



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Transcat - Chesapeake
928 Canal Drive
Chesapeake, VA 23323

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.

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

Jason Stine, Vice President

Expiry Date: 07 September 2025
Certificate Number: AC-2489.21



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 – Chesapeake
928 Canal Drive
Chesapeake, VA 23323
Dante Daneri 757-558-2550

CALIBRATION

Valid to: **September 7, 2025**

Certificate Number: **AC-2489.21**

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Vibration – Measure (any single axis) Voltage Sensitivity	100 Hz 10 mV/g	1.5 % of reading	Comparison to Reference Accelerometer w/ Calibrator
Frequency Response	(0.8 to 20) g RMS (5 to 20) Hz (20 to 100) Hz (100 to 2 500) Hz (2 500 to 10 000) Hz	2.1 % of reading 1.9 % of reading 1.5 % of reading 2.8 % of reading	
Sound – Generate	1 kHz 110 dB	0.42 dB	
Sound – Measure	20 Hz to 10 kHz (50 to 120) dB	0.5 dB	

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meters	4 pH 7 pH 10 pH	0.38 % of reading 0.2 % of reading 0.17 % of reading	Comparisons to Accredited pH Solutions

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conductivity Meters	25 μ S/cm 75 μ S/cm 1 015 μ S/cm 1 408 μ S/cm	5.3 % of reading 1.8 % of reading 0.57 % of reading 0.54 % of reading	Comparisons to Accredited Conductivity Solutions
Gas Detection Equipment ¹ CO (Carbon Monoxide)	0.002 % CO Concentration 0.006 % CO Concentration 0.01 % CO Concentration 0.1 % CO Concentration 0.5 % CO Concentration	0.000 096 % CO Concentration 0.000 15 % CO Concentration 0.000 22 % CO Concentration 0.000 83 % CO Concentration 0.01 % CO Concentration	Comparisons to Certified Gas Mixtures
CH ₄ (Methane LEL)	50 % LEL Concentration	1 % LEL Concentration	
C ₅ H ₁₂ (Pentane LEL)	58 % LEL Concentration	1.5 % LEL Concentration	
H ₂ S (Hydrogen Sulfide)	0.002 % H ₂ S Concentration 0.002 5 % H ₂ S Concentration	0.000 1 % H ₂ S Concentration 0.000 11 % H ₂ S Concentration	
O ₂ (Oxygen)	0.5 % O ₂ Concentration 5 % O ₂ Concentration 15 % O ₂ Concentration 18 % O ₂ Concentration	0.005 2 % O ₂ Concentration 0.038 % O ₂ Concentration 0.14 % O ₂ Concentration 0.16 % O ₂ Concentration	
C ₄ H ₈ (Isobutylene)	0.01 % C ₄ H ₈ Concentration	0.000 23 % C ₄ H ₈ Concentration	
CO ₂ (Carbon Dioxide)	0.5 % CO ₂ Concentration 5 % CO ₂ Concentration	0.004 4 % CO ₂ Concentration 0.081 % CO ₂ Concentration	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source ¹	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	7.5 μ V/V + 0.4 μ V 5 μ V/V + 0.7 μ V 3.5 μ V/V + 2.5 μ V 3.5 μ V/V + 4 μ V 5 μ V/V + 40 μ V 6.5 μ V/V + 0.4 mV	Comparison to Fluke 5730A/03 Multiproduct Calibrator
DC Voltage – Measure ¹	Up to 200 mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1 000) V	5.2 μ V/V + 90 nV 3.6 μ V/V + 0.39 μ V 3.5 μ V/V + 3.9 μ V 5.5 μ V/V + 39 μ V 5.5 μ V/V + 0.47 mV	Comparison to Fluke 8508A opt 001 8.5 Digit Multimeter
DC High Voltage – Measure ¹	(1 to 10) kV	0.039 % of reading + 92 mV	Comparison to Vitretek 4700 High Voltage Meter
DC High Voltage – Measure ¹	Up to 40 kV	2 % of reading	Comparison to Fluke 80K40HV Probe, Fluke 8508A opt 001 8.5 Digit Multimeter
DC Current – Source ¹	(0 to 220) μ A (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 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	Comparison to Fluke 5730A/03 Multiproduct Calibrator
DC Current – Source ¹	(2.2 to 3) A (3 to 11) A (11 to 20.5) A	0.3 mA/A + 31 μ A 0.51 mA/A + 0.39 mA 0.93 mA/A + 0.58 mA	Comparison to Fluke 5522A/11 Multiproduct Calibrator
DC Current – Source ¹	(20 to 100) A	0.04 % of reading	Comparison to Current Source, SR-100 Current Shunt, Fluke 8508 8.5 Digit Multimeter
DC Clamp-on Ammeter (Non-Toroidal Type) Hall Effect Sensor ¹	(20 to 150) A (150 to 1 000) A	0.51 % of reading + 0.14 A 0.52 % of reading + 0.5 A	Comparison to Fluke 5522A/11 Multiproduct Calibrator, 50-turn Coil
DC Current – Measure ¹	Up 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	13 μ A/A + 0.31 nA 13 μ A/A + 3.1 nA 14 μ A/A + 31 nA 47 μ A/A + 0.62 μ A 0.18 mA/A + 12 μ A 0.39 mA/A + 0.31 mA	Comparison to Fluke 8508A opt 001 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
DC Current – Measure ¹	(20 to 100) A	0.04 % of reading + 24 μ A	Comparison to SR-100 Current Shunt, Fluke 8508A opt 001 8.5 Digit Multimeter
Resistance – Source ¹ (Simulation)	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) k Ω (1.1 to 3.3) k Ω (3.3 to 11) k Ω (11 to 33) k Ω (33 to 110) k Ω (110 to 330) k Ω (0.33 to 1.1) M Ω (1.1 to 3.3) M Ω (3.3 to 11) M Ω (11 to 33) M Ω (33 to 110) M Ω (110 to 330) M Ω (0.33 to 1.1) G Ω	32 $\mu\Omega/\Omega$ + 0.78 m Ω 24 $\mu\Omega/\Omega$ + 1.2 m Ω 22 $\mu\Omega/\Omega$ + 1.1 m Ω 22 $\mu\Omega/\Omega$ + 1.6 m Ω 22 $\mu\Omega/\Omega$ + 1.6 m Ω 22 $\mu\Omega/\Omega$ + 1.6 m Ω 22 $\mu\Omega/\Omega$ + 1.6 m Ω 22 $\mu\Omega/\Omega$ + 1.6 m Ω 22 $\mu\Omega/\Omega$ + 0.16 Ω 22 $\mu\Omega/\Omega$ + 0.16 Ω 27 $\mu\Omega/\Omega$ + 1.6 Ω 26 $\mu\Omega/\Omega$ + 1.6 Ω 66 $\mu\Omega/\Omega$ + 23 Ω 0.1 m Ω/Ω + 39 Ω 0.19 m Ω/Ω + 1.9 k Ω 0.41 m Ω/Ω + 2.3 k Ω 0.23 % of reading + 78 k Ω 1.2 % of reading + 0.39 M Ω	Comparison to Fluke 5522A/11 Multiproduct Calibrator
Resistance – Source ¹ (Simulation)	0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 k Ω 1.9 k Ω 10 k Ω 19 k Ω 100 k Ω 190 k Ω 1 M Ω 1.9 M Ω 10 M Ω 19 M Ω 100 M Ω	40 $\mu\Omega$ 95 $\mu\Omega/\Omega$ 95 $\mu\Omega/\Omega$ 23 $\mu\Omega/\Omega$ 23 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 6.5 $\mu\Omega/\Omega$ 6.5 $\mu\Omega/\Omega$ 6.5 $\mu\Omega/\Omega$ 6.5 $\mu\Omega/\Omega$ 8.5 $\mu\Omega/\Omega$ 8.5 $\mu\Omega/\Omega$ 13 $\mu\Omega/\Omega$ 18 $\mu\Omega/\Omega$ 40 $\mu\Omega/\Omega$ 47 $\mu\Omega/\Omega$ 0.1 m Ω/Ω	Comparison to Fluke 5730A/03 Multiproduct Calibrator
High Resistance – Source ¹ (Variable Artifact)	(1 to 1 000) M Ω (1 to 100) G Ω	0.2 % of reading 1 % of reading	Comparison to Biddle 72-6346-1 Decade Resistor



