CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Transcat – New England
149 River Street, Suite 3
Andover, MA 01810

Fulfills the requirements of

ISO/IEC 17025:2017

and national standards

ANSI/NCSL Z540-1-1994 (R2002) AND
ANSI/NCSL Z540.3-2006 (R2013)

In the field 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-2489.04

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 – New England
149 River Street, Suite 3
Andover, MA 01810
Zachary Curry-Brown 978-988-3910

CALIBRATION AND DIMENSIONAL MEASUREMENT

Valid to: **September 7, 2025** Certificate Number: **AC-2489.04**

CALIBRATION

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH – Measuring Equipment [1]	4 pH 7 pH 10 pH	0.011 pH 0.01 pH 0.012 pH	Standard Buffer Solutions

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source [1]	Up to 220 µA (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	 0.031 % of reading + 16 nA 0.019 % of reading + 10 nA 0.015 % of reading + 8 nA 0.03 % of reading + 12 nA 0.11 % of reading + 65 nA 0.03 % of reading + 40 nA 0.018 % of reading + 35 nA 0.014 % of reading + 35 nA 0.021 % of reading + 0.11 µA 0.11 % of reading + 0.65 µA	Fluke 5720A 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 (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	 0.039 % of reading + 0.4 µA 0.019 % of reading + 0.35 µA 0.014 % of reading + 0.35 µA 0.021 % of reading + 0.55 µA 0.11 % of reading + 5 µA 0.033 % of reading + 4 µA 0.018 % of reading + 3.5 µA 0.014 % of reading + 2.5 µA 0.021 % of reading + 3.5 µA 0.11 % of reading + 10 µA 0.027 % of reading + 35 µA 0.046 % of reading + 80 µA 0.7 % of reading + 0.16 mA	Fluke 5720A Multiproduct Calibrator
AC Current – Source [1]	(2.2 to 11) A 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	 0.048 % of reading + 0.17 mA 0.096 % of reading + 0.38 mA 0.36 % of reading + 0.75 mA 0.11 % of reading + 3.9 mA 0.14 % of reading + 3.9 mA 2.7 % of reading + 3.9 mA	Fluke 5720A Multiproduct Calibrator, Fluke 5725A Amplifier
AC Current – Source [1]	(20.5 to 40) (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	 0.14 % of reading + 11 mA 0.17 % of reading + 11 mA 3.3 % of reading + 11 mA	Two Fluke 5520 Multiproduct Calibrators in Parallel
AC Current – Source [1]	(40 to 100) A (50 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	 0.12 % of reading + 0.35 A 0.24 % of reading + 0.47 A 0.35 % of reading + 0.7 A	Fluke 5520A Multiproduct Calibrator, Valhalla 2555A Amplifier
AC Current – Source [1] (Extended Frequency Ranges)	(29 to 330) µA (10 to 30) kHz (0.33 to 3.3) mA (10 to 30) kHz (3.3 to 33) mA (10 to 30) kHz (29 to 330) mA (10 to 30) kHz	 1.5 % of reading + 0.31 µA 0.92 % of reading + 0.47 µA 0.37 % of reading + 3.1 µA 0.37 % of reading + 0.16 mA	Fluke 5520A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Clamp-on Ammeters (Toroidal Type) Transformer Type Sensor [1]	(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	 0.35 % of reading + 0.25 A 0.94 % of reading + 50 µA 0.34 % of reading + 0.13 A 1.2 % of reading + 0.23 A	Fluke 5522A Multiproduct Calibrator, 5500A/COIL 50-turn Coil
AC Clamp-on Ammeters (Non-Toroidal Type) Hall Effect Sensor [1]	(20 to 150) A (45z to 65) Hz (65 to 440) Hz (150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	 0.6 % of reading + 0.29 A 1 % of reading + 0.29 A 0.57 % of reading + 1 A 1.3 % of reading + 1.1 A	Fluke 5522A Multiproduct Calibrator, 5500A/COIL 50-turn Coil
AC Current – Measure [1]	Up to 100 µA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz (0.1 to 1) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (0.1 to 1) A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	 0.46 % of reading + 35 nA 0.18 % of reading + 35 nA 0.072 % of reading + 35 nA 0.072 % of reading + 35 nA 0.46 % of reading + 0.23 µA 0.17 % of reading + 0.23 µA 0.07 % of reading + 0.23 µA 0.038 % of reading + 0.23 µA 0.46 % of reading + 2.3 µA 0.17 % of reading + 2.3 µA 0.07 % of reading + 2.3 µA 0.038 % of reading + 2.3 µA 0.46 % of reading + 23 µA 0.17 % of reading + 23 µA 0.07 % of reading + 23 µA 0.037 % of reading + 23 µA 0.46 % of reading + 0.23 mA 0.19 % of reading + 0.23 mA 0.096 % of reading + 0.23 mA 0.12 % of reading + 0.23 mA	Agilent 3458A/002 8.5 Digit Multimeter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure [1]	(1 to 3) A 40 Hz to 1 kHz (1 to 5) kHz (3 to 30) A 40 Hz to 1 kHz (1 to 5) kHz	0.18 % of reading + 2.1 mA 0.2 % of reading + 2.1 mA 0.35 % of reading + 2.3 mA 5.8 % of reading + 2.3 mA	Agilent 3458A/002 8.5 Digit Multimeter, Agilent 34330A Current Shunt
DC Current – Source [1]	(0.22 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 36 µA/A + 7 nA 35 µA/A + 40 nA 48 µA/A + 0.7 µA 0.2 mA/A + 12 µA	Fluke 5700A/EP Multiproduct Calibrator
DC Current – Source [1]	(2.2 to 11) A	0.4 mA/A + 12 µA	Fluke 5700A/EP Multiproduct Calibrator, Fluke 5725A Amplifier
DC Current – Source [1]	(11 to 20.5) A	0.84 mA/A + 0.58 mA	Fluke 5520A/11 Multiproduct Calibrator
DC Current – Source [1]	(20.5 to 40) A	0.12 % of reading + 0.82 mA	Two Fluke 5520 Multiproduct Calibrators in Parallel
DC Current – Source [1]	(40 to 100) A	0.037 % of reading + 35 mA	Fluke 5520A Multiproduct Calibrator, Valhalla 2555A Amplifier
DC Clamp-on Ammeters (Non-Toroidal Type) Transformer Type Sensor [1]	(20 to 150) A (150 to 1 000) A	0.51 % of reading + 0.14 A 0.51 % of reading + 0.5 A	Fluke 5520A Multiproduct Calibrator, 5500A/COIL 50-turn Coil
DC Current – Source/Measure [1]	Up to 100 µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	33 µA/A + 0.92 nA 29 µA/A + 5.8 nA 29 µA/A + 58 nA 46 µA/A + 0.58 µA 0.013 % of reading + 12 µA	Agilent 3458A/002 8.5 Digit Multimeter w/ Current Source

