



# CERTIFICATE OF ACCREDITATION

**The ANSI National Accreditation Board**

Hereby attests that

**Transcat – Palm Beach Gardens**

**10415 Riverside Drive, Suite 107  
Palm Beach Gardens, FL 33410**

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**

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

A handwritten signature in black ink, appearing to be 'Jason Stine', is positioned above a horizontal line.

Jason Stine, Vice President

Expiry Date: 07 September 2025  
Certificate Number: AC-2489.25



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 – Palm Beach Gardens**

10415 Riverside Drive, Suite 107

Palm Beach Gardens, FL 33410

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**CALIBRATION**

Valid to: **September 7, 2025**

Certificate Number: **AC-2489.25**

**Acoustics and Vibration**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Measuring Equipment	125 Hz to 2 kHz		GenRad 1986 Sound Level Calibrator
	(74 to 104) dB	0.45 dB	
	114 dB	0.33 dB	
	4 kHz		
	(74 to 104) dB	0.72 dB	
	114 dB	0.6 dB	

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure <sup>1</sup>	(0.2 to 20) $\mu$ A		Fluke 8588A 8.5 Digit Multimeter
	1 Hz to 2 kHz	0.2 % of reading + 2.5 nA	
	(2 to 10) kHz	0.2 % of reading + 2.5 nA	
	(10 to 30) kHz	0.2 % of reading + 2.5 nA	
	(20 to 200) $\mu$ A		
	1 Hz to 2 kHz	0.28 mA/A + 5 nA	
	(2 to 10) kHz	0.53 mA/A + 5 nA	
	(10 to 30) kHz	0.74 mA/A + 5 nA	
	(30 to 100) kHz	4.1 mA/A + 10 nA	



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure <sup>1</sup>	(0.2 to 2) mA		Fluke 8588A 8.5 Digit Multimeter
	1 Hz to 2 kHz	0.28 mA/A + 50 nA	
	(2 to 10) kHz	0.53 mA/A + 50 nA	
	(10 to 30) kHz	0.74 mA/A + 50 nA	
	(30 to 100) kHz	4.1 mA/A + 0.1 μA	
	(2 to 20) mA		
	1 Hz to 2 kHz	0.28 mA/A + 0.5 μA	
	(2 to 10) kHz	0.53 mA/A + 0.5 μA	
	(10 to 30) kHz	0.74 mA/A + 0.5 μA	
	(30 to 100) kHz	4.1 mA/A + 1 μA	
	(20 to 200) mA		
	1 Hz to 2 kHz	0.28 mA/A + 5 μA	
	(2 to 10) kHz	0.52 mA/A + 5 μA	
	(10 to 30) kHz	0.74 mA/A + 5 μA	
AC Current – Measure <sup>1</sup>	(0.2 to 2) A		Ohms Labs CS-100 Precision Shunt, 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	
	(2 to 10) kHz	0.86 mA/A + 0.5 mA	
	(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	
AC Current – Source <sup>1</sup>	Up to 220 μA		Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier
	(10 to 20) Hz	0.025 % of reading + 16 nA	
	(20 to 40) Hz	0.016 % of reading + 10 nA	
	40 Hz to 1 kHz	0.011 % of reading + 8 nA	
	(1 to 5) kHz	0.028 % of reading + 12 nA	
	(5 to 10) kHz	0.11 % of reading + 65 nA	
	220 μA to 2.2 mA		
	(10 to 20) Hz	0.025 % of reading + 40 nA	
	(20 to 40) Hz	0.016 % of reading + 35 nA	
	40 Hz to 1 kHz	0.011 % of reading + 35 nA	
(1 to 5) kHz	0.02 % of reading + 0.11 μA		
(5 to 10) kHz	0.11 % of reading + 0.65 μA		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source <sup>1</sup>	(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 220 mA to 2.2 A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz 2.2 A to 11 A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % of reading + 0.4 μA 0.016 % of reading + 0.35 μA 0.011 % of reading + 0.35 μA 0.02 % of reading + 0.55 μA 0.11% of reading + 5 μA 0.025 % of reading + 4 μA 0.016 % of reading + 3.5 μA 0.011 % of reading + 2.5 μA 0.02 % of reading + 3.5 μA 0.11 % of reading + 10 μA 0.025 % of reading + 35 μA 0.045 % of reading + 80 μA 0.7 % of reading + 0.16 mA 0.046 % of reading + 0.17 μA 0.095 % of reading + 0.38 μA 0.36 % of reading + 0.75 μA	Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier
AC Current – Source <sup>1</sup>	Up to 2 A (10 to 850) Hz (0.85 to 6) kHz (6 to 10) kHz 2 A to 20 A (10 to 850) Hz (0.85 to 6) kHz (6 to 10) kHz 20 A to 120 A (10 to 850) Hz (0.85 to 6) kHz (6 to 10) kHz	0.009 % of reading + 40 μA 0.04 % of reading + 80 μA 1.6 % of reading + 62 mA 0.009 % of reading + 0.4 mA 0.04 % of reading + 0.8 mA 2.3 % of reading + 94 mA 0.009 % of reading + 2.4 mA 0.04 % of reading + 4.8 mA 3.1 % of reading + 0.7 A	Fluke 5730A Multiproduct Calibrator, Fluke 52120A Current Amplifier
AC Clamp-on Ammeter <sup>1</sup> (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	0.3 % of reading + 26 mA 0.83 % of reading + 47 mA 0.35 % of reading + 0.12 A 1.1 % of reading + 0.22 A	Fluke 5520A Multiproduct Calibrator, 1 kA Coil



