



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Transcat - Decatur
2708-2 Highway 31 South, Suite D
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 2025

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

ANSI/NCSL Z540-1-1994 (R2002)

Transcat - Decatur

2708-2 Highway 31 South, Suite D

Decatur, AL 35603

LaMarl Jones 256-898-0648

CALIBRATION AND DIMENSIONAL MEASUREMENT

Valid to: **September 7, 2025**

Certificate Number: **AC-2489.31**

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	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	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	Fluke 8588A 8.5 Digit Multimeter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(20 to 200) μ A		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 μ A	
	(2 to 20) mA		
	1 Hz to 2 kHz	0.28 mA/A + 0.5 μ A	
	(2 to 10) kHz	0.53 mA/A + 0.5 μ A	
	(10 to 30) kHz	0.74 mA/A + 0.5 μ A	
	(30 to 100) kHz	4.1 mA/A + 1 μ A	
(20 to 200) mA		Fluke 8588A 8.5 Digit Multimeter	
1 Hz to 2 kHz	0.28 mA/A + 5 μ A		
(2 to 10) kHz	0.52 mA/A + 5 μ A		
(10 to 30) kHz	0.74 mA/A + 5 μ A		
(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		
	(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 μ A		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	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(0.22 to 2.2) mA		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		
AC Current – Source ¹	(0.22 to 2.2) A		Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier
	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 Clamp-on Ammeters (Toroidal Type) Transformer Type Sensor ¹	(20 to 150) A		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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Electrical – DC/Low Frequency

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	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	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	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	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	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 Voltage – Measure ¹	(10 to 100) mV		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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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(100 to 1 050) V 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.011 % of reading + 25 mV 0.011 % of reading + 25 mV 0.023 % of reading + 25 mV 0.059 % of reading + 0.1 V	Fluke 8588A 8.5 Digit Multimeter
AC Voltage – Source ¹	Up to 2.2 mV (10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz (2.2 to 22) mV (10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz (22 to 220) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (0.22 to 2.2) V (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % of reading + 4 μV 0.009 % of reading + 4 μV 0.008 % of reading + 4 μV 0.02 % of reading + 4 μV 0.05 % of reading + 5 μV 0.11 % of reading + 10 μV 0.14 % of reading + 20 μV 0.27 % of reading + 20 μV 0.024 % of reading + 4 μV 0.009 % of reading + 4 μV 0.008 % of reading + 4 μV 0.02 % of reading + 4 μV 0.05 % of reading + 5 μV 0.11 % of reading + 10 μV 0.14 % of reading + 20 μV 0.27 % of reading + 20 μV 0.024 % of reading + 12 μV 0.009 % of reading + 7 μV 0.005 7 % of reading + 7 μV 0.012 % of reading + 7 μV 0.031 % of reading + 17 μV 0.066 % of reading + 20 μV 0.14 % of reading + 25 μV 0.27 % of reading + 45 μV 0.024 % of reading + 40 μV 0.009 % of reading + 15 μV 0.004 2 % of reading + 8 μV 0.006 7 % of reading + 10 μV 0.008 5 % of reading + 30 μV 0.034 % of reading + 80 μV 0.1 % of reading + 0.2 mV 0.17 % of reading + 0.3 mV	Fluke 5730A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(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	0.026 % 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		0.03 % of reading + 16 mV	
(15 to 50) Hz			
(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		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		
AC Voltage – Source ¹ (Wideband Amplitude)	30 Hz to 500 kHz		Fluke 5730A Multiproduct Calibrator
	(0.3 to 1.1) mV	0.62 % of reading + 0.78 μV	
	(1.1 to 3) mV	0.54 % of reading + 1.2 μV	
	(3 to 11) mV	0.54 % of reading + 3.1 μV	
	(11 to 33) mV	0.47 % of reading + 6.2 μV	
	(33 to 110) mV	0.47 % of reading + 16 μV	
	(110 to 330) mV	0.39 % of reading + 39 μV	
	(0.33 to 1.1) V	0.39 % of reading + 0.16 mV	
	(1.1 to 3.5) V	0.31 % of reading + 0.19 mV	



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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		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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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)	(11 to 33) mV		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		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		