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Measure [1]	Up 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	0.13 mA/A + 58 pA 0.12 mA/A + 0.58 nA 0.12 mA/A + 5.8 nA 0.12 mA/A + 58 nA 0.12 mA/A + 0.58 µA 0.12 mA/A + 5.8 µA	Agilent 3458A/002 8.5 Digit Multimeter
DC Current – Measure [1]	(1 to 10) A (10 to 100) A (100 to 300) A	0.14 mA/A + 58 µA 0.59 mA/A + 0.58 mA 0.12 % of reading + 1.7 mA	Guideline 9711A Current Shunt, Agilent 3458A/002 8.5 Digit Multimeter
DC Current – Measure [1]	(300 to 1 000) A	0.12 % of reading + 5.8 mA	Meterman 1000-100 Current Shunt, Agilent 3458A/002 8.5 Digit Multimeter
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	 0.16 % of reading + 4 µV 0.1 % of reading + 4 µV 0.078 % of reading + 4 µV 0.13 % of reading + 4 µV 0.17 % of reading + 5 µV 0.33 % of reading + 10 µV 0.47 % of reading + 20 µV 0.58 % of reading + 20 µV 0.042 % of reading + 4 µV 0.03 % of reading + 4 µV 0.014 % of reading + 4 µV 0.03 % of reading + 4 µV 0.058 % of reading + 5 µV 0.12 % of reading + 10 µV 0.16 % of reading + 20 µV 0.27 % of reading + 20 µV 0.028 % of reading + 12 µV 0.011 % of reading + 7 µV 0.008 5 % of reading + 7 µV 0.021 % of reading + 7 µV 0.047 % of reading + 17 µV 0.091 % of reading + 20 µV 0.14 % of reading + 25 µV 0.28 % of reading + 45 µV	Fluke 5720A 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		Fluke 5720A Multiproduct Calibrator
	(10 to 20) Hz	0.027 % of reading + 40 µV	
	(20 to 40) Hz	0.01 % of reading + 15 µV	
	40 Hz to 20 kHz	0.004 8 % of reading + 8 µV	
	(20 to 50) kHz	0.008 % of reading + 10 µV	
	(50 to 100) kHz	0.012 % of reading + 30 µV	
	(100 to 300) kHz	0.043 % of reading + 80 µV	
	(300 to 500) kHz	0.1 % of reading + 0.2 mV	
	500 kHz to 1 MHz	0.18 % of reading + 0.3 mV	
	(2.2 to 22) V		
	(10 to 20) Hz	0.028 % of reading + 0.4 mV	
	(20 to 40) Hz	0.01 % of reading + 0.15 mV	
	40 Hz to 20 kHz	0.004 9 % of reading + 50 µV	
	(20 to 50) kHz	0.008 3 % of reading + 0.1 mV	
	(50 to 100) kHz	0.012 % of reading + 0.2 mV	
	(100 to 300) kHz	0.03 % 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	0.028 % of reading + 4 mV	
	(20 to 40) Hz	0.01 % of reading + 1.5 mV	
	40 Hz to 20 kHz	0.005 6 % of reading + 0.6 mV	
	(20 to 50) kHz	0.009 3 % of reading + 1 mV	
	(50 to 100) kHz	0.016 % 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 + 40 mV	
AC Voltage – Source [1]	(220 to 750) V		Fluke 5720A Multiproduct Calibrator, Fluke 5725A Amplifier
	(30 to 50) kHz	0.061 % of reading + 11 mV	
	(50 to 100) kHz	0.23 % of reading + 45 mV	
	(220 to 1 100) V		
	40 Hz to 1 kHz	0.011 % of reading + 4 mV	
	(1 to 20) kHz	0.017 % of reading + 6 mV	
	(20 to 30) kHz	0.061 % of reading + 11 mV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure [1]	Up to 10 mV		Agilent 3458A/002 8.5 Digit Multimeter
	(1 to 40) Hz	0.04 % of reading + 3.5 µV	
	40 Hz to 1 kHz	0.03 % of reading + 1.2 µV	
	(1 to 20) kHz	0.04 % of reading + 1.2 µV	
	(20 to 50) kHz	0.15 % of reading + 1.2 µV	
	(50 to 100) kHz	0.59 % of reading + 1.2 µV	
	(100 to 300) kHz	4.6 % of reading + 2.3 µV	
	300 kHz to 1 MHz	1.5 % of reading + 5.8 µV	
	1 MHz to 4 MHz	8.1 % of reading + 8.1 µV	
	(10 to 100) mV		
	(1 to 40) Hz	0.013 % of reading + 4.6 µV	
	40 Hz to 1 kHz	0.009 7 % of reading + 2.3 µV	
	(1 to 20) kHz	0.017 % of reading + 2.3 µV	
	(20 to 50) kHz	0.038 % of reading + 2.3 µV	
	(50 to 100) kHz	0.093 % of reading + 2.3 µV	
	(100 to 300) kHz	0.36 % of reading + 12 µV	
	300 kHz to 1 MHz	1.2 % of reading + 12 µV	
	(1 to 2) MHz	1.8 % of reading + 12 µV	
	(2 to 4) MHz	4.7 % of reading + 81 µV	
	(4 to 8) MHz	4.7 % of reading + 92 µV	
	(8 to 10) MHz	17 % of reading + 0.12 mV	
	(0.1 to 1) V		
	(1 to 40) Hz	0.008 8 % of reading + 46 µV	
	40 Hz to 1 kHz	0.008 3 % of reading + 23 µV	
	(1 to 20) kHz	0.017 % of reading + 23 µV	
	(20 to 50) kHz	0.036 % of reading + 23 µV	
	(50 to 100) kHz	0.093 % of reading + 23 µV	
	(100 to 300) kHz	0.35 % of reading + 0.12 mV	
	300 kHz to 1 MHz	1.2 % of reading + 0.12 mV	
	(1 to 2) MHz	1.8 % of reading + 0.12 mV	
	(2 to 4) MHz	4.6 % of reading + 0.81 mV	
	(4 to 8) MHz	4.6 % of reading + 0.92 mV	
	(8 to 10) MHz	17 % of reading + 1.2 mV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure [1]	(1 to 10) V		Agilent 3458A/002 8.5 Digit Multimeter
	(1 to 40) Hz	0.009 5 % of reading + 0.46 mV	
	40 Hz to 1 kHz	0.023 % of reading + 0.23 mV	
	(1 to 20) kHz	0.017 % of reading + 0.23 mV	
	(20 to 50) kHz	0.036 % of reading + 0.23 mV	
	(50 to 100) kHz	0.093 % of reading + 0.23 mV	
	(100 to 300) kHz	0.35 % of reading + 1.2 mV	
	300 kHz to 1 MHz	1.2 % of reading + 1.2 mV	
	(1 to 2) MHz	1.8 % of reading + 1.2 mV	
	(2 to 4) MHz	4.6 % of reading + 8.1 mV	
	(4 to 8) MHz	4.6 % of reading + 9.2 mV	
	(8 to 10) MHz	17 % of reading + 12 mV	
	(10 to 100) V		
	(1 to 40) Hz	0.024 % of reading + 4.6 mV	
	40 Hz to 1 kHz	0.024 % of reading + 2.3 mV	
	(1 to 20) kHz	0.024 % of reading + 2.3 mV	
	(20 to 50) kHz	0.041 % of reading + 2.3 mV	
	(50 to 100) kHz	0.14 % of reading + 2.3 mV	
	(100 to 300) kHz	0.46 % of reading + 12 mV	
	300 kHz to 1 MHz	1.7 % of reading + 12 mV	
	(100 to 700) V		
	(1 to 40) Hz	0.048 % of reading + 46 mV	
	40 Hz to 1 kHz	0.048 % of reading + 23 mV	
	(1 to 20) kHz	0.071 % of reading + 23 mV	
	(20 to 50) kHz	0.19 % of reading + 23 mV	
	(50 to 100) kHz	0.35 % of reading + 23 mV	
AC Voltage – Measure [1]	Up to 1 mV		Rohde & Schwarz URE3 RMS Voltmeter
	100 kHz to 1 MHz	2 % of reading + 2.4 µV	
	(1 to 3) MHz	3.8 % of reading + 2.4 µV	
	(3 to 10) MHz	10 % of reading + 2.4 µV	
	(10 to 20) MHz	25 % of reading + 2.4 µV	
	(1 to 3) mV		
	100 kHz to 1 MHz	1 % of reading + 2 µV	
	(1 to 3) MHz	3.8 % of reading + 2 µV	
	(3 to 10) MHz	11 % of reading + 2 µV	
	(10 to 20) MHz	25 % of reading + 2 µV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure [1]	(3 to 100) mV 100 kHz to 1 MHz (1 to 3) MHz (3 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.98 % of reading + 3 µV 1.9 % of reading + 3 µV 3.2 % of reading + 3 µV 7.6 % of reading + 3 µV 16 % of reading + 3 µV	Rohde & Schwarz URE3 RMS Voltmeter
AC High Voltage – Measure [1]	(0.7 to 10) kV 60 Hz	0.14 % of reading	Vitrek 4700 High Voltage Meter
AC High Voltage – Measure [1]	(10 to 30) kV 60 Hz	0.095 % of reading + 17 V	Vitrek 4700 High Voltage Meter, Vitrek HVP-35 High Voltage Probe
AC High Voltage – Measure [1]	(30 to 50) kV 60 Hz	0.16 % of reading + 4 V	Vitrek 4700 High Voltage Meter, Vitrek HVP-70 High Voltage Probe
AC High Voltage – Measure [1]	(50 to 70) kV 60 Hz	0.23 % of reading + 1.4 V	Vitrek 4700 High Voltage Meter, Vitrek HVP-100 High Voltage Probe
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	8.5 µV/V + 0.4 µV 5.1 µV/V + 0.7 µV 4 µV/V + 2.5 µV 3.9 µV/V + 4 µV 6.2 µV/V + 40 µV	Fluke 5720A Multiproduct Calibrator