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Clamp-on Ammeter <sup>1</sup> (Non-Toroidal Type) Hall Effect Sensor	(20 to 150) A (45 to 65) Hz (65 to 440) Hz	0.57 % of reading + 0.25 A 1 % of reading + 0.25 A	Fluke 5520A Multiproduct Calibrator, 1 kA Coil  Fluke 5520A Multiproduct Calibrator, Fluke 52120A Transconductance Amplifier, 6 kA Coil
	(150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	0.6 % of reading + 0.9 A 1.3 % of reading + 0.92 A	
	(1 to 6) kA (10 to 300) Hz	0.62 % of reading	
	(1 to 2) kA (300 to 440) Hz	0.8 % of reading	
	(2 to 6) kA (300 to 440) Hz	0.66 % of reading	
AC Voltage – Measure <sup>1</sup>	(0.1 to 10) mV 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.029 % of reading + 1.1 μV 0.037 % of reading + 1.1 μV 0.038 % of reading + 1.1 μV 0.3 % of reading + 0.78 μV 1 % of reading + 3.9 μV 2 % of reading + 3.9 μV	Fluke 8588A 8.5 Digit Multimeter
	(10 to 100) mV 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.008 9 % of reading + 0.5 μV 0.013 % of reading + 0.5 μV 0.023 % of reading + 1 μV 0.053 % of reading + 5 μV 0.21 % of reading + 31 μV 1 % of reading + 0.1 mV	
	(1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	1.5 % of reading + 0.5 mV 4.1 % of reading + 1 mV 8.4 % of reading + 1 mV 16 % of reading + 1 mV	



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure <sup>1</sup>	(0.1 to 1) V		Fluke 8588A 8.5 Digit Multimeter
	1 Hz to 2 kHz	0.007 7% of reading + 5 μV	
	(2 to 10) kHz	0.012 % of reading + 5 μV	
	(10 to 30) kHz	0.023 % of reading + 10 μV	
	(30 to 100) kHz	0.053 % of reading + 50 μV	
	(100 to 300) kHz	0.21 % of reading + 0.31 mV	
	300 kHz to 1 MHz	1 % of reading + 1 mV	
	(1 to 2) MHz	1.5 % of reading + 5 mV	
	(2 to 4) MHz	4 % of reading + 10 mV	
	(4 to 8) MHz	8.2 % of reading + 10 mV	
	(8 to 10) MHz	15 % of reading + 10 mV	
	(1 to 10) V		
	1 Hz to 2 kHz	0.007 6 % of reading + 50 μV	
	(2 to 10) kHz	0.012 % of reading + 50 μV	
	(10 to 30) kHz	0.023 % of reading + 0.1 mV	
	(30 to 100) kHz	0.053 % of reading + 0.5 mV	
	(100 to 300) kHz	0.21 % of reading + 3.1 mV	
	300 kHz to 1 MHz	1 % of reading + 10 mV	
	(1 to 2) MHz	1.5 % of reading + 50 mV	
	(2 to 4) MHz	4 % of reading + 0.1 V	
(4 to 8) MHz	8.2 % of reading + 0.1 V		
(8 to 10) MHz	15 % of reading + 0.1 V		
(10 to 100) V			
1 Hz to 2 kHz	0.009 % of reading + 0.5 mV		
(2 to 10) kHz	0.011 % of reading + 0.5 mV		
(10 to 30) kHz	0.023 % of reading + 1 mV		
(30 to 100) kHz	0.059 % of reading + 5 mV		
(100 to 300) kHz	0.37 % of reading + 47 mV		
300 kHz to 1 MHz	1 % of reading + 0.5 V		
(100 to 1 050) V			
1 Hz to 2 kHz	0.011 % of reading + 25 mV		
(2 to 10) kHz	0.011 % of reading + 25 mV		
(10 to 30) kHz	0.023 % of reading + 25 mV		
(30 to 100) kHz	0.059 % of reading + 0.1 V		
AC Voltage – Measure	Up to 40 mVp-p DC to 100 MHz	1.6 % of reading + 0.15 mV	Differential Amplifier w/ Oscilloscope
	(40 to 400) mVp-p DC to 100 MHz	1.6 % of reading + 1.5 mV	
	(400 to 500) mVp-p DC to 100 MHz	1.6 % of reading + 3 mV	





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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC High Voltage – Measure <sup>1</sup>	(0.7 to 5) kV		Vitrek 4700 High Voltage Meter and Associated 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	0.10 % 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		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source <sup>1</sup>	Up to 2.2 mV		Fluke 5730A Multiproduct Calibrator
	(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	
	(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 % of reading + 7 μV	
	40 Hz to 20 kHz	0.0057 % 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		
220 mV to 2.2 V			
(10 to 20) Hz	0.024 % of reading + 40 μV		
(20 to 40) Hz	0.009 % of reading + 15 μV		
40 Hz to 20 kHz	0.0042 % of reading + 8 μV		
(20 to 50) kHz	0.0067 % of reading + 10 μV		
(50 to 100) kHz	0.0085 % 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		





