CERTIFICATE OF ACCREDITATION

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Hereby attests that

Transcat - Decatur
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Decatur, AL 35603

Fulfills the requirements of

ISO/IEC 17025:2017

and national standard

ANSI/NCSL Z540-1-1994 (R2002)

In the fields of

CALIBRATION and DIMENSIONAL MEASUREMENT

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

Jason Stine, Vice President

Expiry Date: 07 September 2027

Certificate Number: AC-2489.31

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

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CALIBRATION AND DIMENSIONAL MEASUREMENT

Certificate Number: **AC-2489.31** Certificate Expiry Date: **07 September 2027**

CALIBRATION

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meters [1, 2]	4 pH 7 pH 10 pH	0.012 pH 0.012 pH 0.012 pH	Comparison to Accredited Solutions
Conductivity Meters [1, 2]	5 µS/cm 10 µS/cm 100 µS/cm 1 000 µS/cm 10 000 µS/cm 100 000 µS/cm 150 000 µS/cm	0.32 µS/cm 0.32 µS/cm 0.82 µS/cm 3.3 µS/cm 36 µS/cm 300 µS/cm 590 µS/cm	Comparison to Accredited Solutions

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure [1]	(0.2 to 20) µA 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	 0.2 % of reading + 2.5 nA 0.2 % of reading + 2.5 nA 0.2 % of reading + 2.5 nA	Comparison to Fluke 8588A 8.5 Digit Multimeter

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure [1]	(20 to 200) µA		Comparison to Fluke 8588A 8.5 Digit Multimeter
	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	
	(0.2 to 2) mA		
	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	
	(0.2 to 2) A		
	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 – Measure [1]	(10 to 100) A		Comparison to Precision Current Shunt, Fluke 8588A 8.5 Digit Multimeter
	(50 to 60) Hz	0.22 mA/A + 4.3 mA	
	400 Hz	0.26 mA/A + 4 mA	
	1 kHz	1.1 mA/A + 1.3 mA	
AC Current – Source [1]	Up to 220 µA		Comparison to Fluke 5730A Multiproduct Calibrator
	(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	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source [1]	(0.22 to 2.2) mA		Comparison to Fluke 5730A Multiproduct Calibrator
	(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	
	(2.2 to 22) mA		
	(10 to 20) Hz	0.025 % of reading + 0.4 µA	
	(20 to 40) Hz	0.016 % of reading + 0.35 µA	
	40 Hz to 1 kHz	0.011 % of reading + 0.35 µA	
	(1 to 5) kHz	0.02 % of reading + 0.55 µA	
	(5 to 10) kHz	0.11 % of reading + 5 µA	
	(22 to 220) mA		
	(10 to 20) Hz	0.025 % of reading + 4 µA	
	(20 to 40) Hz	0.016 % of reading + 3.5 µA	
	40 Hz to 1 kHz	0.011 % of reading + 2.5 µA	
	(1 to 5) kHz	0.02 % of reading + 3.5 µA	
	(5 to 10) kHz	0.11 % of reading + 10 µA	
	(0.22 to 2.2) A		
	20 Hz to 1 kHz	0.025 % of reading + 35 µA	
	(1 to 5) kHz	0.045 % of reading + 80 µA	
	(5 to 10) kHz	0.7 % of reading + 0.16 mA	
	(2.2 to 3) A		
	(10 to 45) Hz	0.18 % of reading + 0.1 mA	
	45 Hz to 1 kHz	0.06 % of reading + 0.1 mA	
	(1 to 5) kHz	0.6 % of reading + 1 mA	
	(5 to 10) kHz	2.5 % of reading + 5 mA	
AC Current – Source [1]	(2.2 to 11) A		Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier
	(20 to 1 000) kHz	0.046 % of reading + 0.17 mA	
	(1 to 5) kHz	0.095 % of reading + 0.38 mA	
	(5 to 10) kHz	0.36 % of reading + 0.75 mA	
AC Clamp-on Ammeters (Toroidal Type) Transformer Type Sensor [1]	(20 to 150) A		Comparison to Fluke 5522A Multiproduct Calibrator, Fluke 5500A/Coil 50-turn Coil
	(45 to 65) Hz	0.31 % of reading + 26 mA	
	(65 to 440) Hz	0.84 % of reading + 47 mA	
	(150 to 1 000) A		
	(45 to 65) Hz	0.35 % of reading + 0.12 A	
	(65 to 440) Hz	1.2 % of reading + 0.22 A	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Clamp-on Ammeters (Non-Toroidal Type) Hall Effect 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	 0.58 % of reading + 0.25 A 1.1 % of reading + 0.25 A 0.6 % of reading + 0.9 A 1.3 % of reading + 0.92 A	Comparison to Fluke 5522A Multiproduct Calibrator, Fluke 5500A/Coil 50-turn Coil
AC High Voltage – Measure [1]	(0.7 to 5) kV 10 mHz to 10 Hz (10 to 30) Hz (30 to 50) Hz (50 to 70) Hz (70 to 100) Hz (100 to 200) Hz (200 to 450) Hz (450 to 600) Hz	 0.14 % of reading + 0.17 V 0.12 % of reading + 0.29 V 0.099 % of reading + 0.37 V 0.068 % of reading + 0.37 V 0.099 % of reading + 0.37 V 0.099 % of reading + 0.37 V 0.48 % of reading + 0.17 V 0.47 % of reading + 0.17 V	Comparison to Vitrek 4700 High Voltage Meter
AC High Voltage – Measure [1]	(5 to 30) kV 10 mHz to 10 Hz (10 to 30) Hz (30 to 50) Hz (50 to 70) Hz (70 to 100) Hz (100 to 200) Hz (200 to 450) Hz (450 to 600) Hz	 0.19 % of reading + 2.4 V 0.13 % of reading + 2.4 V 0.11 % of reading + 2.4 V 0.077 % of reading + 2.4 V 0.11 % of reading + 2.4 V 0.11 % of reading + 2.4 V 0.7 % of reading + 2.4 V 1.4 % of reading + 2.4 V	Comparison to Vitrek 4700 High Voltage Meter, Vitrek HVL-35 High Voltage Probe
AC High Voltage – Measure [1]	(30 to 50) kV 10 mHz to 10 Hz (10 to 30) Hz (30 to 50) Hz (50 to 70) Hz (70 to 100) Hz (100 to 200) Hz (200 to 450) Hz	 0.24 % of reading + 2.5 V 0.18 % of reading + 2.5 V 0.13 % of reading + 2.5 V 0.10 % of reading + 2.5 V 0.13 % of reading + 2.5 V 0.69 % of reading + 2.5 V 2.9 % of reading + 2.5 V	Comparison to Vitrek 4700 High Voltage Meter, Vitrek HVL-70 High Voltage Probe
AC Voltage – Measure [1]	(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	Comparison to Fluke 8588A 8.5 Digit Multimeter