DC Voltage – Source [1]	220 V to 1.1 kV	7.6 µV/V + 0.4 mV	Fluke 5720A Multiproduct Calibrator, Fluke 5725A Amplifier
DC Voltage – Measure [1]	(0 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	8.3 µV/V + 0.58 µV 5.3 µV/V + 0.58 µV 5.3 µV/V + 0.58 µV 7.7 µV/V + 35 µV 15 µV/V + 0.12 mV 18 µV/V + 0.12 mV 21 µV/V + 0.12 mV	Agilent 3458A/002 8.5 Digit Multimeter
DC High Voltage – Measure [1]	(1 to 10) kV	0.054 % of reading	Vitrek 4700 High Voltage Meter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC High Voltage – Measure [1]	(10 to 35) kV	0.093 % of reading	Vitrek 4700 High Voltage Meter, Vitrek HVP-35 High Voltage Probe
DC High Voltage – Measure [1]	(35 to 70) kV	0.11 % of reading + 8.1 V	Vitrek 4700 High Voltage Meter, Vitrek HVP-70 High Voltage Probe
DC High Voltage – Measure [1]	(70 to 100) kV	0.17 % of reading + 1.3 V	Vitrek 4700 High Voltage Meter, Vitrek HVP-100 High Voltage Probe
Resistance – Source [1] (Artifact)	333 µΩ 1 mΩ 10 mΩ 100 mΩ 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ	0.12 % of reading 0.59 mΩ/Ω 0.14 mΩ/Ω 0.12 mΩ/Ω 0.12 mΩ/Ω 0.12 mΩ/Ω 0.12 mΩ/Ω 0.12 mΩ/Ω 0.13 mΩ/Ω	Guideline 9711A Multi-tap Current Shunt
Resistance – Source [1] (Fixed Artifact)	25 Ω	9.4 µΩ/Ω	IET SRL-25 Standard Resistor
Resistance – Source [1,2] (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	0.18 % of reading + 2.3 Ω 0.21 % of reading + 120 Ω + 1.2 Ω/V 0.22 % of reading + 1.2 kΩ + 12 Ω/V 0.3 % of reading + 32 kΩ + 0.12 kΩ/V 0.58 % of reading + 0.48 MΩ + 1.2 kΩ/V 1.2 % of reading + 62 MΩ + 23 kΩ/V 2.6 % of reading + 15 GΩ + 0.58 MΩ/V	IET HRRS-B-7-100k-5kV High Resistance Decade Box
Resistance – Source/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	18 µΩ/Ω + 58 µΩ 15 µΩ/Ω + 0.58 mΩ 12 µΩ/Ω + 0.58 mΩ 12 µΩ/Ω + 5.8 mΩ 13 µΩ/Ω + 58 mΩ 21 µΩ/Ω + 2.3 Ω 62 µΩ/Ω + 0.12 kΩ 0.059 % of reading + 1.2 kΩ 0.82 % of reading + 12 kΩ	Decade Resistance Box, HP 3458A 8.5 Digit Multimeter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure [1]	Up to 1 Ω (1 to 10) Ω 10 Ω to 10 kΩ (10 to 40) kΩ (40 to 100) kΩ (100 to 500) kΩ	42 µΩ/Ω + 30 nΩ 16 µΩ/Ω 13 µΩ/Ω 16 µΩ/Ω 23 µΩ/Ω 81 µΩ/Ω	Fluke 1595A Super Thermometer
AC Resistance – Measure [1]	1 kHz Up to 6.25 Ω 6.25 Ω to 100 kΩ (100 to 410) kΩ	 0.7 % of reading + 10 mΩ 0.024 % of reading + 10 mΩ 0.3 % of reading + 10 mΩ	General Radio 1689-9700 LCR Meter
Capacitance – Source [1,3] (Artifacts)	100 Hz to 1 kHz (0.1 to 0.5) nF 0.5 nF to 1.4 µF	 0.58 pF 0.12 % of reading + 0.02 pF	Arco SS32 Precision Standard Capacitor Set
Capacitance – Source [1] (Simulation)	10 Hz to 10 kHz (0.19 to 3.3) pF 10 Hz to 1 kHz (3.3 to 11) nF (11 to 110) nF (110 to 330) nF (10 to 600) Hz (0.33 to 1.1) µF (10 to 300) Hz (1.1 to 3.3) µF (10 to 150) Hz (3.3 to 11) µF (10 to 120) Hz (11 to 33) µF (10 to 80) Hz (33 to 110) µF DC to 50 Hz (110 to 330) µF DC to 20 Hz (0.33 to 1.1) mF DC to 6 Hz (1.1 to 3.3) mF DC to 2 Hz (3.3 to 11) mF DC to 0.6 Hz (11 to 33) mF DC to 0.2 Hz (33 to 110) mF	 0.39 % of reading + 6.1 pF 0.21 % of reading + 6.1 pF 0.21 % of reading + 61 pF 0.21 % of reading + 0.18 nF 0.2 % of reading + 0.61 nF 0.2 % of reading + 1.9 nF 0.2 % of reading + 6.1 nF 0.32 % of reading + 18 nF 0.35 % of reading + 61 nF 0.35 % of reading + 0.18 µF 0.35 % of reading + 0.61 µF 0.35 % of reading + 1.8 µF 0.35 % of reading + 6.1 µF 0.58 % of reading + 18 µF 0.85 % of reading + 61 µF	Fluke 5520A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure [1]	1 kHz (1 to 10) pF (10 to 100) pF (0.1 to 1) µF (1 to 100) µF (0.1 to 1) mF	 0.47 % of reading + 0.05 pF 0.058 % of reading + 0.05 pF 0.024 % of reading + 0.05 pF 0.035 % of reading 0.24 % of reading	GR 1689-9700 Precision Impedance Meter
Inductance – Source [1] (Artifacts)	1 kHz 50 mH 100 mH	 0.12 % of reading + 1.4 µH 0.12 % of reading + 1.4 µH	Standard Inductors
Inductance – Measure [1]	1 kHz (1 to 10) mH 10 mH to 10 H	 0.024 % of reading + 0.1 µH 0.024 % of reading + 1.4 µH	GR 1689-9700 Precision Impedance Meter
Electrical Simulation of Thermocouple Indicating Devices – Measure/Source [1]	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 Type K (-270 to -255) °C (-255 to -195) °C (-195 to -115) °C (-115 to -55) °C (-55 to 1 000) °C (1 000 to 1 372) °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 2.5 °C 0.85 °C 0.16 °C 0.12 °C 0.087 °C 0.096 °C	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 N		Ectron 1140A Thermocouple Calibrator/Simulator
	(-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
AC Power – Source [1,4]			Fluke 5520A Multiproduct Calibrator
PF = 1			
(3.3 to 9) mA	(10 to 65) Hz		
	(0.11 mW to 3) mW	0.13 % of reading	
	3 mW to 9 W	0.077 % of reading	
(9 to 33) mA	(10 to 65) W		
	(0.3 to 10) mW	0.089 % of reading	
	10 mW to 33 W	0.077 % of reading	
(33 to 90) mA	(10 to 65) Hz		
	(1 to 30) mW	0.071 % of reading	
	30 mW to 90 W	0.057 % of reading	
(90 to 330) mA	(10 to 65) Hz		
	(3 to 100) mW	0.089 % of reading	
	100 mW to 300 W	0.078 % of reading	
(0.33 to 0.9) A	(10 to 65) Hz		
	(11 to 300) mW	0.071 % of reading	
	(0.3 to 900) W	0.081 % of reading	
(0.9 to 2.2) A	(10 to 65) Hz		
	(30 to 720) mW	0.089 % of reading	
	0.72 W to 2 kW	0.079 % of reading	
(2.2 to 4.5) A	(10 to 65) Hz		
	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	(10 to 65) Hz		
	150 mW to 20 kW	0.17 % of reading	
DC Power – Source [1]			Fluke 5520A Multiproduct Calibrator
(0.33 to 330) mA	11 µW to 1.1 mW	0.024 % of reading	
	1.1 mW to 0.11 W	0.027 % of reading	
	(0.11 to 110) W	0.024 % of reading	
	(110 to 330) W	0.018 % of reading	
(0.33 to 3) A	11 µW to 110 mW	0.044 % of reading	
	(0.11 to 990) W	0.053 % of reading	
	(0.99 to 3) kW	0.009 6 % of reading	
(3 to 20.5) A	99 mW to 0.99 W	0.088 % of reading	
	0.99 W to 6.8 kW	0.07 % of reading	
	(6.8 to 20.5) kW	0.04 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Phase – Source [1]	Up to 180° (10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 20) kHz	 0.11° 0.2° 0.4° 1.9° 3.9° 7.8°	Fluke 5520A Multiproduct Calibrator
Oscilloscopes [1,5,6]			Fluke 5520A/11 Multiproduct Calibrator with 1.1 GHz Scope Option
Amplitude DC			
into 50 Ω load	(-6 to 6) V	0.22 % of reading + 31 µV
into 1 MΩ load	(-130 to 130) V	0.12 % of reading + 31 µV
Square Wave			
into 50 Ω load	10 Hz to 100 kHz 1 mV p-p to 6.6 Vp-p	0.22 % of reading + 31 µV
into 1 MΩ load	10 Hz to 1 kHz 1 mV p-p to 130 Vp-p	0.14 % of reading + 31 µV
	(1 kHz to 10) kHz 1 mV p-p to 130 Vp-p	0.22 % of reading + 31 µV
Time Markers			
into 50 Ω load	1 ns to 20 ms	0.000 2 % of reading
	50 ms	2.3 µs
	0.1 s	7.6 µs
	0.2 s	28 µs
	0.5 s	0.16 ms
	1 s	0.62 ms
	2 s	2.4 ms
	5 s	15 ms
Rise Time – Source			
into 50 Ω load	5 mVp-p to 2.5 Vp-p	
Rate: 1 kHz to 2 MHz	250 ps (nominal)	50 ps
Rate: 2 MHz to 10 MHz	250 ps (nominal)	50 ps