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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source <sup>1</sup>	(2.2 to 22) V		Fluke 5730A Multiproduct Calibrator
	(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 + 0.05 mV	
	(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	
	40 Hz to 20 kHz	0.005 2 % of reading + 0.6 mV	
	(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 <sup>1</sup>	(220 to 750) V		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 1100) 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		
AC Voltage – Source <sup>1</sup> Wide-Band Voltage (50 Ω)	30 Hz to 500 kHz		Fluke 5730A/03 Multiproduct Calibrator
	(0.33 to 1.1) mV	0.62 % of reading + 0.78 μV	
	(1.1 to 3.3) mV	0.54 % of reading + 1.2 μV	
	(3.3 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		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source <sup>1</sup> Wide-Band Flatness (50 Ω) 1 kHz Reference	(0.33 to 1.1) mV		Fluke 5730A, /03, /05 Multiproduct Calibrator
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	(120 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	
	120 kHz 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	
	120 Hz 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	
	120 kHz 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	
120 Hz 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		
120 kHz 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		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source <sup>1</sup> Wide-Band Flatness (50 Ω) 1 kHz Reference	(11 to 33) mV		Fluke 5730A, /03, /05 Multiproduct Calibrator
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	120 Hz 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	
	120 kHz 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	
	120 Hz 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	
	120 Hz 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		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source <sup>1</sup> Wide-Band Flatness (50 Ω) 1 kHz Reference	(110 to 330) mV		Fluke 5730A, /03, /05 Multiproduct Calibrator
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	120 Hz 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	
	120 Hz 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	
	120 Hz 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	
	120 Hz 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 <sup>1</sup> Wide-Band Flatness (50 Ω) 1 kHz Reference	(1.1 to 3.5) V (10 to 30) Hz (30 to 119.99) Hz 120 Hz to 1.199 9 kHz (1.2 to 11.999) kHz (12 to 119.99) kHz 120 Hz 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	Fluke 5730A, /03, /05 Multiproduct Calibrator
DC Current – Measure <sup>1</sup>	Up to 20 μA (20 to 200) μA (0.2 to 2) mA (2 to 20) mA (20 to 200) mA (0.2 to 2) A (2 to 20) A (20 to 30) A	29 μA/A + 0.4 nA 10 μA/A + 0.39 nA 9.9 μA/A + 3.9 nA 15 μA/A + 39 nA 58 μA/A + 1 μA 0.13 mA/A + 0.1 mA 0.23 mA/A + 0.4 mA 0.55 mA/A + 4.4 mA	Fluke 8588A 8.5 Digit Multimeter
DC Current – Measure <sup>1</sup>	(10 to 100) A	0.15 mA/A + 2 mA	Ohm Labs CS-100 Current Shunt, Fluke 8588A 8.5 Digit Multimeter
DC Current – Source <sup>1</sup>	(0.2 to 220) μA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A	40 μA/A + 6 nA 35 μA/A + 7 nA 35 μA/A + 40 nA 45 μA/A + 0.7 μA 80 μA/A + 12 μA	Fluke 5730A Multiproduct Calibrator
DC Current – Source <sup>1</sup>	(2.2 to 11) A Up to 2 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	Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source <sup>1</sup>	(20 to 120) A	0.012 % of reading + 9.6 mA	Fluke 5730A Multiproduct Calibrator, Fluke 52120A Current Amplifier
DC Clamp-on Ammeter <sup>1</sup> (Non-Toroidal Type) Hall Effect Sensor	(20 to 150) A	0.5 % of reading + 0.14 A	Fluke 5520A Multiproduct Calibrator, 1 kA Coil
	(150 to 1 000) A	0.52 % of reading + 0.5 A	
	(1 to 5) kA	0.58 % of reading	Fluke 5520A Multiproduct Calibrator, Current Coils
DC Voltage – Measure <sup>1</sup>	Up to 200 mV	7.7 $\mu$ V/V + 0.2 $\mu$ V	Fluke 8588A 6.5 Digit Multimeter
	(0.2 to 2) V	2.9 $\mu$ V/V + 0.3 $\mu$ V	
	(2 to 20) V	2.9 $\mu$ V/V + 0.47 $\mu$ V	
	(20 to 200) V	4.3 $\mu$ V/V + 30 $\mu$ V	
	(200 to 1050) V	4.4 $\mu$ V/V + 0.5 mV	
DC Voltage – Source <sup>1</sup>	(0 to 220) mV	7.5 $\mu$ V/V + 0.4 $\mu$ V	Fluke 5730A Multiproduct Calibrator
	220 mV to 2.2 V	5 $\mu$ V/V + 0.7 $\mu$ V	
	(2.2 to 11) V	3.5 $\mu$ V/V + 2.5 $\mu$ V	
	(11 to 22) V	3.5 $\mu$ V/V + 4 $\mu$ V	
	(22 to 220) V	5 $\mu$ V/V + 40 $\mu$ V	
	220 V to 1100 V	6.5 $\mu$ V/V + 0.4 mV	
DC High Voltage – Measure <sup>1</sup>	(1 to 10) kV	0.039 % of reading + 0.092 V	Vitrek 4700 High Voltage Meter, Associated High Voltage Probes
	(10 to 20) kV	0.038 % of reading + 2.4 V	
	(20 to 30) kV	0.041 % of reading + 2.4 V	
	(30 to 40) kV	0.047 % of reading + 2.4 V	
	(40 to 50) kV	0.056 % of reading + 2.4 V	
	(50 to 60) kV	0.071 % of reading + 2.4 V	
	(60 to 70) kV	0.089 % of reading + 2.4 V	
	(70 to 80) kV	0.12 % of reading + 2.5 V	
	(80 to 90) kV	0.15 % of reading + 2.5 V	
	(90 to 100) kV	0.17 % of reading + 2.5 V	