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		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	
	(1.75 to 3.5) 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	
Capacitance – Source ¹ (Simulation)	(0.22 to 0.4) nF	0.4 % of reading + 7.8 pF	Fluke 5522A Multiproduct Calibrator
	(0.4 to 1.1) nF	0.4 % of reading + 7.8 pF	
	(1.1 to 3.3) nF	0.4 % of reading + 7.8 pF	
	(3.3 to 11) nF	0.21 % of reading + 7.8 pF	
	(11 to 33) nF	0.2 % of reading + 78 pF	
	(33 to 110) nF	0.21 % of reading + 78 pF	
	(110 to 330) nF	0.2 % of reading + 0.23 nF	
	(0.33 to 1.1) μF	0.21 % of reading + 0.78 nF	
	(1.1 to 3.3) μF	0.21 % of reading + 2.3 nF	
	(3.3 to 11) μF	0.2 % of reading + 7.8 nF	
	(11 to 33) μF	0.32 % of reading + 23 nF	
	(33 to 110) μF	0.37 % of reading + 78 nF	
	(110 to 330) μF	0.38 % of reading + 0.23 μF	
	(0.33 to 1.1) mF	0.35 % of reading + 0.78 μF	
(1.1 to 3.3) mF	0.35 % of reading + 2.3 μF		
(3.3 to 11) mF	0.35 % of reading + 7.8 μF		
(11 to 33) mF	0.58 % of reading + 23 μF		
(33 to 110) mF	0.85 % of reading + 78 μF		
Capacitance – Measure ¹	Up to 2 nF	0.19 % of reading + 1 pF	Fluke 8588A 8.5 Digit Multimeter
	(2 to 20) nF	0.081 % of reading + 2 pF	
	(20 to 200) nF	0.049 % of reading + 10 pF	
	(0.2 to 2) μF	0.041 % of reading + 0.1 nF	
	(2 to 20) μF	0.042 % of reading + 1 nF	
	(20 to 200) μF	0.061 % of reading + 10 nF	
	(0.2 to 2) mF	0.061 % of reading + 0.1 μF	
	(2 to 20) mF	0.071 % of reading + 1 μF	
(20 to 200) mF	0.072 % of reading + 10 μF		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Measure ¹	Up to 20 μ A (20 to 200) μ A (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 μ A/A + 0.4 nA 10 μ A/A + 0.39 nA 9.9 μ A/A + 3.9 nA 15 μ A/A + 39 nA 58 μ A/A + 1 μ A 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 ¹	(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 ¹	(0.2 to 220) μ A (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A	40 μ A/A + 6 nA 35 μ A/A + 7 nA 35 μ A/A + 40 nA 45 μ A/A + 0.7 μ A 80 μ A/A + 12 μ A	Fluke 5730A Multiproduct Calibrator
DC Current – Source ¹	(2.2 to 11) A	0.036 % of reading + 0.48 mA	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	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	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	Vitrek 4700 High Voltage Meter, Vitrek HVL-70 High Voltage Probe
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 μ V/V + 0.2 μ V 2.9 μ V/V + 0.3 μ V 2.9 μ V/V + 0.47 μ V 4.3 μ V/V + 30 μ V 4.4 μ V/V + 0.5 mV	Fluke 8588A 6.5 Digit Multimeter



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment			
AC Power – Source ^{1,2,4} PF = 1	(3.3 to 9) mA	(10 to 65) Hz 110 μ W to 3 mW 3 mW to 9 W	0.13 % of reading 0.077 % of reading	Fluke 5522A Multiproduct Calibrator		
	(9 to 33) mA	(10 to 65) W 300 μ W to 10 mW 10 mW to 33 W	0.089 % of reading 0.077 % of reading			
	(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			
	(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 to 900) mA	(10 to 65) Hz (11 to 300) mW 300 mW to 900 W	0.071 % of reading 0.081 % of reading			
	900 mA to 2.2 A	(10 to 65) Hz (30 to 720) mW 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 20 kW	0.17 % of reading			
	DC Power – Source ¹	330 μ W to 330 mA	11 μ W to 1.1 mW (1.1 to 110) mW 110 mW to 110 W (110 to 330) W		0.024 % of reading 0.027 % of reading 0.024 % of reading 0.018 % of reading	Fluke 5522A Multiproduct Calibrator
		330 mA to 3 A	11 μ W to 110 mW 110 mW to 990 W 990 W to 3 kW		0.044 % of reading 0.053 % of reading 0.01 % of reading	
(3 to 20.5) A		99 mW to 0.99 W 0.99 W to 6.8 kW (6.8 to 20.5) kW	0.088 % of reading 0.07 % of reading 0.04 % of reading			



