CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Transcat – Charlotte
8334 Arrowridge Blvd., Suite B
Charlotte, NC 28273

Fulfills the requirements of

ISO/IEC 17025:2017

and the national standards

ANSI/NCSL Z540-1-1994 (R2002) AND
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.

Jason Stine, Vice President

Expiry Date: 07 September 2025
Certificate Number: AC-2489.07

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

Transcat – Charlotte
8334 Arrowridge Blvd., Suite B
Charlotte, NC 28273

Damon Kegel 856-886-8719

CALIBRATION AND DIMENSIONAL MEASUREMENT

Valid to: **September 7, 2025** Certificate Number: **AC-2489.07**

CALIBRATION

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Measuring Equipment 125 Hz to 2 kHz 4 kHz 125 Hz to 2 kHz 4 kHz	 (74 to 104) dB (74 to 104) dB 114 dB 114 dB	 0.44 dB 0.72 dB 0.34 dB 0.61 dB	Direct Measure GenRad 1986 Sound Level Calibrator
Sound Level Measure 125 Hz to 2 kHz 4 kHz 125 Hz to 2 kHz 4 kHz	 (74 to 104) dB (74 to 104) dB 114 dB 114 dB	 0.45 dB 0.73 dB 0.36 dB 0.62 dB	Comparison to GenRad 1986 Sound Level Calibrator, Sound Meters
Acceleration	(5 to 9) Hz (10 to 99) Hz 100 Hz (101 to 920) Hz (921 to 5 000) Hz (5 001 to 10 000) Hz (10 to 15) kHz (15 to 20) kHz	1.7 % of reading 1.2 % of reading 0.75 % of reading 1 % of reading 1.4 % of reading 1.9 % of reading 2.2 % of reading 2.8 % of reading	Comparison to Master Accelerometer

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sine Wave Flatness [1] 50 Ω, 3 V Input	Up to 3 V 10 Hz to 1 MHz (1 to 10) MHz (10 to 30) MHz (30 to 50) MHz (50 to 80) MHz (80 to 100) MHz	 0.06 % of reading 0.071 % of reading 0.11 % of reading 0.18 % of reading 0.32 % of reading 0.38 % of reading	Comparison to Ballantine 1395B Thermal Voltage Converter
DC Current – Measure [1]	Up to 100 nA (0.1 to 1) µA (1 to 10) µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	36 µA/A + 0.04 nA 29 µA/A + 0.04 nA 29 µA/A + 0.1 nA 23 µA/A + 0.8 nA 24 µA/A + 5 nA 26 µA/A + 50 nA 38 µA/A + 0.5 µA 0.011 % of reading + 10 µA	Comparison to Agilent 3458A 8.5 Digit Multimeter
DC Current – Measure [1]	(1 to 100) A	0.16 mA/A + 2 mA	Comparison to Ohms Lab CS-100 Precision Shunt, Keysight 3458A 8.5 Digit Multimeter
DC Current – Source [1]	200 nA to 220 µA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A	41 µA/A + 6 nA 35 µA/A + 7 nA 35 µA/A + 40 nA 45 µA/A + 0.7 µA 81 µA/A + 12 µA	Comparison to Fluke 5730A/05 Multiproduct Calibrator
DC Current – Source [1]	(2.2 to 11) A	0.36 mA/A + 0.48 mA	Comparison to Fluke 5730A/05 Multiproduct Calibrator, Fluke 5725A Amplifier
DC Current – Source [1]	(11 to 20) A	0.93 mA/A + 0.58 mA	Comparison to Fluke 5522A Multiproduct Calibrator
DC Clamp-on Ammeters [1] (Non-Toroidal Type) Hall Effect Sensor	(20 to 54.999 5) A (55 to 149.999 5) A (150 to 549.995) A (550 to 1025) A	0.47 % of reading + 0.11 A 0.41% of reading + 0.11 A 0.45% of reading + 0.39 A 0.51 % of reading + 0.39 A	Comparison to Fluke 5522A Multiproduct Calibrator, Fluke 5500A/Coil 50-turn Coil

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure [1]	(5 to 100) µA		Comparison to Agilent 3458A 8.5 Digit Multimeter
	(10 to 20) Hz	0.4 % of reading + 30 nA	
	(20 to 45) Hz	0.15 % of reading + 30 nA	
	(45 to 100) Hz	0.064 % of reading + 30 nA	
	100 Hz to 5 kHz	0.064 % of reading + 30 nA	
	(0.1 to 1) mA		
	(10 to 20) Hz	0.4 % of reading + 0.2 µA	
	(20 to 45) Hz	0.15 % of reading + 0.2 µA	
	(45 to 100) Hz	0.062 % of reading + 0.2 µA	
	100 Hz to 5 kHz	0.034 % of reading + 0.2 µA	
	(1 to 10) mA		
	(10 to 20) Hz	0.4 % of reading + 2 µA	
	(20 to 45) Hz	0.15 % of reading + 2 µA	
	(45 to 100) Hz	0.062 % of reading + 2 µA	
	100 Hz to 5 kHz	0.034 % of reading + 2 µA	
	(10 to 100) mA		
	(10 to 20) Hz	0.4 % of reading + 20 µA	
	(20 to 45) Hz	0.15 % of reading + 20 µA	
	(45 to 100) Hz	0.062 % of reading + 20 µA	
	100 Hz to 5 kHz	0.034 % of reading + 20 µA	
	(0.1 to 1) A		
	(10 to 20) Hz	0.4 % of reading + 0.2 mA	
	(20 to 45) Hz	0.16 % of reading + 0.2 mA	
	(45 to 100) Hz	0.087 % of reading + 0.2 mA	
	100 Hz to 5 kHz	0.14 % of reading + 0.2 mA	
AC Current – Measure [1]	(1 to 100) A		Comparison to Ohms Lab CS-100 Precision Shunt, Keysight 3458A 8.5 Digit Multimeter
	(50 to 60) Hz	0.27 mA/A + 1 mA	
	400 Hz	1 mA/A + 1 mA	
	1 kHz	2 mA/A + 1 mA	
AC Current – Source [1]	Up to 220 µA		Comparison to Fluke 5730A/05 Multiproduct Calibrator
	(10 to 20) Hz	0.025 % of reading + 16 nA	
	(20 to 40) Hz	0.019 % of reading + 10 nA	
	40 Hz to 1 kHz	0.016 % of reading + 8 nA	
	(1 to 5) kHz	0.03 % of reading + 12 nA	
	(5 to 10) kHz	0.11 % of reading + 65 nA	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source [1]	(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 (22 to 220) mA (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) A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	 0.025 % of reading + 40 nA 0.016 % of reading + 35 nA 0.01 % of reading + 35 nA 0.02 of reading + 0.11 µA 0.11 % of reading + 0.65 µA 0.025 % of reading + 0.4 µA 0.022 % of reading + 0.35 µA 0.012 % of reading + 0.35 µA 0.023 % of reading + 0.55 µA 0.11 % of reading + 5 µA 0.025 % of reading + 4 µA 0.022 % of reading + 3.5 µA 0.014 % of reading + 2.5µA 0.02 % of reading + 3.5 µA 0.11 % of reading + 10 µA 0.03 % of reading + 35 µA 0.05 % of reading + 80 µA 0.7 % of reading + 0.16 mA	Comparison to Fluke 5730A/05 Multiproduct Calibrator
AC Current – Source [1]	(2.2 to 11) A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	 0.046 % of reading + 0.17 mA 0.095 % of reading + 0.38 mA 0.36 % of reading + 0.75 mA	Comparison to Fluke 5730A/05 Multiproduct Calibrator, Fluke 5725A Amplifier
AC Current – Source [1]	(11 to 20.5) A (10 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	 0.095 % of reading + 3.9 mA 0.12 % of reading + 3.9 mA 2.3 % of reading + 3.9 mA	Comparison to Fluke 5522A Multiproduct Calibrator
AC Current – Source [1]	(20 to 100) A 50 Hz to 1 kHz	 0.12 % of reading + 0.3 mA	Comparison to Fluke 5520A Multiproduct Calibrator, Ballentine 1625A AC/DC Current Shunt, Agilent 3458A 8.5 Digit Multimeter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source [1] Extended Frequency Ranges	29 µA to 329.99 µA (10 to 30) kHz 330 µA to 3.299 mA (10 to 30) kHz 3.3 mA to 32.99 mA (10 to 30) kHz 33 mA to 329.99 mA (10 to 30) kHz	1.2 % of reading + 0.31 µA 0.78 % of reading + 0.47 µA 0.31 % of reading + 3.1 µA 0.31 % of reading + 0.16 mA	Comparison to Fluke 5522A Multiproduct Calibrator
AC Clamp-on Ammeters [1] (Toroidal Type) Transformer Type Sensor	(20 to 150) A (45 to 65) Hz (65 to 440) Hz (150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	0.24 % of reading + 19 mA 0.62 % of reading + 21 mA 0.24 % of reading + 70 mA 0.61 % of reading + 78 mA	Comparison to Fluke 5522A Multiproduct Calibrator, Fluke 5500A/Coil 50-turn Coil
AC Clamp-on Ammeters [1] (Non-Toroidal Type) Hall Effect Sensor	(20 to 150) A (45 to 65) Hz (65 to 440) Hz (150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	0.5 % of reading + 0.19 A 0.9 % of reading + 0.19 A 0.52 % of reading + 0.7 A 0.9 % of reading + 0.7 A	Comparison to Fluke 5522A Multiproduct Calibrator, Fluke 5500A/Coil 50-turn Coil
DC Resistance – Measure [1]	Up to 10 Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ	16 µΩ/Ω + 50 µΩ 14 µΩ/Ω + 0.5 mΩ 12 µΩ/Ω + 0.5 mΩ 12 µΩ/Ω + 5 mΩ 13 µΩ/Ω + 50 mΩ 17 µΩ/Ω + 2 Ω 58 µΩ/Ω + 0.1 kΩ 0.052 % of reading + 1 kΩ 0.5 % of reading + 10 kΩ	Comparison to Agilent 3458A 8.5 Digit Multimeter
DC Resistance – Source [1] (Fixed Artifacts)	100 µΩ 1 mΩ 10 mΩ 100 mΩ 1 Ω	81 nΩ 0.5 µΩ 2 µΩ 8.6 µΩ 0.1 mΩ	Comparison to Standard Resistors
DC Resistance – Source [1] (Variable Artifact)	(0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ (1 to 10) GΩ (10 to 100) GΩ (0.1 to 1) TΩ	0.037 % of reading 0.037 % of reading + 1.2 µΩ/Ω/V 0.12 % of reading + 1.2 µΩ/Ω/V 0.23 % of reading + 1.2 µΩ/Ω/V 0.59 % of reading + 1.2 µΩ/Ω/V 1.2 % of reading + 2.3 µΩ/Ω/V 1.2 % of reading + 5.8 µΩ/Ω/V	Comparison to IET HRRS-B-7-100K-5KV Decade Resistor