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure [1]	(10 to 100) mV		Comparison to Fluke 8588A 8.5 Digit Multimeter
	1 Hz to 2 kHz	0.008 9 % of reading + 0.5 µV	
	(2 to 10) kHz	0.013 % of reading + 0.5 µV	
	(10 to 30) kHz	0.023 % of reading + 1 µV	
	(30 to 100) kHz	0.053 % of reading + 5 µV	
	(100 to 300) kHz	0.21 % of reading + 31 µV	
	300 kHz to 1 MHz	1 % of reading + 0.1 mV	
	(1 to 2) MHz	1.5 % of reading + 0.5 mV	
	(2 to 4) MHz	4.1 % of reading + 1 mV	
	(4 to 8) MHz	8.4 % of reading + 1 mV	
	(8 to 10) MHz	16 % of reading + 1 mV	
	(0.1 to 1) V		
	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	

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AC Voltage – Measure [1]	(100 to 1 050) V		Comparison to Fluke 8588A 8.5 Digit Multimeter
	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 – Source [1]	Up to 2.2 mV		Comparison to Fluke 5730A Multiproduct Calibrator
	(10 to 20) Hz	0.024 % of reading + 4 µV	
	(20 to 40) Hz	0.009 % of reading + 4 µV	
	(0.04 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	
	(0.5 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	
	(0.04 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	
	(0.5 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	0.005 7 % 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 % of reading + 15 µV	
	40 Hz to 20 kHz	0.004 2 % of reading + 8 µV	
	(20 to 50) kHz	0.006 7 % of reading + 10 µV	
	(50 to 100) kHz	0.008 5 % 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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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 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	0.026 % 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 % 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 [1]	(220 to 250) V		Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier
	(15 to 50) Hz	0.03 % of reading + 16 mV	
	(250 to 1 100) V		
	(50 to 1 000) Hz	0.007 % of reading + 3.5 mV	
	(220 to 750) V		
	(30 to 50) kHz	0.06 % of reading + 11 mV	
	(50 to 100) kHz	0.23 % of reading + 45 mV	
	(220 to 1 100) V		
	(40 to 1 000) Hz	0.009 % of reading + 4 mV	
	(1 to 20) kHz	0.017 % of reading + 6 mV	
	(20 to 30) kHz	0.06 % of reading + 11 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 [1] (Wideband Amplitude)	30 Hz to 500 kHz (0.3 to 1.1) mV (1.1 to 3) mV (3 to 11) mV (11 to 33) mV (33 to 110) mV (110 to 330) mV (0.33 to 1.1) V (1.1 to 3.5) V	 0.62 % of reading + 0.78 µV 0.54 % of reading + 1.2 µV 0.54 % of reading + 3.1 µV 0.47 % of reading + 6.2 µV 0.47 % of reading + 16 µV 0.39 % of reading + 39 µV 0.39 % of reading + 0.16 mV 0.31 % of reading + 0.19 mV	Comparison to Fluke 5730A Multiproduct Calibrator