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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure <sup>1</sup>	Up to 2 Ω (2 to 20) Ω (20 to 200) Ω (0.2 to 2) kΩ (2 to 20) kΩ (20 to 200) kΩ (0.2 to 2) MΩ (2 to 20) MΩ (20 to 200) MΩ (0.2 to 2) GΩ	16 μΩ/Ω + 4 μΩ 10 μΩ/Ω + 14 μΩ 9.2 μΩ/Ω + 47 μΩ 9.1 μΩ/Ω + 0.47 mΩ 9.2 μΩ/Ω + 4.7 mΩ 9.3 μΩ/Ω + 47 mΩ 11 μΩ/Ω + 1 Ω 19 μΩ/Ω + 0.1 kΩ 0.12 mΩ/Ω + 10 kΩ 0.13 % of reading + 1 MΩ	Fluke 8588A 8.5 Digit Multimeter
Low Current Resistance – Measure <sup>1</sup>	Up to 2Ω (2 to 20) Ω (20 to 200) Ω (0.2 to 2) kΩ (2 to 20) kΩ (20 to 200) kΩ (0.2 to 2) MΩ (2 to 20) MΩ (20 to 200) MΩ (0.2 to 2) GΩ	17 μΩ/Ω + 4 μΩ 10 μΩ/Ω + 14 μΩ 17 μΩ/Ω + 0.2 mΩ 18 μΩ/Ω + 2 mΩ 22 μΩ/Ω + 20 mΩ 22 μΩ/Ω + 62 mΩ 26 μΩ/Ω + 1 Ω 0.38 mΩ/Ω + 0.30 kΩ 0.13 % of reading + 10 kΩ 0.13 % of reading + 1.0 MΩ	Fluke 8588A 8.5 Digit Multimeter
High Voltage Resistance – Measure <sup>1</sup>	(2 to 20) MΩ (20 to 200) MΩ (0.2 to 2) GΩ (2 to 20) GΩ	17 μΩ/Ω + 10 Ω 68 μΩ/Ω + 0.1 kΩ 0.23 mΩ/Ω + 0.1 MΩ 0.13 % of reading + 10 MΩ	Fluke 8588A 8.5 Digit Multimeter
Resistance – Source <sup>1</sup> (Simulation)	Up to 11 Ω (11 to 33) Ω (33 to 111) Ω (110 to 330) Ω 330 Ω to 1.1 kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 330 kΩ to 1.19 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ 330 MΩ to 1.1 GΩ	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 + 1.6 mΩ 22 μΩ/Ω + 1.6 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 100 μΩ/Ω + 39 Ω 190 μΩ/Ω + 1.9 kΩ 410 μΩ/Ω + 2.3 kΩ 0.23 % of reading + 78 kΩ 12 % of reading + 0.39 MΩ	Fluke 5522A Multiproduct Calibrator