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source [1] (Fixed Point Simulation)	0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	40 µΩ 95 µΩ/Ω 95 µΩ/Ω 23 µΩ/Ω 23 µΩ/Ω 10 µΩ/Ω 10 µΩ/Ω 6.5 µΩ/Ω 6.5 µΩ/Ω 6.5 µΩ/Ω 6.5 µΩ/Ω 8.5 µΩ/Ω 8.5 µΩ/Ω 14 µΩ/Ω 18 µΩ/Ω 57 µΩ/Ω 52 µΩ/Ω 0.47 mΩ/Ω	Comparison to Fluke 5730A/05 Multiproduct Calibrator
Resistance – Source [1] (Simulation)	Up to 11 Ω (11 to 33) Ω (33 to 111) Ω (110 to 330) Ω (0.33 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 (0.33 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 (0.33 to 1.1) GΩ	32 µΩ/Ω + 0.78 mΩ 24 µΩ/Ω + 1.2 mΩ 22 µΩ/Ω + 1.1 mΩ 22 µΩ/Ω + 1.6 mΩ 22 µΩ/Ω + 1.6 mΩ 22 µΩ/Ω + 16 mΩ 22 µΩ/Ω + 16 mΩ 22 µΩ/Ω + 0.16 Ω 22 µΩ/Ω + 0.16 Ω 27 µΩ/Ω + 1.6 Ω 26 µΩ/Ω + 1.6 Ω 66 µΩ/Ω + 23 Ω 0.1 mΩ/Ω + 39 Ω 0.19 mΩ/Ω + 1.9 kΩ 0.41 mΩ/Ω + 2.3 kΩ 0.23 % of reading + 78 kΩ 12 % of reading + 0.39 MΩ	Comparison to Fluke 5522A Multiproduct Calibrator (4-wire)
DC Voltage – Measure [1]	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 500) V (500 to 800) V (800 to 1 000) V	6.6 µV/V + 0.46 µV 4.5 µV/V + 0.46 µV 4.5 µV/V + 0.61 µV 6.8 µV/V + 30 µV 10 µV/V + 0.1 mV 14 µV/V + 0.1 mV 19 µV/V + 0.1 mV	Comparison to Agilent 3458A 8.5 Digit Multimeter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC High Voltage – Measure [1]	(1 to 10) kV (10 to 20) kV (20 to 30) kV (30 to 40) kV (40 to 50) kV	0.039 % of reading + 92 mV 0.038 % of reading + 2.4 V 0.041 % of reading + 2.4 V 0.047 % of reading + 2.4 V 0.056 % of reading + 2.4 V	Comparison to Vitrek 4700A High Voltage Meter; Vitrek HVL-35, HVL-70, HVL-100 High Voltage Probes
DC High Voltage – Measure [1]	(50 to 60) kV (60 to 70) kV (70 to 80) kV (80 to 90) kV (90 to 100) kV	0.071 % of reading + 2.4 V 0.089 % of reading + 2.4 V 0.12 % of reading + 2.5 V 0.15 % of reading + 2.5 V 0.17 % of reading + 2.5 V	Comparison to Vitrek 4700A High Voltage Meter; Vitrek HVL-35, HVL-70, HVL-100 High Voltage Probes
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	7.8 µV/V + 0.4 µV 5 µV/V + 0.7 µV 3.5 µV/V + 2.5 µV 3.5 µV/V + 4 µV 5 µV/V + 40 µV 6.5 µV/V + 0.4 mV	Comparison to Fluke 5700A/05 Multiproduct Calibrator
AC Voltage – Measure [1]	Up to 10 mV (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 (1 to 4) MHz (4 to 8) MHz (10 to 100) mV (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 (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	 0.037 % of reading + 3 µV 0.029 % of reading + 1.1 µV 0.035 % of reading + 1.1 µV 0.1 % of reading + 1.1 µV 0.5 % of reading + 1.1 µV 4 % of reading + 2 µV 1.2 % of reading + 5 µV 7 % of reading + 7 µV 20 % of reading + 8 µV 0.012 % of reading + 4 µV 0.008 5 % of reading + 2 µV 0.014 % of reading + 2 µV 0.03 % of reading + 2 µV 0.08 % of reading + 2 µV 0.3 % of reading + 10 µV 1 % of reading + 10 µV 1.5 % of reading + 10 µV 4 % of reading + 70 µV 4 % of reading + 80 µV 15 % of reading + 0.1 mV	Comparison to Agilent 3458A Opt 002 8.5 Digit Multimeter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure [1]	(0.1 to 1) V		Comparison to Agilent 3458A Opt 002 8.5 Digit Multimeter
	(1 to 40) Hz	0.007 8 % of reading + 40 µV	
	40 Hz to 1 kHz	0.007 3 % of reading + 20 µV	
	(1 to 20) kHz	0.014 % of reading + 20 µV	
	(20 to 50) kHz	0.03 % of reading + 20 µV	
	(50 to 100) kHz	0.08 % of reading + 20 µV	
	(100 to 300) kHz	0.3 % of reading + 0.1 mV	
	300 kHz to 1 MHz	1 % of reading + 0.1 mV	
	(1 to 2) MHz	1.5 % of reading + 0.1 mV	
	(2 to 4) MHz	4 % of reading + 0.7 mV	
	(4 to 8) MHz	4 % of reading + 0.8 mV	
	(8 to 10) MHz	15 % of reading + 1 mV	
	(1 to 10) V		
	(1 to 40) Hz	0.007 5 % of reading + 0.4 mV	
	40 Hz to 1 kHz	0.007 5 % of reading + 0.2 mV	
	(1 to 20) kHz	0.014 % of reading + 0.2 mV	
	(20 to 50) kHz	0.03 % of reading + 0.2 mV	
	(50 to 100) kHz	0.08 % of reading + 0.2 mV	
	(100 to 300) kHz	0.3 % of reading + 1 mV	
	300 kHz to 1 MHz	1 % of reading + 1 mV	
	(1 to 2) MHz	1.5 % of reading + 1 mV	
	(2 to 4) MHz	4 % of reading + 7 mV	
	(4 to 8) MHz	4 % of reading + 8 mV	
	(8 to 10) MHz	15 % of reading + 10 mV	
	(10 to 100) V		
	(1 to 40) Hz	0.021 % of reading + 4 mV	
	40 Hz to 1 kHz	0.02 % of reading + 2 mV	
	(1 to 20) kHz	0.02 % of reading + 2 mV	
	(20 to 50) kHz	0.035 % of reading + 2 mV	
	(50 to 100) kHz	0.12 % of reading + 2 mV	
	(100 to 300) kHz	0.4 % of reading + 10 mV	
	300 kHz to 1 MHz	1.5 % of reading + 10 mV	
	(100 to 700) V		
	(1 to 40) Hz	0.041 % of reading + 40 mV	
	40 Hz to 1 kHz	0.041 % of reading + 20 mV	
	(1 to 20) kHz	0.06 % of reading + 20 mV	
	(20 to 50) kHz	0.12 % of reading + 20 mV	
	(50 to 100) kHz	0.3 % of reading + 20 mV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC High Voltage – Measure [1]	(0.7 to 5) kV		Comparison to Vitrek 4700A High Voltage Meter; Vitrek HVL-35, HVL-70, HVL-100 High Voltage Probes
	10 mHz to 10 Hz	0.14 % of reading + 0.17 V	
	(10 to 30) Hz	0.12 % of reading + 0.29 V	
	(30 to 50) Hz	0.099 % of reading + 0.37 V	
	(50 to 70) Hz	0.068 % of reading + 0.37 V	
	(70 to 100) Hz	0.099 % of reading + 0.37 V	
	(100 to 200) Hz	0.099 % of reading + 0.37 V	
	(200 to 450) Hz	0.48 % of reading + 0.17 V	
	(450 to 600) Hz	0.47 % of reading + 0.17 V	
	(5 to 30) kV		
	10 mHz to 10 Hz	0.19 % of reading + 2.4 V	
	(10 to 30) Hz	0.13 % of reading + 2.4 V	
	(30 to 50) Hz	0.11 % of reading + 2.4 V	
	(50 to 70) Hz	0.077 % of reading + 2.4 V	
	(70 to 100) Hz	0.11 % of reading + 2.4 V	
	(100 to 200) Hz	0.11 % of reading + 2.4 V	
	(200 to 450) Hz	0.7 % of reading + 2.4 V	
	(450 to 600) Hz	1.4 % of reading + 2.4 V	
	(30 to 50) kV		
	10 mHz to 10 Hz	0.24 % of reading + 2.5 V	
	(10 to 30) Hz	0.18 % of reading + 2.5 V	
	(30 to 50) Hz	0.13 % of reading + 2.5 V	
	(50 to 70) Hz	0.1 % of reading + 2.5 V	
	(70 to 100) Hz	0.13 % of reading + 2.5 V	
	(100 to 200) Hz	0.69 % of reading + 2.5 V	
	(200 to 450) Hz	2.9 % of reading + 2.5 V	
	(50 to 70) kV		
	10 mHz to 10 Hz	0.37 % of reading + 2.6 V	
	(10 to 30) Hz	0.26 % of reading + 2.6 V	
	(30 to 50) Hz	0.16 % of reading + 2.6 V	
	(50 to 70) Hz	0.16 % of reading + 2.6 V	
	(70 to 100) Hz	1.2 % of reading + 2.6 V	
	(100 to 200) Hz	1.2 % of reading + 2.6 V	
	(200 to 450) Hz	17 % of reading + 2.6 V	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source [1]	Up to 2.2 mV		Comparison to Fluke 5730/05 Multiproduct Calibrator
	(10 to 20) Hz	0.024 % of reading + 4 µV	
	(20 to 40) Hz	0.009 1 % of reading + 4 µV	
	40 Hz to 20 kHz	0.008 % of reading + 4 µV	
	(20 to 50) kHz	0.025 % of reading + 4 µV	
	(50 to 100) kHz	0.05 % of reading + 5 µV	
	(100 to 300) kHz	0.11 % of reading + 10 µV	
	(300 to 500) kHz	0.14 % of reading + 20 µV	
	500 kHz to 1 MHz	0.27 % of reading + 20 µV	
	(2.2 to 22) mV		
	(10 to 20) Hz	0.024 % of reading + 4 µV	
	(20 to 40) Hz	0.009 % of reading + 4 µV	
	40 Hz to 20 kHz	0.008 % of reading + 4 µV	
	(20 to 50) kHz	0.02 % of reading + 4 µV	
	(50 to 100) kHz	0.05 % of reading + 5 µV	
	(100 to 300) kHz	0.11 % of reading + 10 µV	
	(300 to 500) kHz	0.14 % of reading + 20 µV	
	500 kHz to 1 MHz	0.27 % of reading + 20 µV	
	(22 to 220) mV		
	(10 to 20) Hz	0.024 % of reading + 12 µV	
	(20 to 40) Hz	0.009 3 % of reading + 7 µV	
	40 Hz to 20 kHz	0.005 9 % of reading + 7 µV	
	(20 to 50) kHz	0.012 % of reading + 7 µV	
	(50 to 100) kHz	0.031 % of reading + 17 µV	
	(100 to 300) kHz	0.066 % of reading + 20 µV	
	(300 to 500) kHz	0.14 % of reading + 25 µV	
	500 kHz to 1 MHz	0.27 % of reading + 45 µV	
	(0.22 to 2.2) V		
	(10 to 20) Hz	0.024 % of reading + 40 µV	
	(20 to 40) Hz	0.009 4 % of reading + 15 µV	
	40 Hz to 20 kHz	0.004 6 % of reading + 8 µV	
	(20 to 50) kHz	0.006 9 % of reading + 10 µV	
	(50 to 100) kHz	0.0086 % of reading + 30 µV	
	(100 to 300) kHz	0.034 % of reading + 80 µV	
	(300 to 500) kHz	0.1 % of reading + 0.2 mV	
	500 kHz to 1 MHz	0.17 % of reading + 0.3 mV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source [1]	(2.2 to 22) V		Comparison to Fluke 5730A/05 Multiproduct Calibrator
	(10 to 20) Hz	0.024 % of reading + 0.4 mV	
	(20 to 40) Hz	0.009 3 % of reading + 0.15 mV	
	40 Hz to 20 kHz	0.004 7 % of reading + 50 µV	
	(20 to 50) kHz	0.007 1 % of reading + 0.1 mV	
	(50 to 100) kHz	0.008 4 % of reading + 0.2 mV	
	(100 to 300) kHz	0.25 % of reading + 0.6 mV	
	(300 to 500) kHz	0.1 % of reading + 2 mV	
	500 kHz to 1 MHz	0.15 % 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 4 % of reading + 1.5 mV	
	40 Hz to 20 kHz	0.005 5 % of reading + 0.6 mV	
	(20 o 50) kHz	0.008 1 % 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	0.073 % of reading + 3.5 mV	
AC Voltage – Source [1]	(220 to 1 100) V		Comparison to Fluke 5730A/05 Multiproduct Calibrator, Fluke 5725A Amplifier
	40 Hz to 1 kHz	0.009 3 % of reading + 4 mV	
	(1 to 20) kHz	0.017 % of reading + 6 mV	
	(20 to 30) kHz	0.06 % of reading + 11 mV	
AC Voltage – Source [1] Extended Frequency Ranges	(220 to 750) V		
	(30 to 50) kHz	0.06 % of reading+ 11 mV	
	(50 to 100) kHz	0.23 % of reading + 45 mV	
AC Voltage – Source [1] Wideband Amplitude (50 Ω)	30 Hz to 500 kHz		Comparison to Fluke 5730A/05 Multiproduct Calibrator
	(0.3 to 1.1) mV	0.62 % of reading + 0.78 µV	
	(1.1 to 3) mV	0.54 % of reading + 1.2 µV	
	(3 to 11) mV	0.54 % of reading + 3.1 µV	
	(11 to 33) mV	0.47 % of reading + 6.2 µV	
	(33 to 110) mV	0.47 % of reading + 16 µV	
	(110 to 330) mV	0.39 % of reading + 39 µV	
	(0.33 to 1.1) V	0.39 % of reading + 0.16 mV	
	(1.1 to 3.5) V	0.31 % of reading + 0.19 mV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source [1] Wide-Band Flatness (50 Ω) (1 kHz Reference)	(0.33 to 1.1) mV		Comparison to Fluke 5730A/05 Multiproduct Calibrator
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	(0.12 to 1.199 9) kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	(0.12 to 1.199 9) MHz	0.16 % of reading + 1.2 µV	
	(1.2 to 2) MHz	0.16 % of reading + 1.2 µV	
	(2 to 11.9) MHz	0.31 % of reading + 1.2 µV	
	(12 to 20) MHz	0.47 % of reading + 1.2 µV	
	(20 to 30) MHz	1.2 % of reading + 5.8 µV	
	(30 to 50) MHz	2.3% of reading + 5.8 µV	
	(1.1 to 3.3) mV		
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	(0.12 to 1.199 9) kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	(0.12 to 1.199 9) MHz	0.078 % of reading + 1.2 µV	
	(1.2 to 2) MHz	0.078 % of reading +1.2 µV	
	(2 to 11.9) MHz	0.23 % of reading + 1.2 µV	
	(12 to 20) MHz	0.39 % of reading + 1.2 µV	
	(20 to 30) MHz	1.2 % of reading + 1.2 µV	
	(30 to 50) MHz	2.3% of reading + 1.2 µV	
	(3.3 to 11) mV		
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	(0.12 to 1.199 9) kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	(0.12 to 1.199 9) MHz	0.078 % of reading + 1.2 µV	
	(1.2 to 2) MHz	0.078 % of reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % of reading + 1.2 µV	
	(12 to 20) MHz	0.31 % of reading + 1.2 µV	
	(20 to 30) MHz	0.78 % of reading + 1.2 µV	
	(30 to 50) MHz	1.6% of reading + 1.2 µV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source [1] Wide-Band Flatness (50 Ω) (1 kHz Reference)	(11 to 33) mV		Comparison to Fluke 5730A/05 Multiproduct Calibrator
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	(0.12 to 1.199 9) kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	(0.12 to 1.199 9) MHz	0.078 % of reading + 1.2 µV	
	(11 to 16.5) mV		
	(1.2 to 2) MHz	0.16 % of reading + 1.2 µV	
	(2 to 11.9) MHz	0.23 % of reading + 1.2 µV	
	(12 to 20) MHz	0.39 % of reading + 1.2 µV	
	(20 to 30) MHz	0.85 % of reading + 1.2 µV	
	(30 to 50) MHz	1.6 % of reading + 1.2 µV	
	(16.5 to 33) mV		
	(1.2 to 2) MHz	0.078 % of reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % of reading + 1.2 µV	
	(12 to 20) MHz	0.31 % of reading + 1.2 µV	
	(20 to 30) MHz	0.78 % of reading + 1.2 µV	
	(30 to 50) MHz	1.6 % of reading + 1.2 µV	
	(33 to 110) mV		