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Wideband Amplitude Flatness – Source [1] (1 kHz reference)	Up to 1.1 mV		Comparison to Fluke 5730A 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	0.16 % of reading + 1.2 µV	
	(1.2 to 2) MHz	0.16 % of reading + 1.2 µV	
	(2 to 12) MHz	0.31 % of reading + 1.2 µV	
	(12 to 20) MHz	0.47 % of reading + 1.2 µV	
	(20 to 30) MHz	2.1 % 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 12) 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	
	(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 12) 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	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Wideband Amplitude Flatness – Source [1] (1 kHz reference)	(11 to 33) mV		Comparison to Fluke 5730A 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 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.23 % reading + 1.2 µV	
	(12 to 20) MHz	0.39 % reading + 1.2 µV	
	(20 to 30) MHz	0.85 % reading + 1.2 µV	
	(16.5 to 33) mV		
	(1.2 to 2) MHz	0.078 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % reading + 1.2 µV	
	(12 to 20) MHz	0.31 % reading + 1.2 µV	
	(20 to 30) MHz	0.78 % 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 kHz to 1.199 9 MHz	0.078 % of reading + 1.2 µV	
	(33 to 55) mV		
	(1.2 to 2) MHz	.16 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.23 % reading + 1.2 µV	
	(12 to 20) MHz	0.39 % reading + 1.2 µV	
	(20 to 30) MHz	0.85 % reading + 1.2 µV	
	(55 to 110) mV		
	(1.2 to 2) MHz	0.078 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % reading + 1.2 µV	
	(12 to 20) MHz	0.31 % reading + 1.2 µV	
	(20 to 30) MHz	0.78 % reading + 1.2 µV	
	(110 to 330) 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	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Wideband Amplitude Flatness – Source [1] (1 kHz reference)	(110 to 165) mV		Comparison to Fluke 5730A Multiproduct Calibrator
	(1.2 to 2) MHz	0.16 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.23 % reading + 1.2 µV	
	(12 to 20) MHz	0.39 % reading + 1.2 µV	
	(20 to 30) MHz	0.85 % reading + 1.2 µV	
	(165 to 330) mV		
	(1.2 to 2) MHz	0.078 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % reading + 1.2 µV	
	(12 to 20) MHz	0.31 % reading + 1.2 µV	
	(20 to 30) MHz	0.78 % 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 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.23 % reading + 1.2 µV	
	(12 to 20) MHz	0.39 % reading + 1.2 µV	
	(20 to 30) MHz	0.85 % reading + 1.2 µV	
	(0.55 to 1.1) V		
	(1.2 to 2) MHz	0.078 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % reading + 1.2 µV	
	(12 to 20) MHz	0.31 % reading + 1.2 µV	
	(20 to 30) MHz	0.78 % reading + 1.2 µV	
	(1.1 to 3.5) 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 kHz to 1.199 9 MHz	0.078 % 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
Wideband Amplitude Flatness – Source [1] (1 kHz reference)	(1.1 to 1.75) V (1.2 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) 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	 0.16 % reading + 1.2 µV 0.23 % reading + 1.2 µV 0.39 % reading + 1.2 µV 0.85 % reading + 1.2 µV 0.078 % reading + 1.2 µV 0.16 % reading + 1.2 µV 0.31 % reading + 1.2 µV 0.78 % reading + 1.2 µV	Comparison to Fluke 5730A Multiproduct Calibrator
Capacitance – Source [1] (Simulation)	(0.22 to 0.4) nF (0.4 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF (0.33 to 1.1) µF (1.1 to 3.3) µF (3.3 to 11) µF (11 to 33) µF (33 to 110) µF (110 to 330) µF (0.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	0.4 % of reading + 7.8 pF 0.4 % of reading + 7.8 pF 0.4 % of reading + 7.8 pF 0.21 % of reading + 7.8 pF 0.2 % of reading + 78 pF 0.21 % of reading + 78 pF 0.2 % of reading + 0.23 nF 0.21 % of reading + 0.78 nF 0.21 % of reading + 2.3 nF 0.2 % of reading + 7.8 nF 0.32 % of reading + 23 nF 0.37 % of reading + 78 nF 0.38 % of reading + 0.23 µF 0.35 % of reading + 0.78 µF 0.35 % of reading + 2.3 µF 0.35 % of reading + 7.8 µF 0.58 % of reading + 23 µF 0.85 % of reading + 78 µF	Comparison to Fluke 5522A Multiproduct Calibrator
Capacitance – Measure [1]	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	Comparison to Fluke 8588A 8.5 Digit Multimeter