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Resistance – Measure ¹ Normal Mode – 4W	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 + 3.9 μΩ 9.5 μΩ/Ω + 14 μΩ 7.8 μΩ/Ω + 47 μΩ 8.1 μΩ/Ω + 0.47 mΩ 7.8 μΩ/Ω + 4.7 mΩ 8.6 μΩ/Ω + 47 mΩ 9.5 μΩ/Ω + 93 mΩ 27 μΩ/Ω + 9.3 Ω 0.12 mΩ/Ω + 0.93 kΩ 0.14 % of reading + 93 kΩ	Comparison to Fluke 8508A opt 001 8.5 Digit Multimeter
DC Resistance – Measure ¹ Low Current Mode – 4W	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 + 3.9 μΩ 9.4 μΩ/Ω + 14 μΩ 8 μΩ/Ω + 0.14 mΩ 8.2 μΩ/Ω + 1.4 mΩ 7.9 μΩ/Ω + 14 mΩ 8.6 μΩ/Ω + 93 mΩ 21 μΩ/Ω + 0.93 Ω 88 μΩ/Ω + 93 Ω 0.14 % of reading + 93 kΩ 0.14 % of reading + 0.93 MΩ	Comparison to Fluke 8508A opt 001 8.5 Digit Multimeter
DC Resistance – Measure ¹ High Voltage Mode – 4W	(2 to 20) MΩ (20 to 200) MΩ (0.2 to 2) GΩ (2 to 20) GΩ	25 μΩ/Ω + 9.3 Ω 70 μΩ/Ω + 0.93 kΩ 0.19 mΩ/Ω + 93 kΩ 0.14 % of reading + 9.3 MΩ	Comparison to Fluke 8508A opt 001 8.5 Digit Multimeter
Capacitance – Source ¹ (Variable Artifact)	(50 to 200) pF 200 pF to 1.111 15 μF	0.63 % of reading + 5.8 pF 0.59 % of reading + 5.8 pF	Comparison to General Radio 1412-BC Decade Capacitor
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	0.4 % 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	Comparison to Fluke 5522A/11 Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source ¹ (Simulation)	(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	0.35 % 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/11 Multiproduct Calibrator
Capacitance – Measure ^{1,7}	1 kHz 400 pF to 25 μF (25 to 100) μF (100 to 500) μF (0.5 to 1) mF	0.02 % of reading 0.05 % of reading 0.05 % of reading 0.09 % of reading	Comparison to General Radio 1689 RLC Digibridge
Inductance – Measure ^{1,7}	1 kHz 1 mH to 10 H	0.02 % of reading	Comparison to General Radio 1689 RLC Digibridge
Inductance – Source ^{1,7} (Fixed Artifacts)	1kHz 1 mH 100 mH	0.001 2 mH 0.12 mH	Comparison to General Radio 1482-E, General Radio 1482-L Standard Inductors
AC Voltage – Source ¹	Up to 2.2 mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (2.2 to 22) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	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	Comparison to Fluke 5730A/03 Multiproduct Calibrator