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes [1,5,6]			
Leveled Sine Wave			
into 50 Ω load	5 mVp-p to 5.5 Vp-p		
	50 kHz	1.8 % of reading + 0.23 mV	
	50 kHz to 100 MHz	2.8 % of reading + 0.23 mV	
	(100 to 300) MHz	3.2 % of reading + 0.23 mV	
	(300 to 600) MHz	4 % of reading + 0.23 mV	
	5 mVp-p to 3.5 Vp-p		
	(600 to 1 100) MHz	5.5 % of reading + 0.23 mV	
Bandwidth/Flatness (50 kHz Reference)			
into 50 Ω load	5 mVp-p to 5.5 Vp-p		
	50 kHz to 100 MHz	1.4 % of reading + 78 µV	Fluke 5520A/11 Multiproduct Calibrator with 1.1 GHz Scope Option
	(100 to 300) MHz	1.8 % of reading + 78 µV	
	(300 to 600) MHz	3.2 % of reading + 78 µV	
	5 mVp-p to 3.5 Vp-p		
	(600 to 1 100) MHz	4 % of reading + 78 µV	
Input Impedance – Measure			
into 50 Ω load	(40 to 60) Ω	0.082 % of reading	
into 1 MΩ load	(0.5 to 1.5) MΩ	0.081 % of reading	
Input Capacitance – Measure	(5 to 50) pF	3.9 % of reading + 0.39 pF	
Waveform Generator Amplitude (Sine, Square, Triangle)	10 Hz to 10 kHz		
into 50 Ω load	1.8 mVp-p to 2.5 Vp-p	2.3 % of reading + 78 µV	
into 1 MΩ load	1.8 mVp-p to 55 Vp-p	2.3 % of reading + 78 µV	
Frequency (Sine, Square, Triangle)	10 Hz to 10 kHz	0.001 9 % of reading + 12 mHz	