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Measure [1]	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	Comparison to Fluke 8588A 8.5 Digit Multimeter
DC Current – Measure [1]	(10 to 100) A	0.15 mA/A + 2 mA	Comparison to Ohm Labs CS-100 Current Shunt, Fluke 8588A 8.5 Digit Multimeter
DC Current – Source [1]	(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	Comparison to Fluke 5730A Multiproduct Calibrator
DC Current – Source [1]	(2.2 to 11) A	0.036 % of reading + 0.48 mA	Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier
DC Clamp-on Ammeters (Non-Toroidal Type) Hall Effect 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	Comparison to Fluke 5522A Multiproduct Calibrator, Fluke 5500A/Coil 50-turn Coil
DC High Voltage – Measure [1]	(1 to 10) kV (10 to 20) kV (20 to 30) kV	0.039 % of reading + 92 mV 0.038 % of reading + 2.4 V 0.041 % of reading + 2.4 V	Comparison to Vitrek 4700 High Voltage Meter, Vitrek HVL-35 High Voltage Probe
DC High Voltage – Measure [1]	(30 to 40) kV (40 to 50) kV (50 to 60) kV (60 to 70) kV	0.047 % of reading + 2.4 V 0.056 % of reading + 2.4 V 0.071 % of reading + 2.4 V 0.089 % of reading + 2.4 V	Comparison to Vitrek 4700 High Voltage Meter, Vitrek HVL-70 High Voltage Probe

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure [1]	Up to 200 mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1 050) V	7.7 µV/V + 0.2 µV 2.9 µV/V + 0.3 µV 2.9 µV/V + 0.47 µV 4.3 µV/V + 30 µV 4.4 µV/V + 0.5 mV	Comparison to Fluke 8588A 6.5 Digit Multimeter
AC Power – Source [1,2,4] PF = 1			Comparison to Fluke 5522A Multiproduct Calibrator
(3.3 to 9) mA	(10 to 65) Hz		
	110 µW to 3 mW	0.13 % of reading	
	3 mW to 9 W	0.077 % of reading	
(9 to 33) mA	(10 to 65) W		
	300 µW 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	
(330 to 900) mA	(10 to 65) Hz		
	(11 to 300) mW	0.071 % of reading	
	300 mW to 900 W	0.081 % of reading	
900 mA 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	

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DC Power – Source [1]			Comparison to Fluke 5522A Multiproduct Calibrator
330 µW to 330 mA	11 µW to 1.1 mW	0.024 % of reading	
	(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	
	990 W to 3 kW	0.01 % 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	
Phase – Source [1]	(0 to 90)°		Comparison to Fluke 5522A Multiproduct Calibrator
	(10 to 65) Hz	0.11°	
	(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 30) kHz	7.8°	
DC Voltage – Source [1]	(0 to 220) mV	7.5 µV/V + 0.4 µV	Comparison to Fluke 5730A Multiproduct Calibrator
	220 mV to 2.2 V	5 µV/V + 0.7 µV	
	(2.2 to 11) V	3.5 µV/V + 2.5 µV	
	(11 to 22) V	3.5 µV/V + 4 µV	
	(22 to 220) V	5 µV/V + 40 µV	
	(220 to 1 100) V	6.5 µV/V + 0.4 mV	
Resistance – Measure [1]	Up to 2 Ω	16 µΩ/Ω + 4 µΩ	Comparison to Fluke 8588A 8.5 Digit Multimeter
	(2 to 20) Ω	10 µΩ/Ω + 14 µΩ	
	(20 to 200) Ω	9.2 µΩ/Ω + 47 µΩ	
	(0.2 to 2) kΩ	9.1 µΩ/Ω + 0.47 mΩ	
	(2 to 20) kΩ	9.2 µΩ/Ω + 4.7 mΩ	
	(20 to 200) kΩ	9.3 µΩ/Ω + 47 mΩ	
	(0.2 to 2) MΩ	11 µΩ/Ω + 1 Ω	
	(2 to 20) MΩ	19 µΩ/Ω + 0.1 kΩ	
	(20 to 200) MΩ	0.12 mΩ/Ω + 10 kΩ	
	(0.2 to 2) GΩ	0.13 % of reading + 1 MΩ	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Low Current Resistance – Measure [1]	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	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 + 0.3 kΩ 0.13 % of reading + 10 kΩ 0.13 % of reading + 1 MΩ	Comparison to Fluke 8588A 8.5 Digit Multimeter
High Voltage Resistance – Measure [1]	(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	Comparison to Fluke 8588A 8.5 Digit Multimeter
Resistance – Source [1] (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	Comparison to Fluke 5522A Multiproduct Calibrator