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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	(22 to 220) mV		Comparison to Fluke 5730A/03 Multiproduct Calibrator
	(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	
	(2.2 to 22) V		
	(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		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(220 to 330) V (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (330 to 1 020) V (1 to 5) kHz (5 to 10) kHz	0.016 % of reading + 4.7 mV 0.02 % of reading + 4.7 mV 0.025 % of reading + 4.7 mV 0.16 % of reading + 39 mV 0.02 % of reading + 7.8 mV 0.023 % of reading + 7.8 mV	Comparison to Fluke 5522A/11 Multiproduct Calibrator
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/03 Multiproduct Calibrator
Wideband Amplitude Flatness – Source ¹ (1 kHz reference)	Up to 1.1 mV (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 kHz to 1.199 9 MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (1.1 to 3.3) mV (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 kHz to 1.199 9 MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz	0.23 % of reading 0.078 % of reading 0.078 % of reading 0.078 % of reading 0.078 % of reading 0.16 % of reading + 1.2 μV 0.16 % of reading + 1.2 μV 0.31 % of reading + 1.2 μV 0.47 % of reading + 1.2 μV 2.1 % of reading + 5.8 μV 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 0.078 % of reading + 1.2 μV 0.23 % of reading + 1.2 μV 0.39 % of reading + 1.2 μV 1.2 % of reading + 1.2 μV	Comparison to Fluke 5730A/03 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)	(3.3 to 11) mV		Comparison to Fluke 5730A/03 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	
	(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	
	(11 to 33) 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	
	(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	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		



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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)	(55 to 110) mV		Comparison to Fluke 5730A/03 Multiproduct Calibrator
	(1.2 to 2) MHz	0.078 % reading + 1.2 μ V	
	(2 to 11.9) MHz	0.16 % reading + 1.2 μ V	
	(12 to 20) MHz	0.31 % reading + 1.2 μ V	
	(20 to 30) MHz	0.78 % reading + 1.2 μ V	
	(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 μ V	
	(110 to 165) mV		
	(1.2 to 2) MHz	0.16 % reading + 1.2 μ V	
	(2 to 11.9) MHz	0.23 % reading + 1.2 μ V	
	(12 to 20) MHz	0.39 % reading + 1.2 μ V	
	(20 to 30) MHz	0.85 % reading + 1.2 μ V	
	(165 to 330) mV		
	(1.2 to 2) MHz	0.078 % reading + 1.2 μ V	
	(2 to 11.9) MHz	0.16 % reading + 1.2 μ V	
	(12 to 20) MHz	0.31 % reading + 1.2 μ V	
	(20 to 30) MHz	0.78 % reading + 1.2 μ V	
	(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 μ V		
(0.33 to 0.55) V			
(1.2 to 2) MHz	0.16 % reading + 1.2 μ V		
(2 to 11.9) MHz	0.23 % reading + 1.2 μ V		
(12 to 20) MHz	0.39 % reading + 1.2 μ V		
(20 to 30) MHz	0.85 % reading + 1.2 μ V		
(0.55 to 1.1) V			
(1.2 to 2) MHz	0.078 % reading + 1.2 μ V		
(2 to 11.9) MHz	0.16 % reading + 1.2 μ V		
(12 to 20) MHz	0.31 % reading + 1.2 μ V		
(20 to 30) MHz	0.78 % reading + 1.2 μ V		