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Angle Measuring Devices Protractors, Inclinometers, Squares, Angle Gages [7]	0.005 6" to 5° (5 to 20)° (20 to 35)° (35 to 45)° (45 to 60)° (60 to 75)° (75 to 85)° 90°	6.5″ 7.4″ 9.4″ 11.7″ 18″ 37″ 111″ 3.7″	10 in Sine Bar, Gage Blocks Granite Master Square
Calipers and Micrometers [1,7] (Outside, Inside, Depth)	(0.01 to 1) in (1 to 9) in	13 µin (9 + 4*L*) µin	Gage Blocks
Calipers and Micrometers [1,7] (Outside, Inside, Depth)	(4 to 15) in (15 to 40) in	(10 + 4*L*) µin (14 + 4*L*) µin	Long Gage Blocks
Anvil Flatness [1]	Up to 4 in	5 µin	Optical Flats
Anvil Parallelism [1]	Up to 1 in	16 µin	Optical Parallels
Bore Gages [7]	(0.04 to 1) in (1 to 5) in	83 µin (82 + 1.9*L*) µin	Characterized Ring Gages
Dial/Digital Indicators, LVDT's, Gage Amplifiers [7]	Up to 1 in (1 to 2) in (2 to 6) in	(6.1 + 1.1*L*) µin (4.2 + 3*L*) µin (0.9 + 4.8*L*) µin	Pratt & Whitney Labmaster®
Single Axis Measurement – Outside [7]	Up to 1 in (1 to 7) in (7 to 12) in	(6 + 1*L*) µin (4.3 + 3.5*L*) µin (11 + 4*L*) µin	Pratt & Whitney Labmaster®
Single Axis Measurement – Outside [7]	(12 to 24) in	(1+ 5.8*L*) µin	Pratt & Whitney Supermicrometer®
Single Axis Measurement – Inside [7]	(0.04 to 1) in (1 to 2.5) in (2.5 to 10) in (10 to 14) in	(9 + 1*L*) µin (10 + 3*L*) µin (14 + 3*L*) µin (25 + 3*L*) µin	Pratt & Whitney Labmaster®
Micrometer Heads	Up to 1 in (1 to 2) in	29 µin 31 µin	Gage Amplifier, Gage Blocks
Height Measuring Equipment [1,7]	Up to 12 in (12 to 24) in	(63 + 2*L*) µin (37 + 4.2*L*) µin	Gage Blocks, Surface Plate
Parallelism & Straightness	Up to 36 in	89 µin	Gage Amplifier, Surface Plate
Crimp Tools – Crimp Height	Up to 1 in	0.001 in	Crimp Height Micrometer
Squareness [7]	90°	(160 + 4.8*L*) µin	Granite Square, Surface Plate, Gage Amplifier
Length Measuring Equipment – Linear Displacement [7]	Up to 12 ft	(1 + 2.1*L*) µin	Laser Interferometer

