 % of reading + 45 mV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source/Measure ¹	Up to 2.2 mV		Comparison to Fluke 5790A AC Measurement Standard, Fluke 5720A Multiproduct Calibrator
	(10 to 20) Hz	1.1 mV/V + 1.3 µV	
	(20 to 40) Hz	0.49 mV/V + 1.3 µV	
	(0.04 to 20) kHz	0.28 mV/V + 1.3 µV	
	(20 to 50) kHz	0.54 mV/V + 2 µV	
	(50 to 100) kHz	0.8 mV/V + 2.5 µV	
	(100 to 300) kHz	1.5 mV/V + 4 µV	
	(300 to 500) kHz	1.6 mV/V + 8 µV	
	(0.5 to 1) MHz	2.3 mV/V + 8 µV	
	(2.2 to 7) mV		
	(10 to 20) Hz	0.57 mV/V + 1.3 µV	
	(20 to 40) Hz	0.25 mV/V + 1.3 µV	
	(0.04 to 20) kHz	0.14 mV/V + 1.3 µV	
	(20 to 50) kHz	0.27 mV/V + 2 µV	
	(50 to 100) kHz	0.4 mV/V + 2.5 µV	
	(100 to 300) kHz	0.8 mV/V + 4 µV	
	(300 to 500) kHz	0.87 mV/V + 8 µV	
	(0.5 to 1) MHz	1.5 mV/V + 8 µV	
	(7 to 22) mV		
	(10 to 20) Hz	0.19 mV/V + 1.3 µV	
	(20 to 40) Hz	0.13 mV/V + 1.3 µV	
	(0.04 to 20) kHz	73 µV/V + 1.3 µV	
	(20 to 50) kHz	0.14 mV/V + 2 µV	
	(50 to 100) kHz	0.21 mV/V + 2.5 µV	
	(100 to 300) kHz	0.54 mV/V + 4 µV	
	(300 to 500) kHz	0.59 mV/V + 8 µV	
	(0.5 to 1) MHz	1.1 mV/V + 8 µV	
	(22 to 70) mV		
	(10 to 20) Hz	0.16 mV/V + 1.5 µV	
	(20 to 40) Hz	80 µV/V + 1.5 µV	
	(0.04 to 20) kHz	43 µV/V + 1.5 µV	
	(20 to 50) kHz	87 µV/V + 2 µV	
	(50 to 100) kHz	0.17 mV/V + 2.5 µV	
	(100 to 300) kHz	0.34 mV/V + 4 µV	
	(300 to 500) kHz	0.45 mV/V + 8 µV	
	(0.5 to 1) MHz	0.73 mV/V + 8 µV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source/Measure ¹	(70 to 220) mV		Comparison to Fluke 5790A AC Measurement Standard, Fluke 5720A Multiproduct Calibrator
	(10 to 20) Hz	0.14 mV/V + 1.5 μ V	
	(20 to 40) Hz	57 μ V/V + 1.5 μ V	
	(0.04 to 20) kHz	25 μ V/V + 1.5 μ V	
	(20 to 50) kHz	46 μ V/V + 2 μ V	
	(50 to 100) kHz	0.11 mV/V + 2.5 μ V	
	(100 to 300) kHz	0.17 mV/V + 4 μ V	
	(300 to 500) kHz	0.25 mV/V + 8 μ V	
	(0.5 to 1) MHz	0.67 mV/V + 8 μ V	
	(220 to 700) mV		
	(10 to 20) Hz	0.14 mV/V + 1.5 μ V	
	(20 to 40) Hz	51 μ V/V + 1.5 μ V	
	(0.04 to 20) kHz	22 μ V/V + 1.5 μ V	
	(20 to 50) kHz	34 μ V/V + 2 μ V	
	(50 to 100) kHz	53 μ V/V + 2.5 μ V	
	(100 to 300) kHz	0.12 mV/V + 4 μ V	
	(300 to 500) kHz	0.2 mV/V + 8 μ V	
	(0.5 to 1) MHz	0.64 mV/V + 8 μ V	
	(0.7 to 2.2) V		
	(10 to 20) Hz	0.13 mV/V	
	(20 to 40) Hz	44 μ V/V	
	(0.04 to 20) kHz	16 μ V/V	
	(20 to 50) kHz	31 μ V/V	
	(50 to 100) kHz	47 μ V/V	
	(100 to 300) kHz	0.11 mV/V	
	(300 to 500) kHz	0.17 mV/V	
	(0.5 to 1) MHz	0.6 mV/V	
	(2.2 to 7) V		
	(10 to 20) Hz	0.13 mV/V	
	(20 to 40) Hz	45 μ V/V	
	(0.04 to 20) kHz	16 μ V/V	
	(20 to 50) kHz	32 μ V/V	
	(50 to 100) kHz	54 μ V/V	
	(100 to 300) kHz	0.13 mV/V	
	(300 to 500) kHz	0.27 mV/V	
	(0.5 to 1) MHz	0.8 mV/V	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source/Measure ¹	(7 to 22) V		Comparison to Fluke 5790A AC Measurement Standard, Fluke 5720A Multiproduct Calibrator
	(10 to 20) Hz	0.13 mV/V	
	(20 to 40) Hz	45 μ V/V	
	(0.04 to 20) kHz	18 μ V/V	
	(20 to 50) kHz	32 μ V/V	
	(50 to 100) kHz	54 μ V/V	
	(100 to 300) kHz	0.13 mV/V	
	(300 to 500) kHz	0.27 mV/V	
	(0.5 to 1) MHz	0.8 mV/V	
	(22 to 70) V		
	(10 to 20) Hz	0.13 mV/V	
	(20 to 40) Hz	45 μ V/V	
	(0.04 to 20) kHz	21 μ V/V	
	(20 to 50) kHz	38 μ V/V	
	(50 to 100) kHz	63 μ V/V	
	(100 to 300) kHz	0.13 mV/V	
	(300 to 500) kHz	0.27 mV/V	
	(0.5 to 1) MHz	0.8 mV/V	
	(70 to 220) V		
	(10 to 20) Hz	0.13 mV/V	
	(20 to 40) Hz	45 μ V/V	
	(0.04 to 20) kHz	21 μ V/V	
	(20 to 50) kHz	46 μ V/V	
	(50 to 100) kHz	65 μ V/V	
	(100 to 300) kHz	0.14 mV/V	
	(300 to 500) kHz	0.33 mV/V	
	(220 to 700) V		
	(10 to 20) Hz	0.13 mV/V	
	(20 to 40) Hz	66 μ V/V	
	(0.04 to 20) kHz	27 μ V/V	
	(20 to 50) kHz	87 μ V/V	
	(50 to 100) kHz	0.33 mV/V	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source/Measure (Flatness relative to 1 kHz)	(0 to 2.2) mV		Comparison to Fluke 5790A AC Measurement Standard, Fluke 5720A Multiproduct Calibrator (Wideband)
	(10 to 30) Hz	0.1 % of reading + 1.3 μ V	
	(30 to 120) Hz	0.05 % of reading + 1.3 μ V	
	(0.12 to 1.2) kHz	0.05 % of reading + 1.3 μ V	
	(1.2 to 120) kHz	0.05 % of reading + 2 μ V	
	(120 to 500) kHz	0.07 % of reading + 1 μ V	
	(0.5 to 1.2) MHz	0.07 % of reading + 1 μ V	
	(1.2 to 2) MHz	0.07 % of reading + 1 μ V	
	(2 to 10) MHz	0.17 % of reading + 1 μ V	
	(10 to 20) MHz	0.32 % of reading + 1 μ V	
	(20 to 30) MHz	0.7 % of reading + 2 μ V	
	(2.2 to 7) mV		
	(10 to 30) Hz	0.1 % of reading	
	(30 to 120) Hz	0.05 % of reading	
	(0.12 to 1.2) kHz	0.05 % of reading	
	(1.2 to 120) kHz	0.05 % of reading	
	(120 to 500) kHz	0.07 % of reading + 1 μ V	
	(0.5 to 1.2) MHz	0.07 % of reading + 1 μ V	
	(1.2 to 2) MHz	0.07 % of reading + 1 μ V	
	(2 to 10) MHz	0.1 % of reading + 1 μ V	
	(10 to 20) MHz	0.17 % of reading + 1 μ V	
	(20 to 30) MHz	0.37 % of reading + 1 μ V	
	(7 to 22) mV		
	(10 to 30) Hz	0.1 % of reading	
	(30 to 120) Hz	0.05 % of reading	
	(0.12 to 1.2) kHz	0.05 % of reading	
	(1.2 to 120) kHz	0.05 % of reading	
	(120 to 500) kHz	0.07 % of reading	
	(0.5 to 1.2) MHz	0.07 % of reading	
	(1.2 to 2) MHz	0.07 % of reading	
	(2 to 10) MHz	0.1 % of reading	
	(10 to 20) MHz	0.17 % of reading	
	(20 to 30) MHz	0.37 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source/Measure (Flatness relative to 1 kHz)	(22 to 70) mV		Comparison to Fluke 5790A AC Measurement Standard, Fluke 5720A Multiproduct Calibrator (Wideband)
	(10 to 30) Hz	0.1 % of reading	
	(30 to 120) Hz	0.05 % of reading	
	(0.12 to 1.2) kHz	0.05 % of reading	
	(1.2 to 120) kHz	0.05 % of reading	
	(120 to 500) kHz	0.05 % of reading	
	(0.5 to 1.2) MHz	0.05 % of reading	
	(1.2 to 2) MHz	0.05 % of reading	
	(2 to 10) MHz	0.1 % of reading	
	(10 to 20) MHz	0.15 % of reading	
	(20 to 30) MHz	0.35 % of reading	
	(70 to 220) mV		
	(10 to 30) Hz	0.1 % of reading	
	(30 to 120) Hz	0.04 % of reading	
	(0.12 to 1.2) kHz	0.04 % of reading	
	(1.2 to 120) kHz	0.04 % of reading	
	(120 to 500) kHz	0.04 % of reading	
	(0.5 to 1.2) MHz	0.05 % of reading	
	(1.2 to 2) MHz	0.05 % of reading	
	(2 to 10) MHz	0.1 % of reading	
	(10 to 20) MHz	0.15 % of reading	
	(20 to 30) MHz	0.35 % of reading	
	(220 to 700) mV		
	(10 to 30) Hz	0.1 % of reading	
	(30 to 120) Hz	0.03 % of reading	
	(0.12 to 1.2) kHz	0.03 % of reading	
	(1.2 to 120) kHz	0.03 % of reading	
	(120 to 500) kHz	0.03 % of reading	
	(0.5 to 1.2) MHz	0.05 % of reading	
	(1.2 to 2) MHz	0.05 % of reading	
	(2 to 10) MHz	0.1 % of reading	
	(10 to 20) MHz	0.15 % of reading	
	(20 to 30) MHz	0.35 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source/Measure (Flatness relative to 1 kHz)	(0.7 to 2.2) V (10 to 30) Hz (30 to 120) Hz (0.12 to 1.2) kHz (1.2 to 120) kHz (120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.1 % of reading 0.03 % of reading 0.03 % of reading 0.03 % of reading 0.03 % of reading 0.05 % of reading 0.05 % of reading 0.1 % of reading 0.15 % of reading 0.35 % of reading	Comparison to Fluke 5790A AC Measurement Standard, Fluke 5720A Multiproduct Calibrator (Wideband)
	(2.2 to 7) V (10 to 30) Hz (30 to 120) Hz (0.12 to 1.2) kHz (1.2 to 120) kHz (120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.1 % of reading 0.03 % of reading 0.03 % of reading 0.03 % of reading 0.03 % of reading 0.05 % of reading 0.05 % of reading 0.1 % of reading 0.15 % of reading 0.35 % of reading	
AC Current – Source ¹	Up to 220 μ A (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (0.22 to 2.2) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (2.2 to 22) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % of reading + 16 nA 0.016 % of reading + 10 nA 0.011 % of reading + 8 nA 0.028 % of reading + 12 nA 0.11 % of reading + 65 nA 0.25 % of reading + 40 nA 0.016 % of reading + 35 nA 0.011 % of reading + 35 nA 0.02 % of reading + 0.11 μ A 0.11 % of reading + 0.65 μ A 0.025 % of reading + 0.4 μ A 0.016 % of reading + 0.35 μ A 0.011 % of reading + 0.35 μ A 0.020 % of reading + 0.55 μ A 0.11 % of reading + 5 μ A	Comparison to Fluke 5730A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(2.2 to 22) mA	0.025 % of reading + 0.4 μ A	Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier
	(10 to 20) Hz	0.016 % of reading + 0.35 μ A	
	(20 to 40) Hz	0.011 % of reading + 0.35 μ A	
	40 Hz to 1 kHz	0.02 % of reading + 0.55 μ A	
	(1 to 5) kHz	0.11 % of reading + 5 μ A	
	(5 to 10) kHz		
	(22 to 220) mA	0.025 % of reading + 4 μ A	
	(10 to 20) Hz	0.016 % of reading + 3.5 μ A	
	(20 to 40) Hz	0.011 % of reading + 2.5 μ A	
	40 Hz to 1 kHz	0.02 % of reading + 3.5 μ A	
	(1 to 5) kHz	0.11 % of reading + 10 μ A	
	(5 to 10) kHz		
AC Current – Source ¹	(0.22 to 2.2) A	0.025 % of reading + 35 μ A	Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 52120A Current Amplifier
	20 Hz to 1 kHz	0.045 % of reading + 80 μ A	
	(1 to 5) kHz	0.7 % of reading + 0.16 mA	
	(5 to 10) kHz		
	(2.2 to 11) A	0.046 % of reading + 0.17 mA	
	(40 to 100) Hz	0.095 % of reading + 0.38 mA	
	(1 to 5) kHz	0.36 % of reading + 0.75 mA	
	(5 to 10) kHz		
	Up to 2 A	0.009 % of reading + 40 μ A	
	(10 to 850) Hz	0.04 % of reading + 80 μ A	
	850 Hz to 6 kHz	1.6 % of reading + 62 mA	
	(6 to 10) kHz		
AC Current – Source ¹	(2 to 20) A	0.009 % of reading + 0.4 mA	Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 52120A Current Amplifier
	(10 to 850) Hz	0.04 % of reading + 0.8 mA	
	850 Hz to 6 kHz	2.3 % of reading + 94 mA	
	(6 to 10) kHz		
	(20 to 120) A	0.009 % of reading + 2.4 mA	
	(10 to 850) Hz	0.04 % of reading + 4.8 mA	
	850 Hz to 6 kHz	3.1 % of reading + 0.7 A	
	(6 to 10) kHz		
	9 μ A to 1 mA	75 μ A/A	
	DC to 10 kHz		
	1 mA to 1 A	28 μ A/A	
	DC to 10 kHz		
AC Current – Source ¹	(1 to 20) A	52 μ A/A	Comparison to Fluke 5720A Multiproduct Calibrator, Fluke A40B Shunts
	DC to 10 kHz		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(20 to 120) A DC to 1 kHz (1 to 6) kHz	3 mA/A 12 mA/A	Comparison to Fluke 5720A Multiproduct Calibrator, Fluke A40B Shunts
AC Current – Measure ¹	9 μ A to 1 mA DC to 30 kHz (30 to 100) kHz 1 mA to 1 A DC to 100 kHz (1 to 20) A DC to 10 kHz (10 to 30) kHz (30 to 100) kHz	90 μ A/A 0.18 mA/A 35 μ A/A 61 μ A/A 83 μ A/A 0.13 mA/A	Comparison to Fluke A40B Shunts
AC Current – Measure ¹	9 μ A to 200 μ A (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz 200 μ A to 2 mA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz (2 to 20) mA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz (20 to 200) mA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.62 mA/A 0.54 mA/A 0.94 mA/A 8.4 mA/A 0.6 mA/A 0.54 mA/A 0.94 mA/A 4.2 mA/A 0.6 mA/A 0.54 mA/A 0.94 mA/A 4.2 mA/A 0.57 mA/A 0.49 mA/A 0.83 mA/A	Comparison to Fluke 8508A Reference Multimeter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure	(0.2 to 2) A		Comparison to Fluke 8588A 8.5 Digit Multimeter
	1 Hz to 2 kHz	0.3 mA/A + 0.1 mA	
	(2 to 10) kHz	0.56 mA/A + 0.1 mA	
	(10 to 30) kHz	0.8 mA/A + 0.1 mA	
	(2 to 20) A		
	10 Hz to 2 kHz	0.84 mA/A + 0.5 mA	
Resistance – Source ¹ (Artifacts)	(2 to 10) kHz	0.86 mA/A + 0.5 mA	Comparison to Standard Resistors
	(20 to 30) A		
	10 Hz to 2 kHz	0.84 mA/A + 12 mA	
	(2 to 10) kHz	1.2 mA/A + 12 mA	
	0.001 Ω	3.5 μΩ/Ω	
	0.01 Ω	4.3 μΩ/Ω	
	0.1 Ω	1.5 μΩ/Ω	
	1 Ω	0.67 μΩ/Ω	
	10 Ω	0.56 μΩ/Ω	
	100 Ω	0.68 μΩ/Ω	
	1 kΩ	0.51 μΩ/Ω	
	10 kΩ	0.8 μΩ/Ω	
	100 kΩ	0.57 μΩ/Ω	
	1 MΩ	1.3 μΩ/Ω	
	10 MΩ	14 μΩ/Ω	
	100 MΩ	0.13 mΩ/Ω	
	1 GΩ	26 μΩ/Ω	
	(1 to 10) GΩ	0.16 % of reading	
	(10 to 100) GΩ	0.54 % of reading	
Resistance – Measure ¹	(100 to 900) GΩ	0.56 % of reading	Comparison to Standard Resistors with Resistance Bridge, Digital Multimeter
	1 TΩ	1.6 % of reading	
	10 TΩ	1.7 % of reading	
	(10 to 100) μΩ	0.15 % of reading	
	(0.1 to 1) mΩ	15 μΩ/Ω	
	(1 to 10) mΩ	5.1 μΩ/Ω	
	(10 to 100) mΩ	1.8 μΩ/Ω	
	(0.1 to 1) Ω	0.67 μΩ/Ω	
	(1 to 10) Ω	0.56 μΩ/Ω	
	(10 to 100) Ω	0.68 μΩ/Ω	
	(0.1 to 1) kΩ	0.51 μΩ/Ω	
	(1 to 10) kΩ	0.8 μΩ/Ω	
	(10 to 100) kΩ	0.57 μΩ/Ω	
	(0.1 to 1) MΩ	1.3 μΩ/Ω	
	(1 to 10) MΩ	14 μΩ/Ω	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure ¹	(10 to 200) MΩ (0.2 to 2) GΩ (2 to 20) GΩ	72 μΩ/Ω + 1 kΩ 0.18 mΩ/Ω + 100 kΩ 0.67 mΩ/Ω + 10 MΩ	Comparison to Decade Resistors with Resistance Bridge, Digital Multimeter
Resistance – Measure ¹ (High Voltage Mode)	Up to 200 V (2 to 20) MΩ (20 to 200) MΩ 200 MΩ to 2 GΩ (2 to 20) GΩ	15 μΩ/Ω + 10 Ω 60 μΩ/Ω + 1 kΩ 0.15 mΩ/Ω + 100 kΩ 0.53 mΩ/Ω + 10 MΩ	Comparison to Decade Resistors with Resistance Bridge, Digital Multimeter
AC Resistance (Impedance) (Artifacts)	(1, 500) kHz, 1 MHz 25 Ω 375 Ω (1, 250, 500) kHz, 1 MHz 6 kΩ (1, 25, 50) kHz 100 kΩ	100 μΩ/Ω 100 μΩ/Ω 100 μΩ/Ω 100 μΩ/Ω	Comparison to AC Resistor Set
Capacitance – Measure ¹	1 kHz 1 pF 10 pF 100 pF 1 nF 1 μF	1.9 mF/F 1.1 mF/F 1.2 mF/F 1.2 mF/F 1.2 mF/F	Comparison to QuadTech 1730 LCR Meter
Capacitance – Source ¹ (Fixed Artifacts)	100 Hz, 1 kHz 1 pF 1 nF 10 nF 100 nF 1 μF	1.8 mF/F 0.23 mF/F 0.25 mF/F 0.21 mF/F 0.25 mF/F	Comparison to Standard Capacitors
Capacitance – Source ¹ 10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz (10 to 600) Hz 10 Hz to 300 Hz 10 Hz to 150 Hz 10 Hz to 120 Hz	0.19 nF to 1.1 nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 110) nF (110 to 330) nF 330 nF to 1.1 μF (1.1 to 3.3) μF (3.3 to 11) μF (11 to 33) μF	15 mF/F 8.4 mF/F 3.6 mF/F 3.6 mF/F 3.7 mF/F 3.6 mF/F 3.6 mF/F 3.6 mF/F 5.1 mF/F	Comparison to Fluke 5520A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source ¹ 10 Hz to 80 Hz DC to 50 Hz DC to 20 Hz DC to 6 Hz DC to 2 Hz DC to 0.6 Hz DC to 0.2 Hz	(33 to 110) μ F (110 to 330) μ F 330 μ F to 1.1 mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	5.6 mF/F 5.6 mF/F 8.7 mF/F 5.5 mF/F 5.5 mF/F 8.5 mF/F 12 mF/F	Comparison to Fluke 5520A Multiproduct Calibrator
Inductance – Measure ¹	1 kHz 100 μ H 1 mH 10 mH 100 mH 1 H	1.2 mH/H 1.2 mH/H 1.2 mH/H 1.2 mH/H 1.2 mH/H	Comparison to QuadTech 1730 LCR Meter
Inductance – Source ¹ (Fixed Artifact)	100 Hz 500 μ H 2 mH 20 mH 1 H 1 kHz 500 μ H 2 mH 20 mH 1 H	1.2 mH/H 1.1 mH/H 1.1 mH/H 1 mH/H 1 mH/H 1 mH/H 1 mH/H 1 mH/H	Comparison to Standard Inductors
Oscilloscopes ¹ Square Wave Signal into 50 Ω load into 1 M Ω load DC Voltage into 50 Ω load into 1 M Ω load Leveled Sine Wave Amplitude	1 kHz 40 μ V to 5 V 40 μ V to 5 V 1 mV to 5 V 1 mV to 200 V 5 mV to 5 V	1 mV/V 1 mV/V 0.26 mV/V 0.25 mV/V 15 mV/V	Comparison to Fluke 9500B/3200/9530 Oscilloscope Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes ¹ Leveled Sine Wave Flatness (relative to 50 kHz) into 50 Ω load into 1 M Ω load Time Marker (Source and Period) into 50 Ω load Rise/Fall Time – Source Pulse Width – Source	4.4 mVp-p to 5.6 Vp-p 0.1 Hz to 300 MHz (300 to 550) MHz 4.4 mVp-p to 3.3 Vp-p 550 MHz to 1.1 GHz (1.1 to 3.2) GHz 9 ns to 55 s 150 ps (1 to 100) ns	43 mV/V 43 mV/V 52 mV/V 52 mV/V 0.25 μ s/s 27 ps 52 ms/s	Comparison to Fluke 9500B/3200/9530 Oscilloscope Calibrator
Electrical Simulation of Thermocouple Indicators ¹	Type B (250 to 350) °C (350 to 445) °C (445 to 580) °C (580 to 750) °C (750 to 1 000) °C (1 000 to 1 820) °C Type C (0 to 250) °C (250 to 1 000) °C (1 000 to 1 500) °C (1 500 to 1 800) °C (1 800 to 2 000) °C (2 000 to 2 250) °C (2 250 to 2 315) °C	1.1 °C 0.85 °C 0.67 °C 0.52 °C 0.43 °C 0.33 °C 0.23 °C 0.18 °C 0.21 °C 0.24 °C 0.27 °C 0.33 °C 0.37 °C	Comparison to Ectron 1140A Thermocouple Simulator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicators ¹	Type E		Comparison to Ectron 1140A Thermocouple Simulator
	(-270 to -245) °C	1.4 °C	
	(-245 to -195) °C	0.21 °C	
	(-195 to -155) °C	0.12 °C	
	(-155 to -90) °C	0.09 °C	
	(-90 to 15) °C	0.08 °C	
	(15 to 890) °C	0.07 °C	
	(890 to 1 000) °C	0.08 °C	
	Type J		
	(-210 to -180) °C	0.14 °C	
	(-180 to -120) °C	0.12 °C	
	(-120 to -50) °C	0.09 °C	
	(-50 to 990) °C	0.08 °C	
	(990 to 1 200) °C	0.08 °C	
	Type K		
	(-270 to -255) °C	2.5 °C	
	(-255 to -195) °C	0.81 °C	
	(-195 to -115) °C	0.14 °C	
	(-115 to -55) °C	0.1 °C	
	(-55 to 1 000) °C	0.08 °C	
	(1 000 to 1 372) °C	0.09 °C	
	Type N		
	(-270 to -260) °C	5.8 °C	
	(-260 to -200) °C	1.2 °C	
	(-200 to -140) °C	0.27 °C	
	(-140 to -70) °C	0.17 °C	
	(-70 to 25) °C	0.14 °C	
	(25 to 160) °C	0.12 °C	
	(160 to 1 300) °C	0.1 °C	
	Type R		
	(-50 to -30) °C	0.75 °C	
	(-30 to 45) °C	0.63 °C	
	(45 to 160) °C	0.46 °C	
	(160 to 380) °C	0.35 °C	
	(380 to 775) °C	0.3 °C	
	(775 to 1 768) °C	0.25 °C	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicators ¹	Type S		Comparison to Ectron 1140A Thermocouple Simulator
	(-50 to -30) °C	0.71 °C	
	(-30 to -45) °C	0.64 °C	
	(-45 to -105) °C	0.46 °C	
	(-105 to 310) °C	0.38 °C	
	(310 to 615) °C	0.33 °C	
	(615 to 1 768) °C	0.3 °C	
	Type T		
	(-270 to -255) °C	2.1 °C	
	(-255 to -240) °C	0.56 °C	
	(-240 to -210) °C	0.35 °C	
	(-210 to -150) °C	0.21 °C	
	(-150 to -40) °C	0.14 °C	
Electrical Simulation of RTD Indicators ¹ (Source)	(-40 to 100) °C	0.09 °C	Comparison to Fluke 5520A Multiproduct Calibrator
	(100 to 400) °C	0.08 °C	
	Pt 385, 100 Ω		
	(-200 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	
	Pt 3926, 100 Ω		
	(-200 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	
	Pt 3916, 100 Ω		
	(-200 to -190) °C	0.29 °C	
	(-190 to -80) °C	0.05 °C	
	(-80 to 0) °C	0.06 °C	
	(0 to 100) °C	0.07 °C	
	(100 to 260) °C	0.08 °C	
	(260 to 300) °C	0.09 °C	
	(300 to 400) °C	0.11 °C	
	(400 to 600) °C	0.12 °C	
	(600 to 630) °C	0.27 °C	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicators ¹ (Source)	Pt 385, 200 Ω		Comparison to Fluke 5520A Multiproduct Calibrator
	(-200 to 100) °C	0.05 °C	
	(100 to 260) °C	0.06 °C	
	(260 to 300) °C	0.14 °C	
	(300 to 400) °C	0.15 °C	
	(400 to 600) °C	0.16 °C	
	(600 to 630) °C	0.19 °C	
	Pt 385, 500 Ω		
	(-200 to -80) °C	0.05 °C	
	(-80 to 100) °C	0.06 °C	
	(100 to 260) °C	0.07 °C	
	(260 to 400) °C	0.09 °C	
	(400 to 600) °C	0.01 °C	
	(600 to 630) °C	0.13 °C	
	Pt 395, 100 Ω		
	(-200 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	
	Pt 3926, 100 Ω		
	(-200 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	
	Pt 3916, 100 Ω		
	(-200 to -190) °C	0.29 °C	
	(-190 to -80) °C	0.05 °C	
	(-80 to 0) °C	0.06 °C	
	(0 to 100) °C	0.07 °C	
	(100 to 260) °C	0.08 °C	
	(260 to 300) °C	0.09 °C	
	(300 to 400) °C	0.11 °C	
	(400 to 600) °C	0.12 °C	
	(600 to 630) °C	0.27 °C	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicators ¹ (Source)	Pt 385, 1 000 Ω		Comparison to Fluke 5520A Multiproduct Calibrator
	(-200 to 0) $^{\circ}\text{C}$	0.04 $^{\circ}\text{C}$	
	(0 to 100) $^{\circ}\text{C}$	0.05 $^{\circ}\text{C}$	
	(100 to 260) $^{\circ}\text{C}$	0.06 $^{\circ}\text{C}$	
	(260 to 300) $^{\circ}\text{C}$	0.07 $^{\circ}\text{C}$	
	(300 to 600) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$	
	(600 to 630) $^{\circ}\text{C}$	0.27 $^{\circ}\text{C}$	
	PtNi, 120 Ω		
	(-80 to 100) $^{\circ}\text{C}$	0.09 $^{\circ}\text{C}$	
	(100 to 260) $^{\circ}\text{C}$	0.16 $^{\circ}\text{C}$	
	Cu 427, 10 Ω		
	(-100 to 260) $^{\circ}\text{C}$	0.35 $^{\circ}\text{C}$	