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 3.5) V		Comparison to Fluke 5730A/03 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	
	(1.1 to 1.75) 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	
AC Voltage – Measure ¹	(1.75 to 3.5) V		Comparison to Fluke 8508A opt 001 8.5 Digit Multimeter
	(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	
	Up to 200 mV		
(1 to 10) Hz	0.017 % of reading + 70 μV		
(0.2 to 200) V			
(1 to 10) Hz	0.015 % of reading + 60 μV		
AC Voltage – Measure ¹	(200 to 1 000) V		Comparison to Fluke 5790A-03 AC Measurement Standard
	(1 to 10) Hz	0.015 % of reading + 70 μV	
	(0.6 to 2.2) mV		
	(10 to 20) Hz	0.17 % of reading + 1.3 μV	
	(20 to 40) Hz	0.074 % of reading + 1.3 μV	
	40 Hz to 20 kHz	0.042 % of reading + 1.3 μV	
	(20 to 50) kHz	0.081 % of reading + 2 μV	
	(50 to 100) kHz	0.12 % of reading + 2.5 μV	
	(100 to 300) kHz	0.23 % of reading + 4 μV	
	(300 to 500) kHz	0.24 % of reading + 8 μV	
	500 kHz to 1 MHz	0.35 % of reading + 8 μV	
	(2.2 to 7) mV		
	(10 to 20) Hz	0.085 % of reading + 1.3 μV	
	(20 to 40) Hz	0.037 % of reading + 1.3 μV	
	40 Hz to 20 kHz	0.021 % of reading + 1.3 μV	
	(20 to 50) kHz	0.04 % of reading + 2 μV	
	(50 to 100) kHz	0.06 % of reading + 2.5 μV	
	(100 to 300) kHz	0.12 % of reading + 4 μV	
(300 to 500) kHz	0.13 % of reading + 8 μV		
500 kHz to 1 MHz	0.23% of reading + 8 μV		



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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	(7 to 22) mV		Comparison to Fluke 5790A-03 AC Measurement Standard
	(10 to 20) Hz	0.029 % of reading + 1.3 μ V	
	(20 to 40) Hz	0.019 % of reading + 1.3 μ V	
	40 Hz to 20 kHz	0.011 % of reading + 1.3 μ V	
	(20 to 50) kHz	0.021 % of reading + 2 μ V	
	(50 to 100) kHz	0.031 % of reading + 2.5 μ V	
	(100 to 300) kHz	0.081 % of reading + 4 μ V	
	(300 to 500) kHz	0.089 % of reading + 8 μ V	
	500 kHz to 1 MHz	0.17 % of reading + 8 μ V	
	(22 to 70) mV		
	(10 to 20) Hz	0.024 % of reading + 1.5 μ V	
	(20 to 40) Hz	0.012 % of reading + 1.5 μ V	
	40 Hz to 20 kHz	65 μ V/V + 1.5 μ V	
	(20 to 50) kHz	0.013 % of reading + 2 μ V	
	(50 to 100) kHz	0.026 % of reading + 2.5 μ V	
	(100 to 300) kHz	0.051 % of reading + 4 μ V	
	(300 to 500) kHz	0.067 % of reading + 8 μ V	
	500 kHz to 1 MHz	0.11 % of reading + 8 μ V	
	(70 to 220) mV		
	(10 to 20) Hz	0.021 % of reading + 1.5 μ V	
	(20 to 40) Hz	85 μ V/V + 1.5 μ V	
	40 Hz to 20 kHz	38 μ V/V + 1.5 μ V	
	(20 to 50) kHz	69 μ V/V + 2 μ V	
	(50 to 100) kHz	0.016 % of reading + 2.5 μ V	
	(100 to 300) kHz	0.025 % of reading + 4 μ V	
	(300 to 500) kHz	0.038 % of reading + 8 μ V	
	500 kHz to 1 MHz	0.1 % of reading + 8 μ V	
	(220 to 700) mV		
(10 to 20) Hz	0.021 % of reading + 1.5 μ V		
(20 to 40) Hz	76 μ V/V + 1.5 μ V		
40 Hz to 20 kHz	33 μ V/V + 1.5 μ V		
(20 to 50) kHz	51 μ V/V + 2 μ V		
(50 to 100) kHz	79 μ V/V + 2.5 μ V		
(100 to 300) kHz	0.018 % of reading + 4 μ V		
(300 to 500) kHz	0.03 % of reading + 8 μ V		
500 kHz to 1 MHz	0.096 % of reading + 8 μ 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	(0.7 to 2.2) V		Comparison to Fluke 5790A-03 AC Measurement Standard
	(10 to 20) Hz	0.021 % of reading + 1.5 μ V	
	(20 to 40) Hz	76 μ V/V + 1.5 μ V	
	40 Hz to 20 kHz	33 μ V/V + 1.5 μ V	
	(20 to 50) kHz	51 μ V/V + 2 μ V	
	(50 to 100) kHz	79 μ V/V + 2.5 μ V	
	(100 to 300) kHz	0.018 % of reading + 4 μ V	
	(300 to 500) kHz	0.03 % of reading + 8 μ V	
	500 kHz to 1 MHz	0.096 % of reading + 8 μ V	
	(2.2 to 7) V		
	(10 to 20) Hz	0.02 % of reading	
	(20 to 40) Hz	67 μ V/V	
	40 Hz to 20 kHz	24 μ V/V	
	(20 to 50) kHz	48 μ V/V	
	(50 to 100) kHz	81 μ V/V	
	(100 to 300) kHz	0.02 % of reading	
	(300 to 500) kHz	0.04 % of reading	
	500 kHz to 1 MHz	0.12 % of reading	
	(7 to 22) V		
	(10 to 20) Hz	0.02 % of reading	
	(20 to 40) Hz	67 μ V/V	
	40 Hz to 20 kHz	27 μ V/V	
	(20 to 50) kHz	48 μ V/V	
	(50 to 100) kHz	81 μ V/V	
	(100 to 300) kHz	0.02 % of reading	
	(300 to 500) kHz	0.04 % of reading	
	500 kHz to 1 MHz	0.12 % of reading	
	(22 to 70) V		
(10 to 20) Hz	0.02 % of reading		
(20 to 40) Hz	68 μ V/V		
40 Hz to 20 kHz	32 μ V/V		
(20 to 50) kHz	57 μ V/V		
(50 to 100) kHz	94 μ V/V		
(100 to 300) kHz	0.02 % of reading		
(300 to 500) kHz	0.04 % of reading		
500 kHz to 1 MHz	0.12 % of reading		