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Wire Sets	(2 to 120) TPI (0.008 33 to 0.5) in	12 µin	Universal Length Measuring Machine
Cylindrical Plug Gages [7] (Outside Diameter)	Up to 5 in	(8.8 + 2.9*L*) µin	Universal Length Measuring Machine
Cylindrical Ring Gages [7] (Inside Diameter)	(0.04 to 0.5) in (0.5 to 1) in (1 to 3) in (3 to 11) in	(8.1 + 1.5*L*) µin (8.5 + 1*L*) µin (1.5 + 8.4*L*) µin (16.6 + 4.2*L*) µin	Universal Length Measuring Machine
Laser Micrometers [7]	(0.011 to 1) in	(13 + 1.8*L*) µin	Master Cylindrical Pin Gages
Rulers [7]	Up to 12 in (12 to 18) in	200 + 50*L*) µin (210 + 71*L*) µin	OGP Smartscope Flash 302 Measuring System
Thread Plug Gages [7] Pitch Diameter, 60 ° Thread Major Diameter	Up to 4 in Up to 4 in	83 µin (8.8 + 2.9*L*) µin	Universal Length Measuring Machine, Thread Measuring Wires
Thread Ring Gages Inner Pitch Diameter	Up to 4 in	83 µin	Thread Plug Uncertainty