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source [1] (Fixed-Point)	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 13 µΩ/Ω 18 µΩ/Ω 40 µΩ/Ω 47 µΩ/Ω 0.1 mΩ/Ω	Comparison to Fluke 5730A Multiproduct Calibrator
Resistance – Source [1] (Fixed Artifacts)	1 mΩ 10 mΩ 100 mΩ 1 Ω	0.2 mΩ/Ω 84 µΩ/Ω 84 µΩ/Ω 42 µΩ/Ω	Comparison to Ohms Labs CS-100 Current Shunt; IET DCCS-0.01, IET DCCS-0.1, IET DCCS-1 Standard Resistors
Resistance – Source [1] (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	Comparison to IET HRRS-B-7-100k-10kV Decade Resistor

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicating Devices – Source [1]	Pt 385, 100 Ω		Comparison to Fluke 5522A Multiproduct Calibrator
	(-200 to -80) ºC	0.039 ºC	
	(-80 to 0) ºC	0.039 ºC	
	(0 to 100) ºC	0.054 ºC	
	(100 to 300) ºC	0.07 ºC	
	(300 to 400) ºC	0.078 ºC	
	(400 to 630) ºC	0.093 ºC	
	(630 to 800) ºC	0.18 ºC	
	Pt 385, 200 Ω		
	-200 to -80) ºC	0.031 ºC	
	(-80 to 0) ºC	0.031 ºC	
	(0 to 100) ºC	0.031 ºC	
	(100 to 260) ºC	0.039 ºC	
	(260 to 300) ºC	0.093 ºC	
	(300 to 400) ºC	0.1 ºC	
	(400 to 600) ºC	0.11 ºC	
	(600 to 630) ºC	0.12 ºC	
	Pt 385, 500 Ω		
	(-200 to -80) ºC	0.031 ºC	
	(-80 to 0) ºC	0.039 ºC	
	(0 to 100) ºC	0.039 ºC	
	(100 to 260) ºC	0.047 ºC	
	(260 to 300) ºC	0.062 ºC	
	(300 to 400) ºC	0.062 ºC	
	(400 to 600) ºC	0.07 ºC	
	(600 to 630) ºC	0.085 ºC	
	Pt 385, 1 000 Ω		
	(-200 to -80) ºC	0.023 ºC	
	(-80 to 0) ºC	0.023 ºC	
	(0 to 100) ºC	0.031 ºC	
	(100 to 260) ºC	0.039 ºC	
	(260 to 300) ºC	0.047 ºC	
	(300 to 400) ºC	0.054 ºC	
	(400 to 600) ºC	0.054 ºC	
	(600 to 630) ºC	0.18 ºC	