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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	(70 to 220) 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 (220 to 700) V (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (700 to 1 000) V (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.02 % of reading 68 μV/V 31 μV/V 69 μV/V 98 μV/V 0.02 % of reading 0.05 % of reading 0.02 % of reading 99 μV/V 41 μV/V 0.01 % of reading 0.05 % of reading 0.02 % of reading 99 μV/V 38 μV/V 0.01 % of reading 0.05 % of reading	Comparison to Fluke 5790A-03 AC Measurement Standard
Wideband Amplitude Flatness – Measure ¹ (1 kHz reference)	(0.6 to 2.2) mV 50 kHz to 1.2 MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (2.2 to 7) mV 50 kHz to 1.2 MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (7 to 22) mV 50 kHz to 1.2 MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.07 % of reading + 1 μV 0.07 % of reading + 1 μV 0.17 % of reading + 1 μV 0.3 % of reading + 1 μV 0.7 % of reading + 2 μV 0.07 % of reading + 1 μV 0.07 % of reading + 1 μV 0.1 % of reading + 1 μV 0.17 % of reading + 1 μV 0.37 % of reading + 1 μV 0.07 % of reading 0.07 % of reading 0.1 % of reading 0.17 % of reading 0.37 % of reading	Comparison to Fluke 5790A-03 AC Measurement Standard



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Wideband Amplitude Flatness – Measure ¹ (1 kHz reference)	(22 to 70) mV		Comparison to Fluke 5790A-03 AC Measurement Standard
	50 kHz to 1.2 MHz	0.05 % of reading	
	(1.2 to 2) MHz	0.05 % of reading	
	(2 to 10) MHz	0.1 % of reading	
	(10 to 20) MHz	0.15 % of reading	
	(20 to 30) MHz	0.35 % of reading	
	(70 to 220) mV		
	50 kHz to 1.2 MHz	0.05 % of reading	
	(1.2 to 2) MHz	0.05 % of reading	
	(2 to 10) MHz	0.1 % of reading	
	(10 to 20) MHz	0.15 % of reading	
	(20 to 30) MHz	0.35 % of reading	
	(220 to 700) mV		
	50 kHz to 1.2 MHz	0.05 % of reading	
	(1.2 to 2) MHz	0.05 % of reading	
	(2 to 10) MHz	0.1 % of reading	
	(10 to 20) MHz	0.15 % of reading	
	(20 to 30) MHz	0.35 % of reading	
	(0.7 to 2.2) V		
	50 kHz to 1.2 MHz	0.05 % of reading	
(1.2 to 2) MHz	0.05 % of reading		
(2 to 10) MHz	0.1 % of reading		
(10 to 20) MHz	0.15 % of reading		
(20 to 30) MHz	0.35 % of reading		
(2.2 to 7) V			
50 kHz to 1.2 MHz	0.05 % of reading		
(1.2 to 2) MHz	0.05 % of reading		
(2 to 10) MHz	0.1 % of reading		
(10 to 20) MHz	0.15 % of reading		
(20 to 30) MHz	0.35 % of reading		
AC High Voltage – Measure ¹	(0.7 to 9) kV		Comparison to Vitretek 4700 High Voltage Meter
	10 mHz to 10 Hz	0.15 % reading + 0.17 V	
	(10 to 30) Hz	0.15 % reading + 0.17 V	
	(30 to 50) Hz	0.14 % reading + 0.17 V	
	(50 to 70) Hz	0.14 % reading + 0.17 V	
	(70 to 100) Hz	0.14 % reading + 0.17 V	
	(100 to 200) Hz	0.14 % reading + 0.17 V	
	(200 to 450) Hz	0.48 % reading + 0.17 V	
	(450 to 600) Hz	0.87 % reading + 0.17 V	