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure Absolute Level ¹	(-36 to 20) dBm		Comparison to Agilent E9304A/N1912A Agilent N5531S Measuring Receiver with N5532A Sensor Module
	9 kHz to 6 GHz	0.16 dB	
	(20 to 30) dBm		
	(6 to 18) GHz	0.44 dB	
	(18 to 26.5) GHz	0.5 dB	
RF Power – Measure Absolute Level ¹	(-20 to 20) dBm		Comparison to Agilent N5531S Measuring Receiver with N5532A Sensor Module
	100 kHz to 30 MHz	0.2 dB	
	30 MHz to 2 GHz	0.21 dB	
	(1 to 18) GHz	0.31 dB	
	(18 to 26.5) GHz	0.4 dB	
RF Power – Measure Absolute Level ¹	(-30 to 20) dBm		Comparison to Agilent N5531S Measuring Receiver with 8482A Sensor
	100 kHz to 30 MHz	3.1 % of reading	
Relative Power – Measure ¹ 100 kHz to 26.5 GHz	(-10 to 0) dB	0.02 dB	Comparison to Agilent N5531S Measuring Receiver with N5532A Sensor Module
	(-20 to -10) dB	0.03 dB	
	(-30 to -20) dB	0.03 dB	
	(-40 to -30) dB	0.05 dB	
	(-50 to -40) dB	0.06 dB	
	(-60 to -50) dB	0.06 dB	
	(-70 to -60) dB	0.07 dB	
	(-80 to -70) dB	0.07 dB	