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	(0.12 to 1.199 9) kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	(0.12 to 1.199 9) MHz	0.078 % of reading + 1.2 µV	
	(33 to 55) mV		
	(1.2 to 2) MHz	0.16 % of reading + 1.2 µV	
	(2 to 11.9) MHz	0.23 % of reading + 1.2 µV	
	(12 to 20) MHz	0.39 % of reading + 1.2 µV	
	(20 to 30) MHz	0.85 % of reading + 1.2 µV	
	(30 to 50) MHz	1.6 % of reading + 1.2 µV	
	(55 to 110) mV		
	(1.2 to 2) MHz	0.078 % of reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % of reading + 1.2 µV	
	(12 to 20) MHz	0.31 % of reading + 1.2 µV	
	(20 to 30) MHz	0.78 % of reading + 1.2 µV	
	(30 to 50) MHz	1.6 % of reading + 1.2 µV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source [1] Wide-Band Flatness (50 Ω) (1 kHz Reference)	(110 to 330) mV		Comparison to Fluke 5730A/05 Multiproduct Calibrator
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	(0.12 to 1.199 9) kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	(0.12 to 1.199 9) MHz	0.078 % of reading + 1.2 µV	
	(110 to 165) mV		
	(1.2 to 2) MHz	0.16 % of reading + 1.2 µV	
	(2 to 11.9) MHz	0.23 % of reading + 1.2 µV	
	(12 to 20) MHz	0.39 % of reading + 1.2 µV	
	(20 to 30) MHz	0.85 % of reading + 1.2 µV	
	(30 to 50) MHz	1.6 % of reading + 1.2 µV	
	(165 to 330) mV		
	(1.2 to 2) MHz	0.078 % of reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % of reading + 1.2 µV	
	(12 to 20) MHz	0.31 % of reading + 1.2 µV	
	(20 to 30) MHz	0.78 % of reading + 1.2 µV	
	(30 to 50) MHz	1.6 % of reading + 1.2 µV	
	(0.33 to 1.1) V		
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	(0.12 to 1.199 9) kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	(0.12 to 1.199 9) MHz	0.078 % of reading + 1.2 µV	
	(0.33 to 0.55) V		
	(1.2 to 2) MHz	0.16 % of reading + 1.2 µV	
	(2 to 11.9) MHz	0.23 % of reading + 1.2 µV	
	(12 to 20) MHz	0.39 % of reading + 1.2 µV	
	(20 to 30) MHz	0.85 % of reading + 1.2 µV	
	(30 to 50) MHz	1.6 % of reading + 1.2 µV	
	(0.55 to 1.1) V		
	(1.2 to 2) MHz	0.078 % of reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % of reading + 1.2 µV	
	(12 to 20) MHz	0.31 % of reading + 1.2 µV	
	(20 to 30) MHz	0.78 % of reading + 1.2 µV	
	(30 to 50) MHz	1.6 % of reading + 1.2 µV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source [1] Wide-Band Flatness (50 Ω) (1 kHz Reference)	(1.1 to 3.5) V (10 to 30) Hz (30 to 119.99) Hz (0.12 to 1.199 9) kHz (1.2 to 11.999) kHz (12 to 119.99) kHz (0.12 to 1.199 9) MHz (1.1 to 1.75) V (1.2 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz (1.75 to 3.5) V (1.2 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.23 % of reading 0.078 % of reading 0.078 % of reading 0.078 % of reading 0.078 % of reading 0.078 % of reading + 1.2 µV 0.16 % of reading + 1.2 µV 0.23 % of reading + 1.2 µV 0.39 % of reading + 1.2 µV 0.85 % of reading + 1.2 µV 1.6 % of reading + 1.2 µV 0.078 % of reading + 1.2 µV 0.16 % of reading + 1.2 µV 0.31 % of reading + 1.2 µV 0.78 % of reading + 1.2 µV 1.6 % of reading + 1.2 µV	Comparison to Fluke 5730A/05 Multiproduct Calibrator
Capacitance – Measure [1]	Up to 10 pF 60 Hz to 1 kHz (10 to 100) pF 60 Hz to 1 kHz 100 pF to 1 µF 60 Hz to 1 kHz (1 to 100) µF 60 Hz to 1 kHz 100 µF to 1 mF 60 Hz to 1 kHz	0.47 % of reading + 10 fF 0.06 % of reading + 10 fF 0.02 % of reading + 10 fF 0.03 % of reading + 20 fF 0.24 % of reading + 20 fF	Comparison to GenRad 1689M Digibridge
Capacitance – Source [1] (Fixed Artifacts)	(0.1 to 0.5) nF 100 Hz to 1 kHz 0.5 nF to 1.4 µF 100 Hz to 1 kHz	0.65 pF 0.13 pF	Comparison to Arco SS32 Standard Capacitor Kit
Capacitance – Source [1] (Simulation)	190 pF 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	3.9 pF/nF + 7.8 pF 3.9 pF/nF + 7.8 pF 2.1 pF/nF + 7.8 pF 2.1 pF/nF + 78 pF 2.1 pF/nF + 0.23 nF 2.1 nF/µF + 0.78 nF 2.1 nF/µF + 2.3 nF 2.1 nF/µF + 7.8 nF 3.2 nF/µF + 23 nF	Comparison to Fluke 5522A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source [1] (Simulation)	(33 to 110) µF (110 to 330) µF 330 µF to 1.1 mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	3.6 nF/µF + 78 nF 3.6 nF/µF + 0.23 µF 3.6 µF/mF + 0.78 µF 3.6 µF/mF + 2.3 µF 3.6 µF/mF + 7.8 µF 6.1 µF/mF + 23 µF 9 µF/mF + 78 µF	Comparison to Fluke 5522A Multiproduct Calibrator
Inductance – Measure [1]	60 Hz to 1 kHz (1 to 10) mH 10 mH to 1 H	 0.03 % of reading + 0.1 µH 0.03 % of reading + 1.4 µH	Comparison to GenRad 1689M Digibridge
Inductance – Source [1] (Fixed Artifacts)	1 kHz 1 mH 10 mH 100 mH	 0.12 % of reading 0.12 % of reading 0.12 % of reading	Comparison to Standard Inductors
Electrical Simulation of Thermocouple Indicating Devices – Measure/Source [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 E (-270 to -245) °C (-245 to -195) °C (-195 to -155) °C (-155 to -90) °C (-90 to 0) °C (0 to 15) °C (15 to 890) °C (890 to 1 000) °C Type J (-210 to -180) °C (-180 to -120) °C (-120 to -50) °C (-50 to 990) °C (990 to 1 200) °C	 1.2 °C 0.9 °C 0.71 °C 0.55 °C 0.45 °C 0.35 °C 1.6 °C 0.24 °C 0.12 °C 0.095 °C 0.08 °C 0.076 °C 0.064 °C 0.074 °C 0.15 °C 0.12 °C 0.093 °C 0.08 °C 0.094 °C	Comparison to Ectron 1140A Thermocouple Calibrator/Simulator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Measure/Source [1]	Type K		Comparison to Ectron 1140A Thermocouple Calibrator/Simulator
	(-270 to -255) °C	2.5 °C	
	(-255 to -195) °C	0.85 °C	
	(-195 to -115) °C	0.16 °C	
	(-115 to -55) °C	0.12 °C	
	(-55 to 1 000) °C	0.087 °C	
	(1 000 to 1 372) °C	0.096 °C	
	Type N		
	(-270 to -260) °C	5.4 °C	
	(-260 to -200) °C	1.5 °C	
	(-200 to -140) °C	0.29 °C	
	(-140 to -70) °C	0.18 °C	
	(-70 to 25) °C	0.14 °C	
	(-25 to 160) °C	0.12 °C	
	(160 to 1 300) °C	0.11 °C	
	Type R		
	(-50 to -30) °C	0.8 °C	
	(-30 to 45) °C	0.69 °C	
	(45 to 160) °C	0.49 °C	
	(160 to 380) °C	0.35 °C	
	(380 to 775) °C	0.3 °C	
	(775 to 1 768) °C	0.26 °C	
	Type S		
	(-50 to -30) °C	0.76 °C	
	(-30 to 45) °C	0.68 °C	
	(45 to 105) °C	0.49 °C	
	(105 to 310) °C	0.41 °C	
	(310 to 615) °C	0.35 °C	
	(615 to 1 768) °C	0.31 °C	
	Type T		
	(-270 to -255) °C	1.9 °C	
	(-255 to -240) °C	0.6 °C	
	(-240 to -210) °C	0.36 °C	
	(-210 to -150) °C	0.22 °C	
	(-150 to -40) °C	0.15 °C	
	(-40 to 100) °C	0.095 °C	
	(100 to 400) °C	0.08 °C	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicating Devices – Source [1]	Pt 385, 100 Ω		Comparison to Fluke 5522A Multiproduct Calibrator
	(-200 to -80) °C	0.039 °C	
	(-80 to 0) °C	0.039 °C	
	(0 to 100) °C	0.054 °C	
	(100 to 300) °C	0.07 °C	
	(300 to 400) °C	0.078 °C	
	(400 to 630) °C	0.093 °C	
	(630 to 800) °C	0.18 °C	
	Pt 385, 200 Ω		
	(-200 to -80) °C	0.031 °C	
	(-80 to 0) °C	0.031 °C	
	(0 to 100) °C	0.031 °C	
	(100 to 260) °C	0.039 °C	
	(260 to 300) °C	0.093 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 600) °C	0.11 °C	
	(600 to 630) °C	0.12 °C	
	Pt 385, 500 Ω		
	(-200 to -80) °C	0.031 °C	
	(-80 to 0) °C	0.039 °C	
	(0 to 100) °C	0.039 °C	
	(100 to 260) °C	0.047 °C	
	(260 to 300) °C	0.062 °C	
	(300 to 400) °C	0.062 °C	
	(400 to 600) °C	0.07 °C	
	(600 to 630) °C	0.085 °C	
	Pt 385, 1 kΩ		
	(-200 to -80) °C	0.023 °C	
	(-80 to 0) °C	0.023 °C	
	(0 to 100) °C	0.031 °C	
	(100 to 260) °C	0.039 °C	
	(260 to 300) °C	0.047 °C	
	(300 to 400) °C	0.054 °C	
	(400 to 600) °C	0.054 °C	
	(600 to 630) °C	0.18 °C	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicating Devices – Source [1]	Pt 3916, 100 Ω		Comparison to Fluke 5522A Multiproduct Calibrator
	(-200 to -190) °C	0.19 °C	
	(-190 to -80) °C	0.031 °C	
	(-80 to 0) °C	0.039 °C	
	(0 to 100) °C	0.047 °C	
	(100 to 260) °C	0.054 °C	
	(260 to 300) °C	0.062 °C	
	(300 to 400) °C	0.07 °C	
	(400 to 600) °C	0.078 °C	
	(600 to 630) °C	0.18 °C	
	Pt 3926, 100 Ω		
	(-200 to -80) °C	0.039 °C	
	(-80 to 0) °C	0.039 °C	
	(0 to 100) °C	0.054 °C	
	(100 to 300) °C	0.07 °C	
	(300 to 400) °C	0.078 °C	
	(400 to 630) °C	0.093 °C	
	PtNi 385, 120 Ω		
	(-80 to 0) °C	0.062 °C	
	(0 to 100) °C	0.062 °C	
	(100 to 260) °C	0.1 °C	
	Cu 427, 10 Ω		
	(-100 to 260) °C	0.23 °C	
Scope Voltage – Source [1] DC Signal			Comparison to Fluke 9500B Oscilloscope Calibrator
into 50 Ω	(-5.0 to 5.0) V	0.023 % of reading + 19 µV	
into 1 MΩ	(-200 to 200) V	0.023 % of reading + 19 µV	
Scope Voltage – Source [1] Square Wave			Comparison to Fluke 9500B Oscilloscope Calibrator
into 50 Ω	10 Hz to 10 kHz		
	40 µVp-p to 1 mVp-p	0.78 % of reading + 7.8 µV	
	10 Hz to 100 kHz		
	1 mVp-p to 5 Vp-p	0.078 % of reading + 7.8 µV	
into 1 MΩ	10 Hz to 10 kHz		
	40 µVp-p to 1 mVp-p	0.78 % of reading + 7.8 µV	
	10 Hz to 100 kHz		
	1 mVp-p to 200 Vp-p	0.078 % of reading + 7.8 µV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scope – Time Markers [1] 100 mVp-p to 1 Vp-p (into 50 Ω)			Comparison to Fluke 9500B Oscilloscope Calibrator
Square Wave	9.009 1 ns to 83 µs	0.19 µs/s	
	83 µs to 55 s	2.3 µs/s	
Sine Wave	450.5 ps to 9.009 ns	0.19 µs/s	
Pulse	900.91 ns to 83 µs	0.19 µs/s	
	83 µs to 55 s	2.3 µs/s	
Triangle Wave	900.91 ns to 83 µs	0.19 µs/s	
	83 µs to 55 s	2.3 µs/s	
Scope Rise Time – Source [1,4] (into 50 Ω) 10 Hz to 2 MHz	5 mVp-p to 3 Vp-p 500 ps (Nominal) 150 ps (Nominal)	 290 ps 34 ps	Comparison to Fluke 9500B Oscilloscope Calibrator with Fluke 9530 Active Head
Scope Leveled Sine Wave – Source [1] (50 kHz Ref. Frequency) into 50 Ω	50 kHz to 10 MHz	1.2 % of reading	Comparison to Fluke 9500B Oscilloscope Calibrator with Fluke 9530 Active Head
Scope Bandwidth/Flatness – Source [1] into VSWR (1.2:1) (wrt Reference Frequency)	5 mVp-p to 5 Vp-p 100 Hz to 300 MHz (300 to 550) MHz 5 mVp-p to 3 Vp-p 550 MHz to 1.1 GHz (1.1 to 2.5) GHz 5 mVp-p to 2 Vp-p (2.5 to 3.2) GHz	 1.6 % of reading 1.9 % of reading 2.7 % of reading 3.1 % of reading 3.1 % of reading	Comparison to Fluke 9500B Oscilloscope Calibrator with Fluke 9530 Active Head
Scope Input Impedance – Measure [1]	(10 to 40) Ω (40 to 90) Ω (90 to 150) Ω (50 to 800) kΩ 800 kΩ to 1.2 MΩ (1.2 to 12) MΩ	0.39 % of reading 0.083 % of reading 0.39 % of reading 0.39 % of reading 0.083 % of reading 0.39 % of reading	Comparison to Fluke 9500B Oscilloscope Calibrator
Scope Input Capacitance – Measure [1]	(1 to 35) pF (35 to 95) pF	1.6 % of reading + 0.19 pF 2.3 % of reading + 0.19 pF	Comparison to Oscilloscope Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Power – Source [1]			
(0.33 to 330) mA	11 µW to 1.1 mW	0.024 % of reading	
	1.1 mW to 110 mW	0.027 % of reading	
	0.11 W to 110 W	0.024 % of reading	
	110 W to 330 W	0.018 % of reading	Comparison to Fluke 5522A Multiproduct Calibrator
(0.33 to 3) A	11 W to 110 mW	0.044 % of reading	
	0.11 W to 990 W	0.053 % of reading	
	1 W to 3 kW	0.009 6 % of reading	
(3 to 20.5) A	0.099 W to 0.99 W	0.088 % of reading	
	0.99 W to 6.8 kW	0.07 % of reading	
	6.8 W to 20.5 kW	0.04 % of reading	
AC Power – Source [1,2] (PF=1) (45 to 65) Hz			
(3.3 to 9) mA	(0.11 to 3) mW	0.13 % of reading	
	3.0 mW to 9.0 W	0.077 % of reading	
(9 to 33) mA	(0.3 to 10) mW	0.089 % of reading	
	10 mW to 33 W	0.077 % of reading	
(33 to 90) mA	(1 to 30) mW	0.071 % of reading	
	30 mW to 90 W	0.057 % of reading	Comparison to Fluke 5522A Multiproduct Calibrator
(90 to 330) mA	(3 to 100) mW	0.089 % of reading	
	100 mW to 300 W	0.078 % of reading	
(0.33 to 0.9) A	(11 to 300) mW	0.071 % of reading	
	300 mW to 900 W	0.081 % of reading	
(0.9 to 2.2) A	30 mW to 0.72 W	0.089 % of reading	
	0.72 W to 2 kW	0.079 % of reading	
(2.2 to 4.5) A	80 mW to 1.4 W	0.088 % of reading	
	1.4 W to 4.5 kW	0.18 % of reading	
(4.5 to 20.5) A	150 mW to 6.7 W	0.17 % of reading	
	6.7 W to 20 kW	0.17 % of reading	
LF Phase – Source [1]	(0 to 180)°		
	(10 to 65) Hz	0.11°	Comparison to Fluke 5522A Multiproduct Calibrator
	(65 to 500) Hz	0.21°	
	500 Hz to 1 kHz	0.39°	
	(1 to 5) kHz	1.9°	
	(5 to 10) kHz	3.9°	
	(10 to 20) kHz	7.8°	