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Balances and Scales [1,8] (SI)	(1 to 5) g (5 to 10) g (10 to 20) g (20 to 50) g (50 to 100) g (100 to 150) g (150 to 250) g (250 to 300) g (300 to 320) g	40 µg 59 µg 89 µg 0.15 mg 0.31 mg 0.35 mg 0.64 mg 0.69 mg 0.7 mg	ASTM E617 Class 1 weights and internal calibration procedure utilized for the calibration of the weighing system.
Balances and Scales [1,8] (SI)	(1 to 5) g (5 to 10) g 10 g to 10 kg (10 to 15) kg (15 to 20) kg (20 to 31) kg	63 µg 87 µg 0.000 59 % of reading 0.000 44 % of reading 0.000 42 % of reading 0.000 31 % of reading	ASTM E617 Class 2 weights and internal calibration procedure utilized for the calibration of the weighing system.

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Balances and Scales [1,8] (SI)	(2 to 5) mg (5 to 10) mg (10 to 20) mg (20 to 50) mg (50 to 100) mg (100 to 200) mg (200 to 500) mg (0.5 to 1) g (1 to 2) g (2 to 5) g (5 to 10) g (10 to 20) g (20 to 50) g (50 to 100) g (100 to 200) g (200 to 20) g (200 to 210) g	51 µg 53 µg 57 µg 63 µg 70 µg 80 µg 92 µg 0.12 mg 0.15 mg 0.21 mg 0.29 mg 0.41 mg 0.70 mg 1.2 g 1.4 g 1.6 g 1.7 g	ASTM E617 Class 3 weights and internal calibration procedure utilized for the calibration of the weighing system.
Balances and Scales [1,8] (SI)	(1 to 2) g (2 to 5) g (5 to 10) g (10 to 20) g (20 to 50) g (50 to 100) g (100 to 150) g (150 to 200) g (200 to 210) g	0.13 mg 0.15 mg 0.17 mg 0.20 mg 0.28 mg 0.59 mg 0.65 mg 0.74 mg 0.78 mg	NIST Class S weights and internal calibration procedure utilized for the calibration of the weighing system.
Balances and Scales [1,8] Avoirdupois SI	0.5 lb 1 lb (1 to 700) lb 227 g 454 g (0.454 to 318) kg	0.024 % of reading 0.018 % of reading 0.012 % of reading 0.024 % of reading 0.018 % of reading 0.012 % of reading	NIST Class F weights and internal calibration procedure utilized for the calibration of the weighing system.

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Durometers [7] Spring Force Type A, B, E, O Type D, C, DO Indenter Dimensions Length Angle Radius	 Up to 100 Duro Up to 100 Duro Up to 1 in Up to 40° Up to 5 in	 0.57 Duro 0.51 Duro (85 + 50*L*) µin 0.006° (440 + 50*L*) µin	Direct Verification per ASTM D2240-02B using Durometer Calibrator OGP Smartscope Flash 302
Force Measuring Equipment [1]	(0.5 to 100) lb	0.025 % of reading	NIST Class F Weights
Mass Determination (Metric)	10 kg 20 kg 25 kg	0.29 g 0.29 g 0.32 g	Echelon III
Mass Determination (Avoirdupois)	20 lb 25 lb 50 lb	0.000 64 lb 0.000 64 lb 0.000 71 lb	Echelon III
Absolute Pressure Devices (Pneumatic)	Up to 25 psia (25 to 500) psia	0.001 9 psi 0.006 8 % of reading	Ruska 7250xi Pressure Controller/Calibrator
Absolute Pressure Devices (Hydraulic)	(50 to 150) psia (150 to 15 000) psia	0.014 % of reading 0.013 % of reading	Ametek T150 Deadweight Tester w/ Ruska 7250xi Pressure Controller/Calibrator
Gage Pressure Devices (Pneumatic)	(-60 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 + 0.000 150 inH_2O 0.002 2 inH_2O 0.009 % of reading + 0.000 150 inH_2O 0.006 7 inH_2O 0.009 % of reading + 0.000 150 inH_2O	DHI PPC4 Pressure Controller
Gage Pressure Devices (Pneumatic)	(-15 to 25) psig (25 to 500) psig	0.001 7 psi 0.006 5 % of reading	Ruska 7250xi Pressure Controller/Calibrator
Gage Pressure Devices (Hydraulic)	(50 to 150) psig (150 to 15 000) psig	0.012 % of reading + 0.012 psi 0.012 % of reading	Ametek T150 Deadweight Tester
Torque Measuring Devices [1] (Wrenches, Electronic, etc.)	(3.2 to 80) ozf·in (4 to 50) lbf·in (30 to 1 000) lbf·in (20 to 250) lbf·ft (60 to 600) lbf·ft	1.2 % of reading + 0.002 3 ozf·in 0.7 % of reading 0.4 % of reading 0.4 % of reading 0.37 % of reading	Torque Calibrator