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source <sup>1</sup> (Fixed-Point Simulation)	0 Ω	40 μΩ	Fluke 5730A Multiproduct Calibrator
	1 Ω	95 μΩ/Ω	
	1.9 Ω	95 μΩ/Ω	
	10 Ω	23 μΩ/Ω	
	19 Ω	23 μΩ/Ω	
	100 Ω	10 μΩ/Ω	
	190 Ω	10 μΩ/Ω	
	1 kΩ	6.5 μΩ/Ω	
	1.9 kΩ	6.5 μΩ/Ω	
	10 kΩ	6.5 μΩ/Ω	
	19 kΩ	6.5 μΩ/Ω	
	100 kΩ	8.5 μΩ/Ω	
	190 kΩ	8.5 μΩ/Ω	
	1 MΩ	13 μΩ/Ω	
1.9 MΩ	18 μΩ/Ω		
10 MΩ	40 μΩ/Ω	Ohms Labs CS-100 Current Shunt; IET DCCS-0.01, IET DCCS-0.1, IET DCCS-1 Standard Resistors	
19 MΩ	47 μΩ/Ω		
100 MΩ	0.1 mΩ/Ω		
Resistance – Source <sup>1</sup> (Fixed Artifacts)	1 mΩ 10 mΩ 100 mΩ 1 Ω	0.2 mΩ/Ω 84 μΩ/Ω 84 μΩ/Ω 42 μΩ/Ω	
Resistance – Source <sup>1</sup> (Variable Artifact)	(100 to 1 000) kΩ (1 to 10) MΩ (10 to 100) MΩ (100 to 1 000) MΩ (1 to 10) GΩ (10 to 100) GΩ (100 to 1 000) GΩ	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 + 1.2 μΩ/Ω/V 1.2 % of reading + 1.2 μΩ/Ω/V	IET HRRS-B-7-100k-10kV Decade Resistor
Capacitance – Measure <sup>1</sup>	Up to 2 nF (2 to 20) nF (20 to 200) nF (0.2 to 2) μF (2 to 20) μF (20 to 200) μF (0.2 to 2) mF (2 to 20) mF (20 to 200) mF	0.19 % of reading + 1 pF 0.081 % of reading + 2 pF 0.049 % of reading + 10 pF 0.041 % of reading + 0.1 nF 0.042 % of reading + 1 nF 0.061 % of reading + 10 nF 0.061 % of reading + 0.1 μF 0.071 % of reading + 1 μF 0.072 % of reading + 10 μF	Fluke 8588A 8.5 Digit Multimeter

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment									
Capacitance – Source <sup>1</sup> (Simulation)	(220 to 400) pF		Fluke 5522A Multiproduct Calibrator									
	10 Hz to 10 kHz	0.4 % of reading + 7.8 pF										
	(0.4 to 1.1) nF			Fluke 5522A Multiproduct Calibrator								
	10 Hz to 10 kHz	0.4 % of reading + 7.8 pF										
	(1.1 to 3.3) nF				Fluke 5522A Multiproduct Calibrator							
	10 Hz to 3 kHz	0.4 % of reading + 7.8 pF										
	(3.3 to 11) nF					Fluke 5522A Multiproduct Calibrator						
	10 Hz to 3 kHz	0.21 % of reading + 7.8 pF										
	(11 to 33) nF						Fluke 5522A Multiproduct Calibrator					
	10 Hz to 1 kHz	0.2 % of reading + 78 pF										
	(33 to 110) nF							Fluke 5522A Multiproduct Calibrator				
	10 Hz to 1 kHz	0.21 % of reading + 78 pF										
	(110 to 330) nF								Fluke 5522A Multiproduct Calibrator			
	10 Hz to 1 kHz	0.2 % of reading + 0.23 nF										
	(0.33 to 1.1) μF									Fluke 5522A Multiproduct Calibrator		
	(10 to 600) Hz	0.21 % of reading + 0.78 nF										
	(1.1 to 3.3) μF										Fluke 5522A Multiproduct Calibrator	
	(10 to 300) Hz	0.21 % of reading + 2.3 nF										
	(3.3 to 11) μF											Fluke 5522A Multiproduct Calibrator
	(10 to 150) Hz	0.2 % of reading + 7.8 nF										
(11 to 33) μF		Fluke 5522A Multiproduct Calibrator										
(10 to 120) Hz	0.32 % of reading + 23 nF											
(33 to 110) μF			Fluke 5522A Multiproduct Calibrator									
(10 to 80) Hz	0.37 % of reading + 78 nF											
(110 to 330) μF				Fluke 5522A Multiproduct Calibrator								
DC to 50 Hz	0.38 % of reading + 0.23 μF											
(0.33 to 1.1) mF					Fluke 5522A Multiproduct Calibrator							
DC to 20 Hz	0.35 % of reading + 0.78 μF											
(1.1 to 3.3) mF						Fluke 5522A Multiproduct Calibrator						
DC to 6 Hz	0.35 % of reading + 2.3 μF											
(3.3 to 11) mF							Fluke 5522A Multiproduct Calibrator					
DC to 2 Hz	0.35 % of reading + 7.8 μF											
(11 to 33) mF								Fluke 5522A Multiproduct Calibrator				
DC to 0.6 Hz	0.58 % of reading + 23 μF											
(33 to 110) mF									Fluke 5522A Multiproduct Calibrator			
DC to 0.2 Hz	0.85 % of reading + 78 μF											

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure <sup>1</sup>	Type B		Ectron 1140A Thermocouple Calibrator/Simulator
	(250 to 350) °C	1.2 °C	
	(350 to 445) °C	0.9 °C	
	(445 to 580) °C	0.71 °C	
	(580 to 750) °C	0.55 °C	
	(750 to 1 000) °C	0.45 °C	
	(1 000 to 1 820) °C	0.35 °C	
	Type C		
	(0 to 250) °C	0.24 °C	
	(250 to 1 000) °C	0.19 °C	
	(1 000 to 1 500) °C	0.21 °C	
	(1 500 to 1 800) °C	0.24 °C	
	(1 800 to 2 000) °C	0.27 °C	
	(2 000 to 2 250) °C	0.33 °C	
	(2 250 to 2 315) °C	0.37 °C	
	Type E		
	(-270 to -245) °C	1.6 °C	
	(-245 to -195) °C	0.24 °C	
	(-195 to -155) °C	0.12 °C	
	(-155 to -90) °C	0.095 °C	
	(-90 to 0) °C	0.08 °C	
	(0 to 15) °C	0.076 °C	
	(15 to 890) °C	0.064 °C	
	(890 to 1 000) °C	0.074 °C	
Type J			
(-210 to -180) °C	0.15 °C		
(-180 to -120) °C	0.12 °C		
(-120 to -50) °C	0.093 °C		
(-50 to 990) °C	0.08 °C		
(990 to 1 200) °C	0.094 °C		
Type K			
(-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		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure <sup>1</sup>	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		
(-180 to -40) °C	0.15 °C		
(-40 to 100) °C	0.095 °C		
(100 to 400) °C	0.08 °C		
Electrical Simulation of RTD Indicating Devices – Source <sup>1</sup>	Pt 385, 100 Ω		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	