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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) ºC	0.19 ºC	
	(-190 to -80) ºC	0.031 ºC	
	(-80 to 0) ºC	0.039 ºC	
	(0 to 100) ºC	0.047 ºC	
	(100 to 260) ºC	0.054 ºC	
	(260 to 300) ºC	0.062 ºC	
	(300 to 400) ºC	0.07 ºC	
	(400 to 600) ºC	0.078 ºC	
	(600 to 630) ºC	0.018 ºC	
	Pt 3926, 100 Ω		
	(-200 to -80) ºC	0.039 ºC	
	(-80 to 0) ºC	0.039 ºC	
	(0 to 100) ºC	0.054 ºC	
	(100 to 300) ºC	0.07 ºC	
	(300 to 400) ºC	0.078 ºC	
	(400 to 630) ºC	0.093 ºC	
	PtNi 385, 120 Ω		
	(-80 to 0) ºC	0.062 ºC	
	(0 to 100) ºC	0.062 ºC	
	(100 to 260) °C	0.1 ºC	
	Cu 427, 10 Ω		
	(-100 to 260) °C	0.23 ºC	
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure [1]	Type B		Comparison to Fluke 5522A Multiproduct Calibrator
	(600 to 800) °C	0.35 °C	
	(800 to 1 000) °C	0.28 °C	
	(1 000 to 1 550) °C	0.24 °C	
	(1 550 to 1 820) °C	0.26 °C	
	Type C		
	(0 to 150) °C	0.24 ºC	
	(150 to 650) °C	0.21 ºC	
	(650 to 1000) °C	0.24 ºC	
	(1 000 to 1 800) °C	0.39 ºC	
	(1 800 to 2 316) °C	0.65 ºC	
	Type E		
	(-250 to -100) °C	0.39 °C	
	(-100 to -25) °C	0.13 °C	
	(-25 to 350) °C	0.12 °C	
	(350 to 650) °C	0.13 °C	
	(650 to 1 000) °C	0.17 °C	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure [1]	Type J		Comparison to Fluke 5522A Multiproduct Calibrator
	(-210 to -100) °C	0.21 °C	
	(-100 to -30) °C	0.13 °C	
	(-30 to 150) °C	0.12 °C	
	(150 to 760) °C	0.14 °C	
	(760 to 1 200) °C	0.18 °C	
	Type K		
	(-200 to -100) °C	0.26 °C	
	(-100 to -25) °C	0.15 °C	
	(-25 to 120) °C	0.13 °C	
	(120 to 1 000) °C	0.21 °C	
	(1 000 to 1 372) °C	0.31 °C	
	Type L		
	(-200 to -100) °C	0.29 °C	
	(-100 to 800) °C	0.21 °C	
	(800 to 900) °C	0.14 °C	
	Type N		
	(-200 to -100) °C	0.31 °C	
	(-100 to -25) °C	0.18 °C	
	(-25 to 120) °C	0.15 °C	
	(120 to 410) °C	0.15 °C	
	(410 to 1 300) °C	0.21 °C	
	Type R		
	(0 to 250) °C	0.46 °C	
	(250 to 400) °C	0.29 °C	
	(400 to 1 000) °C	0.26 °C	
	(1 000 to 1 767) °C	0.32 °C	
	Type S		
	(0 to 250) °C	0.45 °C	
	(250 to 1 000) °C	0.3 °C	
	(1 000 to 1 400) °C	0.29 °C	
	(1 400 to 1 767) °C	0.36 °C	
	Type T		
	(-250 to -150) °C	0.49 °C	
	(-150 to 0) °C	0.19 °C	
	(0 to 120) °C	0.13 °C	
	(120 to 400) °C	0.12 °C	
	Type U		
	(-200 to 0) °C	0.44 °C	
	(0 to 600) °C	0.21 °C	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes [1]			
Amplitude DC			
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 10 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	0.078 % of reading + 31 µV	
	(1 to 10) kHz		
	1 mVp-p to 130 Vp-p	0.19 % of reading + 31 µV	
Timing – Generate			
into 50 Ω load	1 ns to 20 ms	0.000 22 % reading	
	50 ms	0.005 9 % reading	
	100 ms	0.009 8 % reading	
	200 ms	0.018 % reading	Comparison to Fluke 5522A/11 Multiproduct Calibrator
	500 ms	0.041 % reading	
	1 s	0.08 % reading	
	2 s	0.16 % reading	
	5 s	0.39 % reading	
Rise Time – Generate			
into 50 Ω Load	5 mVp-p to 2.5 Vp-p		
Rate: 1 kHz to 2 MHz	(200 to 300) ps	50 ps	
Rate: 2 MHz to 10 MHz	(250 to 350) ps	50 ps	
Leveled Sine Wave – Generate			
into 50 Ω load	5 mVp-p to 5.5 Vp-p		
	50 kHz	1.8 % of reading + 0.23 mV	
	100 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 MHz to 1.1 GHz	5.5 % of reading + 0.23 mV	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes [1]			
Bandwidth/Flatness – Measure			
(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	
	(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 MHz to 1.1 GHz	4 % of reading + 78 µV	
Input Impedance – Measure			Comparison to Fluke 5522A/11 Multiproduct Calibrator
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	
Wave Generator – Source 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	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 [1, 3] (Protractors, Inclinometers, Squares, Angle Gages, etc.)	0.005 6″ to 5°	3.3″	Comparison to 5 in Sine Bar, Gage Blocks
	(5 to 20)°	6.5″	
	(20 to 35)°	12″	
	(35 to 45)°	17″	
	(45 to 60)°	28″	
	(60 to 75)°	59″	
	(75 to 85)°	190″	
Bore Gages [1]	Up to 6 in	110 µin	Comparison to Characterized Cylindrical Ring Gages