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Calibration Systems (Analyzers, Transducers, etc.)	2.5 ozf·in to 50 lbf·ft	0.12 % of reading	Torque Wheels, NIST Class F Weights

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
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 70) %RH (70 to 95) %RH	 0.5 %RH 0.65 %RH 0.5 %RH 0.5 %RH 0.7 %RH 0.85 %RH	Thunder Scientific 2500 Two-Pressure Humidity Generator
Relative Humidity – Measure [1]	(10 to 60) °C (10 to 90) %RH	 1.3 %RH	Vaisala Thermohygrometer
SPRT/PRT/RTD Probes [9]	-195 °C	5.4 mK	Comparison to Fluke 1595A Super Thermometer, PRT, $NBPLN_2$
SPRT/PRT/RTD Probes [9]	-78 °C -38.8 °C	4.4 mK 4 mK	Comparison to Fluke 1595A Super Thermometer, PRT, Precision Bath
SPRT/PRT/RTD Probes [9]	0.01 °C	2.9 mK	Triple Point of Water (Fixed Cell)
SPRT/PRT/RTD Probes [9]	29.8 °C 100 °C 156 °C 232 °C 300 °C 420 °C 500 °C	3.3 mK 3.9 mK 7.6 mK 8.2 mK 8.8 mK 9.9 mK 14 mK	Comparison to Fluke 1595A Super Thermometer, PRT, Precision Bath
Temperature – Measure [1]	(-195 to 0) °C (0 to 660) °C	0.002 7 % of reading + 7.2 mK 0.002 7 % of reading + 10 mK	Hart Scientific 5628 Secondary PRT, Black Stack

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measure [1]	(660 to 1 200) °C	0.46 % of reading + 2.9 °C	Druck DPI 620 Calibrator, Geo Corp Type N Thermocouple Probe

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency Dissemination Source/Measure	10 MHz	5.8 nHz/Hz	Rubidium Standard
Rise Time – Measure	≥ 700 ps	140 ps	Tektronix TDS3052C Digital Oscilloscope
Stopwatches, Timers	Up to 599 s/month	58 ms/d	Timometer
AC Duty Cycle – Source [1] Square Wave < 3.3 Vp-p Freq: 0.1 Hz to 100 kHz	10 µs to 100 s (1 to 10) % Duty Cycle (10 to 49) % Duty Cycle 50 % Duty Cycle (51 to 90) % Duty Cycle (90 to 99) % Duty Cycle	0.62 % of reading + 78 ns 0.039 % of reading + 78 ns 0.001 6 % of reading + 78 ns 0.039 % of reading + 78 ns 0.62 % of reading + 78 ns	Fluke 5522A Multiproduct Calibrator

DIMENSIONAL MEASUREMENT

2 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
2-D Measurements [7] Angle Perpendicularity Radius	(0 to 360)° Up to 2 in to angle (2 to 16) in to angle Up to 12 in (12 to 18) in Up to 5 in	 0.007 2° (0.000 5L) + 0.006 2° (120 + 48L) µin (123 + 71L) µin (440 + 50L) µin	OGP Smartscope Flash 302 Measuring System utilized in the Dimensional Measurements of Customer Gages and Fixtures.

3 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
3-D Measurements [7]	X-axis: Up to 12 in Y-axis: Up to 12 in Z-axis: Up to 10 in	(85 + 50*L*) µin (85 + 50*L*) µin (140 + 75*L*) µin	OGP Smartscope Flash 302 Measuring System utilized in the Dimensional Measurements of Customer Gages and Fixtures.
	X-axis: (12 to 18) in Y-axis: (12 to 18) in Z-axis: Up to 10 in	(120 + 71*L*) µin (120 + 71*L*) µin (140 + 75*L*) µin	

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. 230 V maximum up to 100 kΩ; 1 kV maximum up to 1 MΩ; 5 kV maximum up to 1 TΩ.
3. As frequency deviates from the listed values, uncertainty may be higher than stated. If needed, contact laboratory for more information regarding uncertainties at frequency and range combinations other than the ones shown.
4. 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 laboratory for more information regarding uncertainties at frequency and power factor combinations other than the ones shown.
5. As frequency & amplitude deviate from the listed values, uncertainty may be higher than stated. If needed, contact laboratory for more information regarding uncertainties at frequency and range combinations other than the ones shown.
6. The stated uncertainty is the laboratory's ability to source a fast rise pulse that is approximately 250 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. The known source rise time is mathematically removed from the total measured rise time measured on the DUT.
7. ″ = arc-second; L = length in inches;
8. 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.
9. $NBPLN_2$ = boiling point of liquid nitrogen.
10. The legal entity for this location is Transcat, Inc.
11. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2489.04.

Jason Stine, Vice President