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
Electrical Simulation of RTD Indicating Devices – Source <sup>1</sup>	Pt 385, 200 $\Omega$		Fluke 5522A Multiproduct Calibrator	
	(-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 $\Omega$			
	(-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, 1 000 $\Omega$			
	(-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		
	Pt 3916, 100 $\Omega$			
(-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	0.018 °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 <sup>1</sup>	Pt 3926, 100 Ω		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		
	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			
DC Power – Source <sup>1</sup>	330 μW to 330 mA	11 μW to 1.1 mW	0.024 % of reading	Fluke 5522A Multiproduct Calibrator
		(1.1 to 110) mW	0.027 % of reading	
		110 mW to 110 W	0.024 % of reading	
		(110 to 330) W	0.018 % of reading	
	330 mA to 3 A	11 μW to 110 mW	0.044 % of reading	
		110 mW to 990 W	0.053 % of reading	
		1 W 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 W to 20.5 kW		0.04 % of reading		
AC Power – Source <sup>1,2</sup> PF = 1	(3.3 to 9) mA	(10 to 65) Hz		Fluke 5522A Multiproduct Calibrator
		(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	

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
AC Power – Source <sup>1,2</sup> PF = 1				
(33 to 90) mA	(10 to 65) Hz (1 to 30) mW 30 mW to 90 W	0.071 % of reading 0.057 % of reading	Fluke 5522A Multiproduct Calibrator	
(90 to 330) mA	(10 to 65) Hz (3 to 100) mW 100 mW to 300 W	0.089 % of reading 0.078 % of reading		
330 mA to 0.9 A	(10 to 65) Hz (11 to 300) mW 300 mW to 900 W	0.071 % of reading 0.081 % of reading		
(0.9 to 2.2) A	(10 to 65) Hz 30 mW to 0.72 W 0.72 W to 2 kW	0.089 % of reading 0.079 % of reading		
(2.2 to 4.5) A	(10 to 65) Hz 80 mW to 1.4 W 1.4 W to 4.5 kW	0.088 % of reading 0.18 % of reading		
(4.5 to 20.5) A	(10 to 65) Hz 150 mW to 6.7 W 6.7 W to 20 kW	0.17 % of reading 0.17 % of reading		
Phase – Source <sup>1</sup>	(0 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 5522A Multiproduct Calibrator
Phase – Measure <sup>1</sup>	20 Hz to 50 kHz (0 to 360) °	0.19 °		Krohn Hite 6400A Phase Meter
Oscilloscopes <sup>1,3</sup> Amplitude – DC			Fluke 5522A/SC1100 Multiproduct Calibrator	
into 50 Ω load	(-6.6 to 6.6) V	0.22 % of reading + 31 μV		
into 1 MΩ load	(-130 to 130) V	0.12 % of reading + 31 μV		
Amplitude – Square Wave				
into 50 Ω load	10 Hz to 100 kHz 1 mVp-p to 6.6 Vp-p	0.22 % of reading + 31 μV		
into 1 MΩ load	10 Hz to 1 kHz 1 mVp-p to 130 Vp-p (1 kHz to 10) kHz 1 mVp-p to 130 Vp-p	0.14 % of reading + 31 μV 0.22 % of reading + 31 μV		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes <sup>1,3</sup> Time Markers into 50 Ω load	1 ns to 20 ms 50 ms 0.1 s 0.2 s 0.5 s 1 s 2 s 5 s	0.000 22 % of reading 0.0046 % of reading 0.0076 % of reading 0.014 % of reading 0.032 % of reading 0.062 % of reading 0.12 % of reading 0.30 % of reading	Fluke 5522A/SC1100 Multiproduct Calibrator
Rise Time into 50 Ω load Rate: 1 kHz to 2 MHz Rate: 2 MHz to 10 MHz	5 mVp-p to 2.5 Vp-p (200 to 300) ps (250 to 350) ps	50 ps 50 ps	
Leveled Sine Wave into 50 Ω load	5 mVp-p to 5.5 Vp-p 50 kHz 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz 5.0 mVp-p to 3.5 Vp-p 600 MHz to 1.1 GHz	1.8 % of reading + 0.23 mV 2.8 % of reading + 0.23 mV 3.2 % of reading + 0.23 mV 4 % of reading + 0.23 mV 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 (100 to 300) MHz (300 to 600) MHz 5.0 mVp-p to 3.5 Vp-p 600 MHz to 1.1 GHz	1.4 % of reading + 78 μV 1.8 % of reading + 78 μV 3.2 % of reading + 78 μV 4.0 % of reading + 78 μV	
Input Impedance – Measure	(40 to 60) Ω 500 kΩ to 1.5 MΩ	0.082 % of reading 0.081 % of reading	
Input Capacitance – Measure	(5 to 50) pF	3.9 % of reading + 0.39 pF	