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC High Voltage – Measure ¹	(9 to 10) 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	0.15 % reading + 0.69 V 0.15 % reading + 0.69 V 0.14 % reading + 0.69 V 0.14 % reading + 0.69 V 0.14 % reading + 0.69 V 0.14 % reading + 0.69 V 0.48 % reading + 0.69 V 0.87 % reading + 0.69 V	Comparison to Vitrek 4700 High Voltage Meter
AC Current – Source ¹	Up to 220 μ A (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (0.22 to 2.2) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (2.2 to 22) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (22 to 220) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (0.22 to 2.2) A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % of reading + 16 nA 0.016 % of reading + 10 nA 0.011 % of reading + 8 nA 0.028 % of reading + 12 nA 0.11 % of reading + 65 nA 0.025 % of reading + 40 nA 0.016 % of reading + 35 nA 0.011 % of reading + 35 nA 0.02 % of reading + 0.11 μ A 0.11 % of reading + 0.65 μ A 0.025 % of reading + 0.4 μ A 0.016 % of reading + 0.35 μ A 0.011 % of reading + 0.35 μ A 0.02 % of reading + 0.55 μ A 0.11 % of reading + 5 μ A 0.025 % of reading + 4 μ A 0.016 % of reading + 3.5 μ A 0.011 % of reading + 2.5 μ A 0.02 % of reading + 3.5 μ A 0.11 % of reading + 10 μ A 0.025 % of reading + 35 μ A 0.045 % of reading + 80 μ A 0.7 % of reading + 0.16 mA	Comparison to Fluke 5730A/03 Multiproduct Calibrator
AC Current – Source ¹	(2.2 to 3) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.18 % of reading + 0.1 mA 0.06 % of reading + 0.1 mA 0.6 % of reading + 1 mA 2.5 % of reading + 5 mA	Comparison to Fluke 5730A/03 Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(3 to 11) A (45 to 100) Hz (0.1 to 1) kHz (1 to 5) kHz (11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.049 % of reading + 1.6 mA 0.079 % of reading + 1.6 mA 2.3 % of reading + 1.6 mA 0.095 % of reading + 3.9 mA 0.12 % of reading + 3.9 mA 2.3 % of reading + 3.9 mA	Comparison to Fluke 5522A/11 Multiproduct Calibrator
AC Clamp-on Ammeters (Toroidal Type) Transformer Type Sensor ¹	(20 to 150) A (45 to 65) Hz (65 to 440) Hz (150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	0.31 % of reading + 26 mA 0.84 % of reading + 47 mA 0.35 % of reading + 0.12 A 1.2 % of reading + 0.22 A	Comparison to Fluke 5522A/11 Multiproduct Calibrator, 50-turn Coil
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/11 Multiproduct Calibrator, 50-turn Coil
AC Current – Measure ¹	Up to 200 μ A 1 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz (0.2 to 2) mA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz (2 to 20) mA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.031 % of reading + 20 nA 0.071 % of reading + 20 nA 0.4 % of reading + 20 nA 0.031 % of reading + 0.2 μ A 0.03 % of reading + 0.2 μ A 0.071 % of reading + 0.2 μ A 0.4 % of reading + 0.2 μ A 0.031 % of reading + 2 μ A 0.03 % of reading + 2 μ A 0.071 % of reading + 2 μ A 0.4 % of reading + 2 μ A	Comparison to Fluke 8508A opt 001 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) mA 1 Hz to 10 Hz 10 Hz to 10 kHz (10 to 30) kHz (0.2 to 2) A 10 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (2 to 20) A 10 Hz to 2 kHz (2 to 10) kHz	0.031 % of reading + 20 μA 0.029 % of reading + 20 μA 0.063 % of reading + 20 μA 0.062 % of reading + 0.2 mA 0.074 % of reading + 0.2 mA 0.3 % of reading + 0.2 mA 0.082 % of reading + 2 mA 0.25 % of reading + 2 mA	Comparison to Fluke 8508A opt 001 8.5 Digit Multimeter
AC Current – Measure ¹	(1 to 10) mA (5 to 400) Hz 400 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (10 to 30) mA (5 to 400) Hz 400 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (30 to 300) mA (5 to 400) Hz 400 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (0.3 to 3) A (5 to 400) Hz 400 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (3 to 10) A (5 to 400) Hz 400 Hz to 20 kHz (20 to 50) kHz (10 to 20) A (5 to 400) Hz 400 Hz to 20 kHz (20 to 50) kHz	0.002 % of reading 0.003 % of reading 0.004 % of reading 0.006 % of reading 0.002 % of reading 0.003 % of reading 0.005 % of reading 0.007 % of reading 0.003 % of reading 0.004 % of reading 0.007 % of reading 0.01 % of reading 0.002 % of reading 0.003 % of reading 0.005 % of reading 0.01 % of reading 0.002 % of reading 0.003 % of reading 0.005 % of reading 0.007 % of reading 0.012 % of reading 0.018 % of reading	Comparison to Fluke 5790A-03 AC Measurement Standard, Fluke A40 Current Shunts