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Power – Measure ¹ 100 kHz to 26.5 GHz	(-90 to -80) dB (-100 to -90) dB (-110 to -100) dB (-120 to -110) dB (-130 to -120) dB (-140 to -130) dB	0.08 dB 0.08 dB 0.09 dB 0.1 dB 0.1 dB 0.1 dB	Comparison to Agilent N5531S Measuring Receiver with N5532A Sensor Module
RF Power – Source ¹	(-90 to -75) dBm 250 kHz to 2 GHz (2 to 20) GHz (20 to 32) GHz (-75 to -10) dBm 250 kHz to 2 GHz (2 to 20) GHz (20 to 32) GHz (-20 to -10) dBm 250 kHz to 2 GHz (2 to 20) GHz (20 to 32) GHz	0.73 dB 1 dB 1.2 dB 0.72 dB 1 dB 1.2 dB 1.4 dB 1.3 dB 1.3 dB	Comparison to Agilent N5183A Signal Generator
RF Power – Source ¹	(-10 to 10) dBm 250 kHz to 2 GHz (2 to 20) GHz (20 to 32) GHz > 10 dBm 250 kHz to 2 GHz (2 to 20) GHz (20 to 32) GHz	0.61 dB 0.91 dB 0.93 dB 0.63 dB 0.92 dB 1 dB	Comparison to Agilent N5183A Signal Generator
Phase Modulation – Source ¹ 100 kHz to 32 GHz	Rate: DC to 1 MHz DC to 4 MHz	0.59 % of reading + 0.01 rad	Comparison to Agilent N5183A Signal Generator
LO Phase Noise @ 1GHz	(-50 to 20) dB Frequency offset: (0.10 to 1 000) Hz (1 to 9 900) kHz	0.48 dB 0.64 dB	Comparison to Keysight E4440A Spectrum Analyzer
Amplitude Modulation ¹ - Source 100 kHz to 32 GHz	Rate: DC to 10 kHz Depths: (1 to 90) %	4.1 % of reading	Comparison to Agilent N5183A Signal Generator