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Chamfer Gages [1]	Up to 0.8 in (0.8 to 1.5) in (1.5 to 2.5) in	120 µin 130 µin 150 µin	Comparison to Characterized Cylindrical Ring Gages
Micrometers, Calipers [1,3] (Outside, Inside, Depth)	(0.05 to 0.4) in (0.4 to 1) in (1 to 9) in (9 to 40) in	13 µin 14 µin (13 + 4*L*) µin (10 + 5*L*) µin	Comparison to Gage Blocks
Height Gages [1]	Up to 1 in (1 to 9) in (9 to 15) in (15 to 40) in	(37 + 1*L*) µin (33 + 3*L*) µin (29 + 4*L*) µin (42 + 4*L*) µin	Comparison to Gage Blocks, Surface Plate
Indicators [1,3] (Dial, Digital, Test)	Up to 1 in (1 to 6) in	(10 + 2*L*) µin (4 + 6*L*) µin	Comparison to Gage Blocks, Surface Plate
Measuring Tapes, Rulers [1]	Up to 5 ft (5 to 10) ft (10 to 48) ft (48 to 1 000) ft	0.006 3 in 0.013 in 140 µin/in 120 µin/in	Comparison to Ruler Calibrator
Optical Comparators [1] X,Y Length Squareness	 Up to 2 in (2 to 12) in (0.4 to 1) in	 230 µin 970 µin 220 µin	Comparisons to Calibration Grids Calibration Grids
Cylindrical Pin/Plug Gages Outside Diameter	(0.004 to 1) in	42 µin	Comparison to Laser Micrometer
Single Axis Length – Inside [1,3]	Up to 1 in (1 to 3) in (3 to 12) in (12 to 20) in	49 µin (48 + 1*L*) µin (42 + 3*L*) µin (32 + 4*L*) µin	Comparison to Universal Length Measuring Machine
Single Axis Length – Outside [1,3]	Up to 1 in (1 to 3) in (3 to 12) in (12 to 20) in	41 µin (41 + 1L) µin (38 + 3L) µin (29 + 4L) µin	Comparison to Universal Length Measuring Machine, Gage Blocks
Cylindrical Ring Gages Inside Diameter	 Up to 6 in (6 to 12) in	 39 µin 69 µin	Comparison to Ring Comparator, Gage Blocks

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Plug Gages [3] Pitch Diameter, 60° Thread	Up to 1.25 in (1.25 to 4.5) in (4.5 to 7) in	97 µin 100 µin 110 µin	Comparisons to Universal Length Measuring Machine, Master Thread Wires, Gage Blocks
Major Diameter	Up to 1.75 in (1.75 to 7) in	59 µin (56 + 2*D*) µin	Universal Length Measuring Machine, Gage Blocks
Step Height	Up to 1 in	160 µin	Gage Blocks, Test Stand
Tapered Thread Plug Gages Pitch Diameter	Up to 3 in	120 µin	Comparisons to Universal Length Measuring Machine, Master Thread Wires, Gage Blocks
Stand Off	Up to 1 in	160 µin	Gage Blocks, Test Stand
Thread Ring Gages [1] Inner Pitch Diameter	Up to 1.25 in (1.25 to 4.5) in (4.5 to 7) in	97 µin 100 µin 110 µin	Comparison to Master Plug Gage
Wire Crimpers [1] Crimp Height	Up to 0.8 in	180 µin	Comparisons to Mitutoyo 342-371-30 Height Micrometer
Die Diameter	(0.011 to 0.5) in	0.001 3 in	Pin Gage Set (0.001 in step)
Pull Test	Up to 200 lbf	0.51 lbf	Mark 10 Pull Tester

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Wrenches, Torque Drivers, Torque Indicators [1]	15 ozf·in to 200 ozf·in 4 lbf·in to 600 lbf·ft	0.68 % of reading 0.5 % of reading	Comparison to CDI Torque Calibration System
Force Measuring Devices (Tension and Compression)	Up to 500 lbf	0.088 % of reading	Comparison to NIST Class F Weights