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Absolute Power – Measure (50 Ω Load) 100 kHz to 4.2 GHz	(-30 to 20) dBm 1 µW to 100 mW	1.7 % of reading	Comparison to Agilent 437 RF Power Meter, Agilent 8482A Power Sensor
Total Harmonic Distortion – Measure 5 Hz to 600 kHz Fundamental Input Voltage: < 30 V Level: (0.3 to 100) % 0.1 % Input Voltage: > 30 V Level: (0.3 to 100) % 0.1 %	 10 Hz to 1 MHz (1 to 3) MHz (10 to 20) Hz (20 to 30) Hz 30 Hz to 300 kHz (300 to 500) kHz 500 kHz to 1.2 MHz 10 Hz to 300 kHz (300 to 500) kHz 500 kHz to 3 MHz (10 to 20) Hz (20 to 30) Hz 30 Hz to 300 kHz (300 to 500) kHz 500 kHz to 1.2 MHz	 3.5 % of reading 6.9 % of reading 14 % of reading 6.9 % of reading 3.5 % of reading 6.9 % of reading 14 % of reading 3.5 % of reading 6.9 % of reading 14 % of reading 14 % of reading 6.9 % of reading 3.5 % of reading 6.9 % of reading 14 % of reading	Comparison to Agilent 334A Distortion Analyzer
Total Harmonic Distortion	(-110 to 0) dBm 100 Hz to 1.5 GHz	1.8 dB	Comparison to Rigol DSA815 Spectrum Analyzer