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation – Measure ¹			
100 kHz to 10 MHz	Rate: 20 Hz to 10 kHz Depths: (5 to 99) %	0.83 % of reading	Comparison to Agilent N5531S Measuring Receiver with N5532A Sensor Modules
10 MHz to 3 GHz	Rate: 50 Hz to 100 kHz Depths: (20 to 99) %	0.59 % of reading	
10 MHz to 3 GHz	Rate: 50 Hz to 100 kHz Depths: (5 to 20) %	2.6 % of reading	
(3 to 26.5) GHz	Rate: 50 Hz to 100 kHz Depths: (20 to 99) %	1.6 % of reading	
(3 to 26.5) GHz	Rate: 50 Hz to 100 kHz Depths: (5 to 20) %	4.7 % of reading	
Pulse Generation – Source ¹ Repetition Frequency: 0.10 Hz to 10.0 MHz	30 ns to 42 s	10 ns	Comparison to Agilent N5183A Signal Generator
Frequency Modulation – Source ¹ 100 kHz to 32 GHz	1 dB Rate: DC to 3 MHz 3 dB Rate: DC to 7 MHz	2 % of setting + 20 Hz	Comparison to Agilent N5183A Signal Generator
Phase Modulation – Measure ¹			
100 kHz to 6.6 GHz	Rate: 200 Hz 20 kHz Dev.: > 0.7 rad	1.1 % of reading	Comparison to Agilent N5531S Measuring Receiver with N5532A Sensor Modules
100 kHz to 6.6 GHz	Rate: 200 Hz, 20 kHz Dev.: > 0.3 rad	3.1 % of reading	
(6.6 to 13.2) GHz	Rate: 200 Hz 20 kHz Dev.: > 2 rad	1.1 % of reading	
(6.6 to 13.2) GHz	Rate: 200 Hz 20 kHz Dev.: > 0.6 rad	3.1 % of reading	
(13.2 to 26.5) GHz	Rate: 200 Hz 20 kHz Dev.: > 2 rad	1.1 % of reading	
(13.2 to 26.5) GHz	Rate: 200 Hz 20 kHz Dev.: > 0.6 rad	3.1 % of reading	