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes <sup>1,3</sup> Waveform Generator (Sine, Square, Triangle) Amplitude into 50 Ω load into 1 MΩ load  Frequency	10 Hz to 10 kHz  1.8 mVp-p to 2.5 Vp-p 1.8 mVp-p to 55 Vp-p  10 Hz to 10 kHz	  2.3 % of reading + 78 μV 2.3 % of reading + 78 μV  0.001 9 % of reading + 12 mHz	  Fluke 5522A/SC1100 Multiproduct Calibrator

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers <sup>1</sup> Travel (Outside, Inside, Depth, Step)  Jaw Flatness  Jaw Parallelism	(0.05 to 1) in (1 to 9) in  (4 to 15) in (15 to 40) in  Up to 1 in <i>D</i>  Up to 1 in <i>D</i>	(13 + 1 <i>L</i> ) μin (8 + 5 <i>L</i> ) μin  (10 + 5 <i>L</i> ) μin (11 + 5 <i>L</i> ) μin  4.4 μin  34 μin	Gage Blocks,  Long Gage Blocks  Optical Flats  Gage Pins
Micrometers <sup>1</sup> Travel (Outside, Inside, Depth)  Anvil Flatness  Anvil Parallelism	(0.05 to 1) in (1 to 9) in  (4 to 15) in (15 to 40) in  Up to 1 in <i>D</i>  Up to 1 in <i>D</i>	(13 + 1 <i>L</i> ) μin (8 + 5 <i>L</i> ) μin  (10 + 5 <i>L</i> ) μin (11 + 5 <i>L</i> ) μin  4.4 μin  6.5 μin	Gage Blocks,  Long Gage Blocks  Optical Flats  Optical Parallels
Indicators <sup>1,3</sup> Digital, Dial, Drop, Test	(0 to 0.05) in	5.6 μin	Universal Length Measuring Machine
Indicators <sup>1,3</sup> Digital, Dial, Drop, Test	up to 1 in (1 to 5) in	34 μin (60 + 2 <i>L</i> ) μin	Gage Blocks, Stand

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Length Single Axis <sup>3</sup> Outside Dimension	(0 to 1) in (1 to 7) in (7 to 12) in	(7.3 + 1L) μin (5.3 + 3.3L) μin (2 + 4L) μin	Universal Length Measuring Machine
Inside Dimension	(0.04 to 1) in (1 to 2.5) in (2.5 to 10) in (10 to 14) in	(10 + 1L) μin (10 + 4L) μin (15 + 3L) μin (27 + 3L) μin	
Thread Wires	2 TPI to 120 TPI (0.008 33 to 0.5) in	12 μin	Universal Length Measuring Machine
Cylindrical Plug Gages <sup>4</sup> (Outside Diameter)	Up to 1 in (1 to 7) in	13 μin (11 + 3L) μin	Universal Length Measuring Machine
Pin Gages (Outside Diameter)	(0.01 to 0.04) in (0.04 to 0.5) in (0.5 to 1) in (1 to 2) in	40 μin 39 μin 39 μin 41 μin	Non-contact Method using Laser Micrometer.
Optical Comparators <sup>3</sup> Length	Up to 8 in	(100 + 14L) μin	Calibration Grids
Squareness	(0.04 to 1) in	(120 + 1.5L) μin	Calibration Grids
Thread Plug Gages <sup>3</sup> Pitch Diameter, 60° Thread	Up to 1 in (1 to 4) in (4 to 7) in	82 μin 84 μin 88 μin	Master Thread Wires, Super-micrometer Model C
Major Diameter	Up to 1 in (1 to 7) in	36 μin (33 + 3L) μin	
Step Height	Up to 1 in	62 μin	
Thread Ring Gages Inner Pitch Diameter	Up to 1 in (1 to 4) in (4 to 7) in	88 μin 85 μin 93 μin	Master Plug Gage Uncertainty
Ring Gages <sup>3</sup> Inside Diameter	(0.04 to 1) in (1 to 2.5) in (2.5 to 5) in	(9 + 1L) μin (10 + 3L) μin (15 + 3L) μin	Universal Length Measuring Machine, Working Reference Rings
Tapered Thread Plug Pitch Diameter Taper	Up to 3 in	90 μin	Universal Length Measuring Machine, Thread Wires