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks [3]	(0.05 to 1) in (1 to 4) in	(1.5 + 1.4*L*) µin (0.7 + 1.9*L*) µin	Mechanical Comparison Method Federal Gage Block Comparator, Grade 1 Gage Blocks
	(1 to 10) mm (10 to 100) mm	(0.061 + 0.001*L*) µm (0.055 + 0.001 7*L*) µm	
Angles [3]	(0 to 75)°	5.3”	Comparison to Angle Blocks, Master Square, Surface Plate
	90°	1.2”	
Angle Measuring Devices [3] (Protractors, Inclinometers, Squares, Angle Gages)	(0.000 001 6 to 5)° (5 to 20)° (20 to 35)° (35 to 45)° (45 to 60)° (60 to 75)° (75 to 85)° 90°	9.7″ 10.7″ 13″ 15.7″ 23.5″ 47″ 141″ 1.2″	Comparison to 10-inch Sine Plate, Gage Blocks, Surface Plate Master Square
Calipers [1,3] (Outside, Inside, Depth & Step)	Up to 8 in (8 to 48) in	(20 + 5*L*) µin (13 + 7*L*) µin	Direct Measure Gage Blocks
Micrometers [1,3] (Outside, Inside, & Depth)	Up to 8 in (8 to 48) in	(20 + 5*L*) µin (13 + 7*L*) µin	Direct Measure Gage Blocks
Anvil Flatness [1]	Up to 3 in	6.7 µin	Direct Measure Optical Flats
Length Single Axis [3] Outside Dimension	Up to 1 in (1 to 10) in	33 µin (33 + 3*L*) µin	Direct Measure Supermicrometer Model C
Height Gages [1,3]	Up to 8 in (8 to 44) in	(30 + 2*L*) µin (10 + 4*L*) µin	Comparison to Gage Blocks
Height – Measure [1,3]	Up to 8 in (8 to 44) in	(37 + 2*L*) µin (11 + 4*L*) µin	Comparison to Gage Blocks using Test Indicator with Electronic Amplifier
Indicators [1,3]	Up to 6 in	(4 + 7*L*) µin	Comparison to Gage Blocks or to Supermicrometer Model C
Parallelism & Straightness [3]	Up to 3 in (3 to 24) in	(20 + 3*L*) µin (30 + 3*L*) µin	Direct Measure Gage Amplifier, Surface Plate
Pin Gages (Outside Diameter)	Up to 1 in	33 µin	Direct Measure Laser Micrometer