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Freq Modulation – Measure ¹ Freq. Dev. Mod Rate Ratio > 0.2			
250 kHz to 10 MHz	Rate: 20 Hz to 10 kHz Dev.: 200 Hz to 40 kHz peak Freq. Dev. Mod Rate Ratio > 0.2	1.6 % of reading	Comparison to Agilent N5531S Measuring Receiver with N5532A Sensor Modules
250 kHz to 10 MHz	Rate: 20 Hz to 10 kHz Dev.: 200 Hz to 40 kHz peak Freq. Dev. Mod Rate Ratio > 1.2	1.1 % of reading	
10 MHz to 6.6 GHz	Rate: 50 Hz to 200 kHz Dev.: 250 Hz to 400 kHz peak Freq. Dev. Mod Rate Ratio > 0.2	1.6 % of reading	
Freq Modulation-Measure ¹ Freq. Dev. Mod Rate Ratio > 0.2 10 MHz to 6.6 GHz			
	Rate: 50 Hz to 200 kHz Dev.: 250 Hz to 400 kHz peak Freq. Dev. Mod Rate Ratio > 0.45	1.1 % of reading	Comparison to Agilent N5531S Measuring Receiver with N5532A Sensor Modules
(6.6 to 13.2) GHz	Rate: 50 Hz to 200 kHz Dev.: 250 Hz to 400 kHz peak Freq. Dev. Mod Rate Ratio > 0.2	2.6 % of reading	
(6.6 to 13.2) GHz	Rate: 50 Hz to 200 kHz Dev.: 250 Hz to 400 kHz peak Freq. Dev. Mod Rate Ratio > 8	1.1 % of reading	