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
DC Power – Source ¹ 330 μ W to 330 mA 330 mA to 3 A (3 to 20.5) A	11 μ W to 1.1 mW (1.1 to 110) mW	0.024 % of reading 0.027 % of reading	Comparison to Fluke 5520A Multiproduct Calibrator		
	110 mW to 110 W (110 to 330) W	0.024 % of reading 0.018 % of reading			
	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			
	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			
	AC Power – Source ^{1,2,8} PF = 1 (3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA 900 mA to 2.2 A (2.2 to 4.5) A (4.5 to 20.5) A	(10 to 65) Hz 110 μ W to 3 mW 3 mW to 9 W		0.13 % of reading 0.077 % of reading	Comparison to Fluke 5520A Multiproduct Calibrator
		(10 to 65) Hz 300 μ W to 10 mW 10 mW to 33 W		0.089 % of reading 0.077 % of reading	
		(10 to 65) Hz (1 to 30) mW 30 mW to 90 W		0.071 % of reading 0.057 % of reading	
		(10 to 65) Hz (3 to 100) mW 100 mW to 300 W		0.089 % of reading 0.078 % of reading	
		(10 to 65) Hz (11 to 300) mW 300 mW to 900 W		0.071 % of reading 0.081 % of reading	
(10 to 65) Hz (30 to 720) mW 0.72 W to 2 kW		0.089 % of reading 0.079 % of reading			
(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			
(10 to 65) Hz 150 mW to 20kW		0.17 % of reading			

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	Type B		Comparison to Fluke 5522A/11 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 °C	
	(150 to 650) °C	0.21 °C	
	(650 to 1000) °C	0.24 °C	
	(1 000 to 1 800) °C	0.39 °C	
	(1 800 to 2 316) °C	0.65 °C	
	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	
	Type J		
	(-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		

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	Type R (0 to 250) °C (250 to 400) °C (400 to 1 000) °C (1 000 to 1 767) °C Type S (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C Type U (-200 to 0) °C (0 to 600) °C	0.46 °C 0.29 °C 0.26 °C 0.32 °C 0.45 °C 0.3 °C 0.29 °C 0.36 °C 0.49 °C 0.19 °C 0.13 °C 0.12 °C 0.44 °C 0.21 °C	Comparison to Fluke 5522A/11 Multiproduct Calibrator
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	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	Comparison to Fluke 5522A/11 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 385, 500 Ω		Comparison to Fluke 5522A/11 Multiproduct Calibrator	
	(-200 to -80) °C	0.031 °C		
	(-80 to 0) °C	0.039 °C		
	(0 to 100) °C	0.039 °C		
	(100 to 260) °C	0.047 °C		
	(260 to 300) °C	0.062 °C		
	(300 to 400) °C	0.062 °C		
	(400 to 600) °C	0.07 °C		
	(600 to 630) °C	0.085 °C		
	Pt 385, 1 kΩ			
	(-200 to -80) °C	0.023 °C		
	(-80 to 0) °C	0.023 °C		
	(0 to 100) °C	0.031 °C		
	(100 to 260) °C	0.039 °C		
	(260 to 300) °C	0.047 °C		
	(300 to 400) °C	0.054 °C		
	(400 to 600) °C	0.054 °C		
	(600 to 630) °C	0.18 °C		
	Pt 3916, 100 Ω			
	(-200 to -190) °C	0.19 °C		
	(-190 to -80) °C	0.031 °C		
	(-80 to 0) °C	0.039 °C		
	(0 to 100) °C	0.047 °C		
	(100 to 260) °C	0.054 °C		
	(260 to 300) °C	0.062 °C		
	(300 to 400) °C	0.07 °C		
	(400 to 600) °C	0.078 °C		
	(600 to 630) °C	0.18 °C		
Pt 3926, 100 Ω				
(-200 to -80) °C	0.039 °C			
(-80 to 0) °C	0.039 °C			
(0 to 100) °C	0.054 °C			
(100 to 300) °C	0.07 °C			
(300 to 400) °C	0.078 °C			
(400 to 630) °C	0.093 °C			
PtNi 385, 120 Ω				
(-80 to 0) °C	0.062 °C			
(0 to 100) °C	0.062 °C			
(100 to 260) °C	0.1 °C			
Cu 427, 10 Ω				
(-100 to 260) °C	0.23 °C			