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Plug Gages [3] Outside Diameter	Up to 1 in (1 to 6) in	48 µin (46 + 2*L*) µin	Direct Measure Supermicrometer Model C
Thread Wires	(2 to 120) TPI (0.008 to 0.5) in	35 µin	Direct Measure Supermicrometer Model C
Thread Plugs [3] (60 ° Thread) Pitch Diameter Major Diameter	 Up to 1 in (1 to 4) in (4 to 6) in Up to 1 in (1 to 6) in	 82 µin 84 µin 88 µin 36 µin (36 + 3*L*) µin	Direct Measure Thread Wires, Supermicrometer Model C
Measuring Tapes, Rulers [1,2]	Up to 1 ft (1 to 3) ft (3 to 1 000) ft	(463 + 2*L*) µin (410 + 6*L*) µin (18*L*) µin	Direct Measure Single-axis Vision System
Laser Micrometers [1,3]	Up to 1 in	(13 + 3*L*) µin	Comparison to Master Gage Pins
Optical Comparators [1] (Linearity)	(0.05 to 12) in X-Axis Y-Axis X-Y Axis	 200 µin 200 µin 260 µin	Comparison to Glass Scale, Cylindrical Square

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Force Gages – Tension and Compression [1]	(0 to 500) lbf	0.025 % of reading + 0.000 15 lbf	Comparison to NIST Class F Weights
Force Gages – Tension and Compression [1]	(50 to 2 000) lbf (2 000 to 5 000) lbf (5 000 to 10 000) lbf (10 000 to 25 000) lbf (25 000 to 50 000) lbf (50 000 to 100 000) lbf	0.024 % of reading + 0.72 lbf 0.023 % of reading + 0.78 lbf 0.023 % of reading + 1.1 lbf 0.024 % of reading + 4.6 lbf 0.023 % of reading + 8.2 lbf 0.023 % of reading + 9.5 lbf	Comparison to Interface Gold System