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Freq Modulation-Measure ¹ Freq. Dev. Mod Rate Ratio > 0.2 (13.2 to 26.5) GHz	Rate: 50 Hz to 200 kHz Dev.: 250 Hz to 400 kHz peak Freq. Dev. Mod Rate Ratio > 0.2	3.9 % of reading	Comparison to Agilent N5531S Measuring Receiver with N5532A Sensor Modules
(13.2 to 26.5) GHz	Rate: 50 Hz to 200 kHz Dev.: 250 Hz to 400 kHz peak Freq. Dev. Mod Rate Ratio > 8	1.1 % of reading	

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Angle Plates – Measuring Equipment ²	(0.25 to 365)°	2.4"	Comparison to Gage Blocks, Gage Amplifier, Sine Bar
Angle Plates – Squareness ²	Up to 18 in	0.000 32° (5.6 μin/in)	Comparison to Gage Amplifier with probe, Master Square(s)
Gage Blocks ²	(0.01 to 1) in (2 to 3) in 4 in	(1.1 + 0.4L) μin (1.2 + 0.7L) μin 4.6 μin	Comparison to Master Gage Blocks, Gage Block Comparator
Gage Blocks ²	(5 to 20) in	(0.96 + 1.2L) μin	Comparison to Horizontal Measuring Machine, Master Gage Blocks
Gage Blocks ²	100 mm (125 to 500) mm	0.17 μm (0.06 + 0.000 6L) μm	Comparison to Horizontal Measuring Machine, Master Gage Blocks
Indicators ^{1,2}	(0.000 1 to 6) in	(5 + 8L) μin	Comparison to Horizontal Measuring Machine

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers ^{1,2}	Up to 60 in (60 to 80) in	$(5 + 8L) \mu\text{in}$ $(410 + 2L) \mu\text{in}$	Comparison to Gage Blocks
Outside Micrometers ^{1,2} Travel Linearity	Up to 12 in (12 to 24) in	$(5 + 8L) \mu\text{in}$ $(34 + 4.6L) \mu\text{in}$	Comparison to Gage Blocks
Anvil Flatness	Up to 1 inD (0 to 84) μin	4 μin	Optical Parallels
Height Measuring Devices ^{1,2}	Up to 36 in (36 to 48) in	$(43 + 1.7L) \mu\text{in}$ $(7 + 3L) \mu\text{in}$	Comparison to Gage Blocks
Grind Gages	Up to 100 mm	0.35 mm	Comparison to Digital Indicator
Coating Thickness Gages ^{1,2,7}	Up to 0.02 in	58 μin	Comparison to Coating Thickness Standards
Coating Thickness Gage Standards	Up to 0.1 in	21 μin	Comparison to Horizontal Measuring Machine
External Diameter ^{1,2}	(0.000 1 to 1) in (1 to 12) in	$(3 + 1L) \mu\text{in}$ $(3 + 3L) \mu\text{in}$	Comparison to Horizontal Measuring Machine
Internal Diameter ^{1,2}	(0.04 to 13) in	$(3 + 3L) \mu\text{in}$	Comparison to Horizontal Measuring Machine
Thread Plugs ^{1,2} Pitch Diameter	Up to 8 in Pitch (0.2 to 5) mm	$(87 + 1.9L) \mu\text{in}$	Comparison to Horizontal Measuring Machine, Thread Measuring Wires
Major Diameter	Pitch 90 – 4 TPI Up to 4 in	$(8 + 3L) \mu\text{in}$	
Adjustable Thread Rings ⁵ Pitch Diameter	Up to 4 in	See footnote	Tactile fit using a Thread Setting Plug
Optical Comparators ^{1,2} Linear Accuracy	Up to 6 in 6 to 12 in	$(43 + 11L) \mu\text{in}$ $(30 + 7.5L) \mu\text{in}$	Comparison to Glass Scale
Magnification	(5 to 100) X	350 μin	Glass Scale (Sphere)

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Surface Plates ^{1,2}			In accordance with ASME B89.3.7 using Laser System
Overall Flatness	Up to 54 inDL (54 to 238) inDL	$(17 + 0.7DL) \mu\text{in}$ $(1 + 1.4DL) \mu\text{in}$	
Local Area Flatness (Repeat Readings)	Up to 0.02 in	34 μin	Repeat-O-Meter
Profilometers ¹	Up to 500 μin	1.1 % of reading + 0.7 μin	Comparison to Master Patch
Optical Flats ²			Comparison to Gage Block Comparator, Master Flat
Parallelism	Up to 6 inD	2.7 μin	
Flatness	(0 to 80) μin	3.5 μin	
Coordinate Measuring Machine ^{1,2}			Comparison to Laser Measuring System
Linearity	(0 to 144) in	$(25 + 2.4L) \mu\text{in}$	
Volumetric Repeatability	(6 to 24) in (0.5 to 2) in	66 μin 45 μin	Ball Bar, CMM Sphere
Video Measuring Machines ^{1,2}			Comparison to Glass Scales
X-Y Linearity	Up to 6 in	$(32 + 4.1L) \mu\text{in}$	
Graduated Scales ^{1,2} Glass, Steel, Tape	Up to 12 in (1 to 200) ft	$(40 + 1L) \mu\text{in}$ $(10 + 3L) \mu\text{in}$	Comparison to Laser Measuring System
Horizontal Measuring Systems ^{1,2}			Comparison to Gage Blocks
Travel Linearity	Up to 8 in (8 to 60) in	$(6 + 1.7L) \mu\text{in}$ $(3 + 2.5L) \mu\text{in}$	
Bore Gages ^{2,7}			Comparison to Horizontal Measuring Machine
2-point	(0.24 to 9) in	$(4.3 + 3L) \mu\text{in}$	
3-point	(0.24 to 9) in	$(85 + 7L) \mu\text{in}$	Cylindrical Rings
Protractors	(0 to 90)°	0.16°	Comparison to Sine Bar, Gage Blocks
Chamfer Gages ^{2,7}	(0.179 to 2.749) in	280 μin	Comparison to Chamfer Rings