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Phase – Source ¹	(0 to 90)° (10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.11° 0.21° 0.39° 1.9° 3.9° 7.8°	Fluke 5522A Multiproduct Calibrator
DC Voltage – Source ¹	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	7.5 μV/V + 0.4 μV 5 μV/V + 0.7 μV 3.5 μV/V + 2.5 μV 3.5 μV/V + 4 μV 5 μV/V + 40 μV 6.5 μV/V + 0.4 mV	Fluke 5730A Multiproduct Calibrator
Resistance – Measure ¹	Up to 2 Ω (2 to 20) Ω (20 to 200) Ω (0.2 to 2) kΩ (2 to 20) kΩ	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	Fluke 8588A 8.5 Digit Multimeter
Resistance – Measure ¹	(20 to 200) kΩ (0.2 to 2) MΩ (2 to 20) MΩ (20 to 200) MΩ (0.2 to 2) GΩ	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 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	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	Fluke 8588A 8.5 Digit Multimeter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
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	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	Fluke 5522A Multiproduct Calibrator
Resistance – Source ¹ (Simulation)	(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	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
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	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	Ohms Labs CS-100 Current Shunt; IET DCCS-0.01, IET DCCS-0.1, IET DCCS-1 Standard Resistors

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
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	IET HRRS-B-7-100k-10kV Decade Resistor
Electrical Simulation of RTD Indicating Devices – Source ¹	Pt 385, 100 Ω (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C Pt 385, 200 Ω -200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C Pt 385, 500 Ω (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C Pt 385, 1 000 Ω (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.039 °C 0.039 °C 0.054 °C 0.07 °C 0.078 °C 0.093 °C 0.18 °C 0.031 °C 0.031 °C 0.031 °C 0.039 °C 0.093 °C 0.1 °C 0.11 °C 0.12 °C 0.031 °C 0.039 °C 0.039 °C 0.047 °C 0.062 °C 0.062 °C 0.07 °C 0.085 °C 0.023 °C 0.023 °C 0.031 °C 0.039 °C 0.047 °C 0.054 °C 0.054 °C 0.18 °C	Fluke 5522A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicating Devices – Source ¹	Pt 3916, 100 Ω (-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C Pt 3926, 100 Ω (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C PtNi 385, 120 Ω (-80 to 0) °C (0 to 100) °C (100 to 260) °C Cu 427, 10 Ω (-100 to 260) °C	0.19 °C 0.031 °C 0.039 °C 0.047 °C 0.054 °C 0.062 °C 0.07 °C 0.078 °C 0.018 °C 0.039 °C 0.039 °C 0.054 °C 0.07 °C 0.078 °C 0.093 °C 0.062 °C 0.062 °C 0.1 °C 0.23 °C	Fluke 5522A Multiproduct Calibrator
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure ¹	Type B (600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °C Type C (0 to 150) °C (150 to 650) °C (650 to 1000) °C (1 000 to 1 800) °C (1 800 to 2 316) °C Type E (-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1 000) °C	0.35 °C 0.28 °C 0.24 °C 0.26 °C 0.24 °C 0.21 °C 0.24 °C 0.39 °C 0.65 °C 0.39 °C 0.13 °C 0.12 °C 0.13 °C 0.17 °C	Fluke 5522A Multiproduct Calibrator

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 ¹	Type J		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		
into 1 MΩ load	1 mVp-p to 6.6 Vp-p	0.22 % of reading + 31 μV	
	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	
	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	
			Fluke 5522A/11 Multiproduct Calibrator