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass Determination (Metric)	30 kg 25 kg 20 kg 10 kg 5 kg 2 kg 1 kg 500 g 200 g 100 g 50 g 20 g 10 g 5 g 2 g 1 g 500 mg 200 mg 100 mg 50 mg 20 mg 10 mg 5 mg 2 mg 1 mg	33 mg 33 mg 19 mg 9 mg 3.7 mg 3.3 mg 1.1 mg 0.37 mg 0.18 mg 0.23 mg 97 µg 70 µg 35 µg 21 µg 27 µg 29 µg 17 µg 17 µg 16 µg 16 µg 16 µg 16 µg 16 µg 16 µg 16 µg	Double Substitution Method; ASTM E617 Class 2 Weights, Electronic Balances
Mass Determination (Avoirdupois)	50 lb 30 lb 20 lb 10 lb 5 lb 3 lb 2 lb 1 lb 8 oz 4 oz 2 oz 1 oz 0.5 oz	45 mg 45 mg 45 mg 8.2 mg 8.2 mg 7.3 mg 6.8 mg 6.8 mg 6.8 mg 2.31 mg 2.31 mg 2.31 mg 2.31 mg	Single Substitution Method; ASTM E617 Class 2 Weights, Electronic Balances

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness and Superficial Testers [1]	HRC High Middle Low HRBW High Middle Low	 0.53 HRC 0.73 HRC 0.92 HRC 1.2 HRBW 1.2 HRBW 1.3 HRBW	Indirect Verification per ASTM E18 using Test Blocks
Durometers [1] Spring Force Only Types A, B, O Types C, D, DO	 Up to 822 g Up to 4 536 g	 2.3 g 7.2 g	Partial Verification per ASTM D2240 using Duro Calibrator
Torque Tools [1]	2.5 ozf·in to 1 000 lbf·ft (1 000 to 2 000) lbf·ft	0.5 % of reading 0.39 % of reading	Direct Measure CDI Torque Measuring System
Torque Measuring Equipment	2.5 ozf·in to 25 lbf·in (25 to 500) lbf·in 500 lbf·in to 1 000 lbf·ft (1 000 to 2 000) lbf·ft	0.049 % of reading 0.049 % of reading 0.055 % of reading 0.18 % of reading	Comparison to Torque Wheels/Arms, NIST Class F Weights
Torque Angle [1]	45° 90° 135° 180° 225° 270° 315° 360°	0.38° 0.39° 0.36° 0.36° 0.38° 0.39° 0.36° 0.36°	Comparison to Torque Angle Fixture