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Cylindrical Squares ² Squareness	Up to 12 in	1.5"	Comparison to Gage Amplifier w/ probe, Master Square(s)
Cylindricity		0.02 μ m	Roundness Machine
Feeler/Thickness Gages ²	Up to 0.2 in	(4.3 + 3L) μ in	Comparison to Horizontal Measuring System
Gage Amplifier w/ Probe(s)	Up to 0.1 in	10 μ in	Comparison to Gage Blocks
Gage Balls/Spheres ² Diameter	Up to 6 in	(4.3 + 3D) μ in	Comparison to Gage Blocks, Horizontal Measuring System
Roundness		0.02 μ m	Roundness Machine
Indicator Calibrator ⁷ Linearity	Up to 6 in	60 μ in	Comparison to Horizontal Measuring System
Groove Micrometers ²	Up to 12 in	(44 + 2.6L) μ in	Comparison to Gage Blocks
Machinist Levels ² Zero Check	Up to 24 in	350 μ in	Comparison to Master Level, Gage Blocks, Surface Plate
Linearity		(100 + 0.83L) μ in	
Microscopes, Stereo Reticle Linearity	Up to 2 in	870 μ in	Comparison to Stage Micrometer
Microscopes – Toolmakers ^{2,7} Scale Linearity	Up to 4 in	(774 + 70L) μ in	Comparison to Stage Micrometer
Length Standards ²	(1 to 60) in	(3.4 + 3.5L) μ in	Comparison to Horizontal Measuring System
Micrometers – Inside ²	Up to 8 in (8 to 60) in	(6 + 1.7L) μ in (3 + 2.5L) μ in	Comparison to Horizontal Measuring System
Pi Tapes ² Length	Up to 12 in	(40 + 1L) μ in (10+ 3L) μ in	Comparison to Laser System
Thickness	(12 to 200) in	240 μ in	Micrometer

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Parallels ²			
Steel	Up to 18 in	$(96 + 1.8L) \mu\text{in}$	Comparison to Electronic Amplifier with Probe
Granite	Up to 18 in	$(49 + 0.7L) \mu\text{in}$	Surface Plate
Pitch Micrometer Standard ²			
Length	(1 to 65) in	$(3.4 + 3.5L) \mu\text{in}$	Comparison to Horizontal Measuring System
Angle	60°	0.004° (70 $\mu\text{in/in}$)	Vision System
Radius Gages	(0.015 625 to 0.5) in	300 μin	Comparison to Vision System
Sine Plates/Bars ²			
Top Surface Flatness	Up to 0.1 in	$(41 + 2.2L) \mu\text{in}$	Comparison to Electronic Amplifier with Probe
Overall Length	Up to 10 in	$(3.4 + 3.5L) \mu\text{in}$	Horizontal Measuring System
Squares ²	Up to 18 in	0.000 32° (5.6 $\mu\text{in/in}$)	Comparison to Electronic Amplifier with Probe, Master Square
Straightness, Straight Edges ²	Up to 60 in	$(208 + 2.3L) \mu\text{in}$	Comparison to Electronic Amplifier with Probe, Surface Plate
Tapered Plugs ²			
Pitch Diameter		$(137 + 3.3L) \mu\text{in}$	Comparison to Horizontal Measuring System,
Major Diameter	(0.0625 to 6) in	$(123 + 6.7L) \mu\text{in}$	Sine Block, Thread Wires, Height Gage
Step Height		280 μin	
Roundness Machine Roundness (Spindle Performance)	Up to 0.016 in	15 μin	Comparison to Master Sphere
Tapered Rings			
Pitch Diameter	(0.0625 to 6) in	160 μin	Comparison to NPT Master Plug, Electronic Amplifier with Probe
Step Height		5 μin	Height Gage

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thickness Gages ^{2,7} Dial	Up to 1 in	410 μ in	Comparison to Gage Blocks
Digital	Up to 1 in	44 μ in	
Thread Micrometers ^{2,7} (Screw Thread, Pitch Point) Linearity	Up to 12 in	(44 + 2.6L) μ in	Comparison to Gage Blocks, Thread Setting Plug
Anvil Wear		690 μ in	
Granite V Blocks - Side Parallelism V Parallelism Squareness	Up to 12 in	(51 + 0.47L) μ in	Comparison to Electronic Amplifier with Probe, Surface Plate
Extensometers ¹	Up to 2 in	16 μ in	Comparison to Extensometer Calibrator
Extensometers ¹ Gage Length	(0 to 2) in	78 μ in	Comparison to Caliper

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Force Measuring Devices ¹	(0.035 to 16) ozf (1 to 10) lbf (10 to 50) lbf (50 to 500) lbf	0.018 % of reading + 0.000 000 21 ozf 0.018 % of reading + 0.000 000 33 lbf 0.018 % of reading + 0.009 3 lbf 0.036 % of reading + 0.005 3 lbf	Comparison to Dead Weight
Force Measuring Devices ¹	(500 to 100 000) lbf	0.04 % of reading	Comparison to Load Cells
Force Measuring Devices ¹	(30 000 to 400 000) lbf	0.29 % of applied value	Comparison to Class A Load Cells (compression only)
Test Machine ^{1,2} Crosshead Displacement	Up to 1 in (1 to 36) in	0.000 3 in (150 + 146L) μ in	Comparison to Indicator, Gage Blocks
Cable Tensiometers	Up to 600 lb (600 to 2 000) lb	1.2 % of applied value 1.3 % of applied value	Comparison to Dead Weight Load Cells

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Viscometers ¹	Up to 25 cP (25 to 1 500) cP (1 500 to 75 000) cP	0.33 % of reading 0.52 % of reading 0.55 % of reading	Comparison to Viscosity Standards
Absolute Pressure Measuring Devices ¹	(10 to 17) psia	0.000 4 psi	Comparison to Pressure Calibrator
Pressure Measuring Devices	(-14.5 to -0.5) psi (1 to 500) psi (500 to 10 000) psi	0.006 5 % of reading 0.006 5 % of reading 0.007 % of reading	Comparison to Dead Weight Tester
Low Pressure Measuring Devices ¹	(0 to 2) inH ₂ O (2 to 60) inH ₂ O	0.000 35 inH ₂ O 0.009 1 % of reading + 0.000 3 inH ₂ O	Comparison to Fluke 7250LP Low Pressure Calibrator
Mass Flow (Gas)	(5 to 50 000) sccm (0.5 to 50) slpm (50 to 500) slpm	0.25 % of reading 0.22 % of reading 0.2 % of reading	Comparison to Mesa Flow System
Air Velocity	30 fpm (40 to 60) fpm (60 to 150) fpm (150 to 275) fpm (275 to 9 000) fpm	5.1 % of reading 2.6 % of reading 1.2 % of reading 0.99 % of reading 0.74 % of reading	Comparison to Wind Tunnel with Pitot Tube
Torque Tools ¹	(2 to 20) ozf·in (20 to 200) ozf·in (5 to 50) lbf·in (50 to 400) lbf·in (400 to 1000) lbf·in (80 to 250) lbf·ft (250 to 600) lbf·ft (600 to 2 000) lbf·ft	0.1 % of reading + 0.006 1 ozf·in 0.08% of reading + 0.14 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	Comparison to Torque Tester
Torque Transducers ¹	0.5 ozf·in to 1 000 lbf·ft (1 000 to 2 000) lbf·ft	0.08 % of reading 0.09 % of reading	Comparison to Dead Weight, Torque Arms
Graduated Cylinders	(1 to 200) mL (100 to 1 000) mL (600 to 6 000) mL	1.9 µL 3.2 µL 26 µL	Gravimetric method using Balances