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Drivers, Indicators <sup>1</sup>	(2 to 60) cN·m (20 to 600) cN·m	3.6 % of reading + 0.005 8 cN·m 3.6 % of reading + 0.058 cN·m	Tohnichi Torque Calibrator
Torque Wrenches <sup>1</sup>	(0.2 to 10) N·m (10 to 1100) N·m	1.1 % of reading 0.71 % of reading	Stahlwille Torque Calibrator
Scales and Balances <sup>1,7</sup> SI	(1 to 5) g (5 to 20) g 20 g to 11 kg	40 µg 90 µg 0.000 31 % of reading	ASTM E617 Class 1 weights and internal calibration procedure utilized for calibration of the weighing system.
Scales and Balances <sup>1,7</sup> Avoirdupois	(5 to 350) lb	0.012 % of reading	NIST Class F weights and internal calibration procedure utilized for the calibration of the weighing system.
Force Tension and Compression	(10 to 300) lbf (300 to 2 000) lbf	0.024 % of reading + 0.041 lbf 0.024 % of reading + 0.33 lbf	Morehouse Force Calibration System
Pneumatic Pressure Devices (at 20 °C)	(-30 to -5) inH <sub>2</sub> O (-5 to -1) inH <sub>2</sub> O (-1 to 1) inH <sub>2</sub> O (1 to 5) inH <sub>2</sub> O (5 to 30) inH <sub>2</sub> O	0.035 inH <sub>2</sub> O 0.004 8 inH <sub>2</sub> O 0.001 2 inH <sub>2</sub> O 0.004 8 inH <sub>2</sub> O 0.035 inH <sub>2</sub> O	Additel ADT761-LLP, Pressure Modules
Pneumatic Pressure Devices	(-14.5 to 300) psig (300 to 1 000) psig	0.001 4 % of reading + 0.057 psi 0.012 % of reading + 0.046 psi	Additel ADT780 Pressure Controller
Hydraulic Pressure Devices	(100 to 1 000) psig (1 000 to 10 000) psig	0.09 psi 0.008 % of reading + 0.01 psi	Deadweight Tester
Absolute Pneumatic Pressure Devices	Up to 300 psia (300 to 1 000) psia	0.002 1 % of reading + 0.057 psi 0.012 % of reading + 0.046 psi	Additel ADT780 Pressure Controller

**Thermodynamic**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity – Measure <sup>1</sup>	(15 to 25) °C (10 to 90) %RH (90 to 98) %RH	1.3 %RH 2 %RH	Comparison to Master Thermohygrometer
Humidity – Generate	(-10 to 15) °C (10 to 75) %RH (75 to 95) %RH	0.5 %RH 0.65 %RH	Humidity Generator





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**Thermodynamic**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity – Generate	(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 0.5 %RH 0.7 %RH 0.85 %RH	Humidity Generator
Temperature – Measure <sup>1</sup>	(-195 to 155) °C (155 to 420) °C (420 to 660) °C	0.023 °C 0.033 °C 0.045 °C	Fluke 1502A Temperature Readout, Accumac AM1760 Secondary SPRT
Temperature – Source <sup>1</sup>	(-40 to 0) °C (0 to 100) °C (155 to 420) °C (420 to 660) °C	0.041 °C 0.02% of reading + 0.037°C 0.056% of reading + 0.064°C 0.071% of reading	Fluke 1502A Temperature Readout, Accumac AM1760 Secondary SPRT, Additel ADT878 Reference Dry Well Calibrator

**Time and Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency Reference	10 MHz	5.9 mHz	Stanford Research FS725 Rubidium Frequency Oscillator
Period – Source	(1 to 100) s	58 ns/s	Keysight 33250A Function/Arbitrary Waveform Generator, Stanford Research FS725 Rubidium Frequency Oscillator
Period – Measure	(1 to 100) s	45 μs	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
Frequency – Source	1 Hz to 80 MHz	58 nHz/Hz	Keysight 33250A Function/Arbitrary Waveform Generator, Stanford Research FS725 Rubidium Frequency Oscillator
Frequency – Source <sup>1</sup> Sine Wave	10 mHz to 2 MHz	2 µHz/Hz + 8 µHz	Fluke 5522A Multiproduct Calibrator
AC Duty Cycle – Source <sup>1</sup> 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 (90 to 99) % Duty Cycle 10 µs to 100 s	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
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	HP 53132A Universal Counter, Stanford Research FS725 Rubidium Frequency
Non-Contact Rate of Rotation <sup>5</sup>	(5 to 99.999) rpm (100.00 to 999.99) rpm (1 000.0 to 9 999.9) rpm (10 000 to 99 999) rpm (100 000 to 200 000) rpm	0.012 % of reading + 0.0012 rpm 0.012 % of reading + 0.012 rpm 0.012 % of reading + 0.12 rpm 0.014 % of reading + 1.2 rpm 0.014 % of reading + 12 rpm	Optical Tachometer
Stopwatches/Timers	Up to 599 s/mon	58 ms/d	Vibrograf TM-4500 Timometer

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 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.
- Dimensional Lab Environment  $\pm 2$  °F.
- 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.
- $D$  = diameter;  $L$  = length in inches; rpm = revolutions per minute.



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6. 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.
7. The CMC presented here does not include the Resolution of the Device Under Test (DUT). The Resolution will be added at the time of calibration in the Measurement Uncertainty (MU).
8. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2489.25.

Jason Stine, Vice President