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales and Balances [1,5] (SI)	30 kg 25 kg 20 kg 10 kg 5 kg 2 kg 1 kg 500 g 200 g 100 g 50 g 20 g 10 g 5 g 2 g 1 g	36 mg 33 mg 27 mg 7.2 mg 4.5 mg 6.3 mg 1 mg 0.35 mg 0.27 mg 0.38 mg 0.21 mg 0.16 mg 83 µg 42 µg 35 µg 21 µg	Comparison to ASTM E617 Class 1 Weights and internal calibration procedure utilized in the calibration of the weighing device.
Scales and Balances [1,5] (SI)	500 mg 200 mg 100 mg 50 mg 20 mg 10 mg 5 mg 2 mg 1 mg	14 µg 14 µg 11 µg 11 µg 11 µg 11 µg 11 µg 11 µg 11 µg	Comparison to ASTM E617 Class 1 Weights and internal calibration procedure utilized in the calibration of the weighing device.
Scales and Balances [1,5] (Avoirdupois)	(1 to 500) lb	0.013 % of reading	Comparison to NIST Class F Weights and internal calibration procedure utilized in the calibration of the weighing device.
Pneumatic Absolute Pressure – Source	(0.1 to 30) psia (30 to 1 000) psia	0.002 4 psi 0.007 % of reading + 0.000 5 psi	Direct Measure; DHI PPC4 Pressure Controller, RPM4 Indicator
Pneumatic Pressure – Source [1]	(-14.2 to 30) psig (30 to 1 000) psig	0.002 psi 0.007 % of reading + 0.000 1 psi	Direct Measure; DHI PPC4 Pressure Controller, RPM4 Indicator

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pneumatic Pressure – Source [1]	(0.14 to 0.36) inH_2O	0.06 % of reading + 0.000 044 inH_2O	Direct Measure; Ametek RK-1100 WC Deadweight Tester
Pneumatic Pressure – Source [1]	(-36 to -22) inH_2O (-22 to 22) inH_2O (22 to 60) inH_2O (60 to 72) inH_2O (72 to 804) inH_2O	0.009 % of reading + 0.000 15 inH_2O 0.002 2 inH_2O 0.009 % of reading + 0.000 15 inH_2O 0.007 inH_2O 0.009 % of reading + 0.000 15 inH_2O	Direct Measure; DHI PPC4 Pressure Controller
Hydraulic Pressure – Source [1]	(10 to 16 000) psig	0.01 % of reading	Direct Measure; Pressurements P3125-3 Hydraulic Deadweight Tester

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity – Measure [1]	(10 to 30) °C (20 to 80) %RH	 1.3 %RH	Vaisala HMI41/HMP46 Temperature/Humidity Probe with Indicator
Relative Humidity – Source	(-10 to 15) °C (10 to 75) %RH (75 to 95) %RH (15 to 35) °C (10 to 95) %RH (35 to 70) °C (10 to 50) %RH (50 to 75) %RH (75 to 95) %RH	 0.5 %RH 0.65 %RH 0.5 %RH 0.5 %RH 0.7 %RH 0.85 %RH	Humidity Generator
Temperature – Measure [1]	(-195 to 0) °C (0 to 420) °C (420 to 600) °C	0.013 °C 0.021 °C 0.029 °C	Direct Measure; Hart 5628 Secondary PRT with Indicator
Temperature Measuring Equipment	(-80 to 100) °C (100 to 200) °C	0.017 °C 0.023 °C	Comparison to Liquid Bath, Hart 5628 Secondary PRT with Indicator
Temperature Measuring Equipment	(200 to 300) °C (300 to 600) °C	0.12 °C 0.35 °C	Comparison to Dry Block Calibrator, Hart 5628 Secondary PRT with Indicator

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Infrared Temperature Measuring Equipment	(-15 to 0) °C (0 to 50) °C (50 to 100) °C (100 to 120) °C (120 to 200) °C (200 to 350) °C (350 to 500) °C	0.8 °C 0.65 °C 0.7 °C 0.76 °C 0.95 °C 1.6 °C 2.1 °C	Comparison to Black Body Source (flat plate) $\varepsilon = 0.95$, $\lambda = (8 \text{ to } 14)$ µm

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Reference	10 MHz	5.9 nHz/Hz	Comparison to Rubidium Oscillator
Frequency – Source [1]	1 Hz to 80 MHz	58 nHz/Hz	Direct Measure; Keysight 33250A Function/Arbitrary Waveform Generator, characterized with Stanford Research FS725 Rubidium Frequency Oscillator
Frequency – Measure	1 Hz to 10 kHz 10 kHz to 10 MHz (10 to 100) MHz	0.64 nHz/Hz + 4.5 µHz 0.64 nHz/Hz + 5 µHz 0.64 nHz/Hz	Direct Measure; HP 53132A Universal Counter, characterized with Stanford Research FS725 Rubidium Frequency Oscillator
Period – Source	(1 to 100) s	58 ns/s	Direct Measure; Keysight 33250A Function/Arbitrary Waveform Generator, Stanford Research FS725 Rubidium Frequency Oscillator
Period – Measure	(1 to 100) s	45 µs	Direct Measure; HP 53132A Universal Counter, Stanford Research FS725 Rubidium Frequency Oscillator

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Time Measuring Equipment (Error)	Up to 599 s/mon	58 ms/day	Comparison to Vibrograf TM-4500 Timometer
Rise Time – Measure [1]	800 ps to 1 µs	0.93 ns	Direct Measure; Tektronix TDS 5054 Digital Oscilloscope
AC Duty Cycle – Source [1] Square-wave < 3.3 Vp-p Freq: 0.1 Hz to 100 kHz	(1 to 10) % Duty Cycle 10 µs to 100 s (10 to 49) % Duty Cycle 10 µs to 100 s 50 % Duty Cycle 10 µs to 100 s (51 to 90) % Duty Cycle 10 µs to 100 s (91 to 99) % Duty Cycle 10 µs to 100 s	0.039 % of reading + 78 ns 0.62 % of reading + 78 ns 0.001 6 % of reading + 78 ns 0.62 % of reading + 78 ns 0.039 % of reading + 78 ns	Direct Measure; Fluke 55xxA Multiproduct Calibrator

DIMENSIONAL MEASUREMENT

1 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dimensional Measurement – 1D	X-axis Up to 1 in (1 to 3) in (3 to 6) in Y-axis Up to 2 in (2 to 3) in (3 to 5) in	 190 µin 300 µin 430 µin 290 µin 400 µin 520 µin	Optical Comparator utilized as Reference for Length Measurement Inspection using Drawings and Specifications.

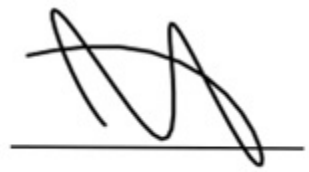
2 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dimensional Measurement – 2D	Up to 180°	0.008°	Optical Comparator utilized as Reference for Angle Measurement Inspection using Drawings and Specifications.
Dimensional Measurement – 2D	Up to 1 in (1 to 3) in (3 to 6) in	350 µin 610 µin 610 µin	Optical Comparator utilized as Reference for Radius Measurement Inspection using Drawings and Specifications.

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. The uncertainties shown are for the most favorable conditions. There is an increase in uncertainty that corresponds to the laboratory's AC voltage and current uncertainties at different frequencies other than the ones shown. Power factors (PF) other than the one shown contribute to the power uncertainty. PF is related to the cosine of phase. Therefore, uncertainties track the laboratory's phase uncertainty closely at PF near one but are magnified heavily as PF approaches zero. The lab may also report reactive power, apparent power, and power factor under this accreditation. If needed, contact the laboratory for more information regarding uncertainties at frequency and power factor combinations other than the ones shown.
3. L = length in inches or millimeters; ″ = arc-second.
4. The stated uncertainty is the laboratory's ability to source a fast rise pulse that is approximately 500 ps or 150 ps. In the typical application of measuring rise time of an oscilloscope, this value is one of the contributing factors, but other factors are derived from the DUT.
5. The CMC for scales and balances is highly dependent upon the resolution of the unit under test. The CMC 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.
6. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2489.07.



Jason Stine, Vice President