Electrical – DC/Low Frequency

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 (100 to 300) MHz (300 to 600) MHz	1.4 % of reading + 78 μV 1.8 % of reading + 78 μV 3.2 % of reading + 78 μV	Fluke 5522A/11 Multiproduct Calibrator
	5 mVp-p to 3.5 Vp-p 600 MHz to 1.1 GHz	4 % of reading + 78 μV	
Input Impedance – Measure into 50 Ω load into 1 MΩ load	(40 to 60) Ω (0.5 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	
Wave Generator – Source Amplitude (Sine, Square, Triangle) into 50 Ω load into 1 MΩ load	10 Hz to 10 kHz 1.8 mVp-p to 2.5 Vp-p 1.8 mVp-p to 55 Vp-p	2.3 % of reading + 78 μV 2.3 % of reading + 78 μV	
Frequency	10 Hz to 10 kHz	0.0019 % 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° (5 to 20)° (20 to 35)° (35 to 45)° (45 to 60)° (60 to 75)° (75 to 85)°	3.3" 6.5" 12" 17" 28" 59" 190"	5 in Sine Bar, Gage Blocks
Bore Gages ¹	Up to 6 in	110 μin	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	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 + 4L) μin (10 + 5L) μin	Gage Blocks
Height Gages ¹	Up to 1 in (1 to 9) in (9 to 15) in (15 to 40) in	(37 + 1L) μin (33 + 3L) μin (29 + 4L) μin (42 + 4L) μin	Gage Blocks, Surface Plate
Indicators ^{1,3} (Dial, Digital, Test)	Up to 1 in (1 to 6) in	(10 + 2L) μin (4 + 6L) μin	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	Ruler Calibrator
Optical Comparators ¹ X,Y Length	Up to 2 in (2 to 12) in	230 μin 970 μin	Calibration Grids
Squareness	(0.4 to 1) in	220 μin	Calibration Grids
Cylindrical Pin/Plug Gages Outside Diameter	(0.004 to 1) in	42 μin	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 + 1L) μin (42 + 3L) μin (32 + 4L) μin	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	Universal Length Measuring Machine, Gage Blocks
Cylindrical Ring Gages Inside Diameter	Up to 6 in (6 to 12) in	39 μin 69 μin	Ring Comparator, Gage Blocks

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	Universal Length Measuring Machine, Master Thread Wires, Gage Blocks	
	Major Diameter	Up to 1.75 in (1.75 to 7) in	59 μin (56 + 2D) 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	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	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	CDI Torque Calibration System
Force Measuring Devices (Tension and Compression)	Up to 500 lbf	0.088 % of reading	NIST Class F Weights
	(500 to 10 000) lbf	0.01 % of reading + 3 lbf	Morehouse Force Calibration System

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
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	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	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	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.

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	3.6 %RH 4.7 %RH	Vaisala HM40/HMP113 Temperature/Humidity Indicator/Probe

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity – Measure ¹	(0 to 40) °C (0 to 90) %RH (90 to 100) %RH	1.9 %RH 3 %RH	Vaisala HM40/HMP113 Temperature/Humidity Indicator/Probe
	(40 to 60) °C (0 to 90) %RH (90 to 100) %RH	3.6 %RH 4.7 %RH	
Infrared Thermometers ¹	(50 to 100) °C	0.67 °C	Fluke 4181A Blackbody Source $\epsilon = (0.9 \text{ to } 1)$, $\lambda = (8 \text{ to } 14) \mu\text{m}$
	(100 to 120) °C	0.72 °C	
	(120 to 200) °C	0.97 °C	
	(200 to 350) °C	1.6 °C	
	(350 to 500) °C	2.2 °C	
Temperature – Measure ¹	(-195 to 0) °C	0.036 °C	Additel ADT878 Temperature Readout, Accumac AM1751 Secondary PRT
	(0 to 155) °C	0.041 °C	
	(155 to 420) °C	0.054 °C	
	(420 to 660) °C	0.073 °C	
Temperature Measuring Devices ¹ (Source)	(-40 to 0) °C	0.052 °C	Additel ADT878 Temperature Readout, Accumac AM1751 Secondary SPRT, Additel ADT878 Reference Dry Well Calibrator
	(0 to 160) °C	0.02 % of reading + 0.051 °C	
	(160 to 420) °C	0.056 % of reading + 0.072 °C	
	(420 to 660) °C	0.073 % of reading	

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source/Measure Reference ¹	10 MHz	3.7 pHz/Hz	Fluke 910R GPS Frequency Standard
Frequency – Source ¹ (Sinewave)	10 mHz to 2 MHz	2 $\mu\text{Hz}/\text{Hz} + 8 \mu\text{Hz}$	Fluke 5522A Multiproduct Calibrator
Stopwatches/Timers ¹	Up to 599 s/mon	58 ms/d	Vibrograf TM-4500 Timometer
Non-Contact Rate of Rotation ^{1,3}	(5 to 99.999) rpm	0.012 % of reading + 0.001 2 rpm	Optical Tachometer
	(100.00 to 999.99) rpm	0.012 % of reading + 0.012 rpm	
	(1 000.0 to 9 999.9) rpm	0.012 % of reading + 0.12 rpm	
	(10 000 to 99 999) rpm	0.014 % of reading + 1.2 rpm	
	(100 000 to 200 000) rpm	0.014 % of reading + 12 rpm	

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
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	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.

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.
Angles	Up to 180°	0.013°	Vision System utilized as the reference standard for Angle Measurements.

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. The legal entity name for this client is Transcat, Inc.
7. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2489.31.



Jason Stine, Vice President