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Force Measuring Devices (Tension and Compression)	(500 to 10 000) lbf	0.01 % of reading + 3 lbf	Comparison to Morehouse Force Calibration System
Pneumatic Pressure Devices [1]	(-14.7 to 50) psig (-14.7 to 100) psig (-14.7 to 300) psig (-14.7 to 1 000) psig	0.01 psi 0.02 psi 0.049 psi 0.16 psi	Comparison to Additel ADT761A Automated Pressure Calibrator
Hydraulic Pressure Devices [1]	Up to 3 000 psig Up to 10 000 psig	0.52 psi 1.8 psi	Comparison to Additel ADT762W Automated Pressure Calibrator
Absolute Pressure Devices [1]	Up to 65 psia Up to 115 psia Up to 315 psia Up to 1 015 psia	0.015 psi 0.023 psi 0.05 psi 0.16 psi	Comparison to Additel ADT761A Automated Pressure Calibrator
Rockwell Hardness and Superficial Testers [1,2]	HRBw 44.1 HRBw 55.5 HRBw 88.2 HRBw HRC 27.5 HRC 47.8 HRC 62.6 HRC	 0.5 HRBw 0.5 HRBw 0.42 HRBw 0.27 HRC 0.46 HRC 0.25 HRC	Indirect Verification per ASTM E18 using Hardness Test Blocks
Scales and Balances [1,5] Metric (SI)	Up to 227 kg	0.013 % of reading	NIST Class F weights and internal calibration procedure utilized for the calibration of the weighing system.
Scales and Balances [1,5] Avoirdupois	Up to 500 lb	0.013 % of reading	NIST Class F weights and internal calibration procedure utilized for the calibration of the weighing system.

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Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity – Measure [1]	(-10 to 0) °C (0 to 90) %RH (90 to 100) %RH (0 to 40) °C (0 to 90) %RH (90 to 100) %RH (40 to 60) °C (0 to 90) %RH (90 to 100) %RH	 3.6 %RH 4.7 %RH 1.9 %RH 3 %RH 3.6 %RH 4.7 %RH	Direct measure using Vaisala HM40/HMP113 Temperature/Humidity Indicator/Probe
Infrared Thermometers [1]	(50 to 100) °C (100 to 120) °C (120 to 200) °C (200 to 350) °C (350 to 500) °C	0.67 °C 0.72 °C 0.97 °C 1.6 °C 2.2 °C	Comparison to Fluke 4181A Blackbody Source ε = (0.9 to 1), λ = (8 to 14) µm
Temperature – Measure [1]	(-195 to 0) °C (0 to 155) °C (155 to 420) °C (420 to 660) °C	0.036 °C 0.041 °C 0.054 °C 0.073 °C	Comparison to Additel ADT878 Temperature Readout, AccuMac AM1751 Secondary PRT
Temperature Measuring Devices [1] (Source)	(-40 to 0) °C (0 to 160) °C (160 to 420) °C (420 to 660) °C	0.052 °C 0.02 % of reading + 0.051 °C 0.056 % of reading + 0.072 °C 0.073 % of reading	Comparison to Additel ADT878 Temperature Readout, AccuMac AM1751 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 [1]	10 MHz	3.7 pHz/Hz	Comparison to Fluke 910R GPS Frequency Standard
Frequency – Source [1] (Sinewave)	10 mHz to 2 MHz	2 µHz/Hz + 8 µHz	Comparison to Fluke 5522A Multiproduct Calibrator

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Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Stopwatches/Timers [1]	Up to 599 s/mon	58 ms/d	Comparison to Vibrograf TM-4500 Timometer
Non-Contact Rate of Rotation [1,3]	(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 + 0.001 2 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	Comparison to Optical Tachometer
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 (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	Comparison to Fluke 5522A 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 6 in Y-axis Up to 2 in	 780 µin 780 µin	Vision System utilized as the reference standard for 1-D Length Measurements; Comparison method.

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2 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dimensional Measurement – 2D	Up to 6 in	1 100 µin	Vision System utilized as the reference standard for 2-D Length Measurements; Comparison Method.
Angles	Up to 180°	0.013°	Vision System utilized as the reference standard for Angle Measurements; Comparison Method.

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 values represented here are nominal values. The certified values and associated uncertainty will be reported at the time of calibration.
3. L = length in inches or millimeters; rpm = revolutions per minute; PF = Power Factor; ″ = arcsecond; D = diameter in inches or millimeters.
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 the laboratory for more information regarding uncertainties at frequency and power factor combinations other than the ones shown.
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. Unless otherwise specified in the far-right column, the calibration procedure/method utilized by the laboratory was internally developed.
7. The legal entity name for this client is Transcat, Inc.

Jason Stine, Vice President

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