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pipettes	Up to 1 μ L (1 to 5) μ L (5 to 10) μ L (10 to 20) μ L (20 to 50) μ L (50 to 100) μ L (100 to 200) μ L (200 to 500) μ L (500 to 1 000) μ L (1 000 to 10 000) μ L (10 to 20) mL	0.041 μ L 0.033 μ L 0.028 μ L 0.034 μ L 0.046 μ L 0.061 μ L 0.27 μ L 0.3 μ L 0.79 μ L 2.7 μ L 5.8 μ L	Comparison to Pipette Calibration System
Scales and Balances ^{1,6}	Up to 5 mg (5 to 500) mg 500 mg to 5 g (5 to 10) g (10 to 20) g (20 to 50) g (50 to 100) g (100 to 250) g 250 g to 1.1 kg (1.1 to 6.1) kg (6.1 to 33) kg	5 μ g 6 μ g 7 μ g 12 μ g 14 μ g 24 μ g 86 μ g 92 μ g 1.4 mg 9 mg 90 mg	Comparison to OIML E2 weights, ASTM E617 Class 1 weights and internal calibration procedure utilized in the calibration of the weighing system.
Scales and Balances ^{1,6}	(0.5 to 2 000) lb	0.01 % of reading	Comparison to ASTM E 617 Class 6 Weights and internal calibration procedure utilized in the calibration of the weighing system.
Mass Determination	1 mg to 50 g (50 to 100) g (100 to 250) g (250 to 500) g (500 to 1 kg (1 to 6) kg (6 to 25) kg	10 μ g 30 μ g 0.12 mg 0.17 mg 0.9 mg 9 mg 90 mg	Comparison to Class 1 Weights, Electronic Balances
Micro-indentation Hardness Testers ¹ (Knoop and Vickers)	gf 100 $\leq$ HK $\leq$ 500 gf HV = 100	2.1 % of Reading 4.1 % of Reading	Indirect Verification per ASTM E384 using Hardness Test Blocks

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Brinell Hardness Testers ¹	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 per ASTM E10 using Hardness Test Blocks
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	0.69 HRA 0.62 HRA 0.36 HRA 0.71 HRBW 0.53 HRBW 0.9 HRBW 0.54 HRC 0.7 HRC 1.2 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	Indirect Verification per ASTM E18 using Hardness Test Blocks

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness Testers ¹	HR15TW Low	0.87 HR15TW	Indirect Verification per ASTM E18 using Hardness Test Blocks
	HR15TW Middle	0.72 HR15TW	
	HR15TW High	0.72 HR15TW	
	HR30N Low	0.87 HR30N	
	HR30N Middle	0.91 HR30N	
	HR30N High	0.36 HR30N	
	HR30TW Low	0.54 HR30TW	
	HR30TW Middle	0.72 HR30TW	
	HR30TW High	0.39 HR30TW	
	HR45N Low	0.64 HR45N	
Durometers	HR45N Middle	1.2 HR45N	Direct Verification per ASTM D2240 using Durometer Calibrator, Balance
	HR45N High	0.34 HR45N	
	HR45TW Low	0.92 HR45TW	
	HR45TW Middle	0.92 HR45TW	
	HR45TW High	0.61 HR45TW	
	Spring Force Types A, B, E, O	(1.3 to 8.05) N	Video Measuring Machine
	Types C, D, and DO	(4.445 to 44.5) N	
	Types OO, OOO, OOO-S	(0.294 to 1.932) N	
	Indenter Dimensions		
	Angle	(20 to 40)°	
	Length	(0.049 to 0.198) in	
	Radius	(0.05 to 0.1) in	

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measure ¹	(-200 to -20) °C	0.006 2 °C	Comparison to Fluke 5699 SPRT, Fluke 1590 Super Thermometer
	(-20 to 120) °C	0.001 7 °C	
	(120 to 200) °C	0.023 °C	
	(200 to 300) °C	0.023 °C	
	(300 to 600) °C	0.024 °C	

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Source ¹ (Measuring Instruments)	(-95 to -20) °C (-20 to 120) °C (120 to 425) °C (425 to 660) °C	0.032 °C 0.001 7 °C 0.038 °C 0.063 °C	Comparison to SPRT, Fluke 1590 Super Thermometer, Liquid Baths, Metrology Dry Well
Radiation (Infrared) Thermometers	(-15 to 0) °C (0 to 100) °C (100 to 200) °C (200 to 350) °C (350 to 500) °C	0.54 °C 0.69 °C 1.1 °C 1.6 °C 2.4 °C	Comparison to Fluke 4180 and 4181 Black Body Calibrators (flat plate) $\lambda = (8 \text{ to } 14) \mu\text{m}$, $\epsilon = (0.9 \text{ to } 1)$
Humidity – Measure ¹	(0 to 2) %RH (5 to 10) %RH (10 to 50) %RH (50 to 90) %RH (90 to 95) %RH	1.2 %RH 0.56 %RH 0.5 %RH 0.55 %RH 0.58 %RH	Comparison to Humidity Indicator
Humidity – Source (Measuring Instruments)	0 %RH (5 to 10) %RH (10 to 98) %RH	0.62 %RH 0.56 %RH 0.5 % of reading	Comparison to Nitrogen with Rotronic Humidity Indicator, Thunder Scientific 2900

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Reference ⁴	10 MHz	5×10^{-11} MHz	Comparison to SRS FS Rubidium GPS Disciplined Oscillator

DIMENSIONAL MEASUREMENT

2 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
2D Angle – Measure	(0.25 to 365)°	0.004°	Comparison to Coordinate Measuring Machine
Roundness, Cylindricity – Measure	Up to 150 mm	20 nm	Comparison to Rondcom 41c Roundness Machine
Surface Finish Analysis	Up to 118 µin 118.1 to 500 µin	1 % of reading + 0.5 µin 1.1 % of reading + 0.6 µin	Comparison to Profilometer, Master Patch

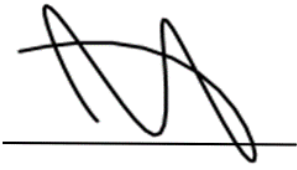
3 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
3D Dimensional Measurements ²	X: Up to 12 in Y: Up to 8 in Z: Up to 4 in	(44 + 1L) µin	Comparison to Vision System
3D Dimensional Measurements ²	X: Up to 28 in Y: Up to 40 in Z: Up to 28 in	(74 + 4.7L) 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%.

Notes:

- 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.
- The use of (L) represents Length in inches; the use of (D) represents Diameter in inches; the use of DL represents Diagonal Length in inches; " = arc-seconds.
- Uncertainties listed for Electromagnetic - DC/Low Frequency and RF/Microwave does not include possible contributions from a "best available" unit under test
- Derivatives of 10 MHz will have different uncertainties due to resolution, noise, and gating errors.
- 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.
- 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.
- 0.6R will be added to the Measurement Uncertainty at the time of calibration (where R = resolution of the device under calibration).
- Unless otherwise specified in the far-right column, the calibration method/procedure utilized by the laboratory was written and validated internally.
- The legal owner of Martin Calibration LLC is Transcat, Inc.
- The sites in Mundelein, IL and Eau Claire, WI each have their own Scopes of Accreditation.



Jason Stine, Vice President