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°	Comparison to Fluke 5522A/11 Multiproduct Calibrator
Phase – Measure ¹ (0 to 360)° (Sine Wave)	10 mV to 350 V (5 to 10) Hz 10 Hz to 50 kHz 10 mV to 12.5 V (50 to 100) kHz (12.5 to 350) V 10 Hz to 10 kHz	0.23° 0.051° 0.23° 0.051°	Comparison to Clarke-Hess 6000 Precision Phase Meter
Oscilloscopes ^{1,2} Amplitude DC into 50 Ω load into 1 MΩ load Amplitude Square Wave into 50 Ω load into 1 MΩ load Timing – Generate into 50 Ω load Rise Time – Generate into 50 Ω Load Rate: 1 kHz to 2 MHz Rate: 2 MHz to 10 MHz	 (-6.6 to 6.6) V (-130 to 130) V 10 Hz to 10 kHz 1 mVp-p to 6.6 Vp-p 10 Hz to 1 kHz 1 mVp-p to 130 Vp-p (1 to 10) kHz 1 mVp-p to 130 Vp-p 1 ns to 20 ms 50 ms 100 ms 200 ms 500 ms 1 s 2 s 5 s 5 mVp-p to 2.5 Vp-p (200 to 300) ps (250 to 350) ps	 0.22 % of reading + 31 μV 0.12 % of reading + 31 μV 0.22 % of reading + 31 μV 0.14 % of reading + 31 μV 0.19 % of reading + 31 μV 0.000 22 % reading 0.005 9 % reading 0.009 8 % reading 0.018 % reading 0.041 % reading 0.08 % reading 0.16 % reading 0.39 % reading 51 ps 51 ps	 Comparison to Fluke 5522A/11 Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
Oscilloscopes ^{1,2} Leveled Sine Wave – Generate into 50 Ω load Bandwidth/Flatness – Measure (50 kHz Reference) into 50 Ω load Input Impedance – Measure into 50 Ω load into 1 MΩ load Input Capacitance – Measure Wave Generator – Source Amplitude (Sine, Square, Triangle) into 50 Ω load into 1 MΩ load Frequency	5 mVp-p to 5.5 Vp-p 50 kHz 100 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz 5 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 4.7 % of reading + 0.23 mV 5.5 % of reading + 0.23 mV	Comparison to Fluke 5522A/11 Multiproduct Calibrator		
	5 mVp-p to 5.5 Vp-p 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz 5 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 % of reading + 78 μV			
	(40 to 60) Ω (0.5 to 1.5) MΩ	0.082 % of reading 0.081 % of reading			
	(5 to 50) pF	3.9 % of reading + 0.39 pF			
	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			
	10 Hz to 10 kHz	0.001 9 % of reading + 12 mHz			
	Oscilloscopes ^{1,2} Bandwidth/Flatness – Measure into 50 Ω load	(5 to 89.3) mVp-p (1.1 to 4) GHz 89.3 mVp-p to 3.17 Vp-p (1.1 to 4) GHz		5.7 % of reading 3.3 % of reading	Comparison to Fluke 96720A RF Reference Source, Fluke 96040A-50 Low Phase Noise Reference Source



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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Absolute Power – Source ^{1,3}	(-35 to 14) dBm 100 MHz to 2.4 GHz (2.4 to 8) GHz (8 to 18) GHz (18 to 26.5) GHz	0.08 dB 0.11 dB 0.14 dB 0.17 dB	Comparison to Fluke 96720A RF Reference Source, R&S NRP-Z55(x2) Power Sensor, Agilent 11667B Power Splitter, Sucoflex 102EA 40 GHz Test Cable
RF Absolute Power – Measure ¹	1 mW Reference, 50 MHz	0.03 % of reading	Comparison to HP 8478B Power Sensor, HP 432A Power Meter
RF Absolute Power – Measure ^{1,3}	(-65 to -35) dBm (> 0.01 to ≤ 0.03) GHz (> 0.03 to ≤ 4.00) GHz (> 4.00 to ≤ 8.00) GHz (> 8.00 to ≤ 10.00) GHz (> 10.00 to ≤ 13.00) GHz (> 13.00 to ≤ 15.00) GHz (> 15.00 to ≤ 18.00) GHz	2.8 % of reading 1.9 % of reading 2.3 % of reading 2.4 % of reading 3 % of reading 3.5 % of reading 3.8 % of reading	Comparison to HP 8484A Power Sensor, Agilent E4419B Power Meter
RF Absolute Power – Measure ^{1,3}	(-35 to 20) dBm DC to 100 MHz (> 0.1 to ≤ 2.4) GHz (> 2.4 to ≤ 8) GHz (> 8 to ≤ 12.4) GHz (> 12.4 to ≤ 18) GHz (> 18 to ≤ 26.5) GHz (> 26.5 to ≤ 33) GHz (> 33 to ≤ 40) GHz	0.04 dB 0.048 dB 0.054 dB 0.063 dB 0.082 dB 0.086 dB 0.11 dB 0.11 dB	Comparison to Fluke 96720A RF Reference Source, R&S NRP-Z55(x2) Power Sensor
Tuned RF Absolute Power – Measure ³	2.5 MHz to 26.5 GHz (-127 to -110) dBm (-110 to -90) dBm (-90 to -80) dBm (-80 to -50) dBm (-50 to -40) dBm (-40 to -10) dBm (-10 to 0) dBm (0 to 10) dBm	0.54 dB 0.39 dB 0.37 dB 0.34 dB 0.33 dB 0.31 dB 0.3 dB 0.3 dB	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor, HP 11792A Microwave Converter, HP 11793A Microwave Converter



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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation – AM Depth Measure ¹ Rate: 50 Hz to 10 kHz	150 kHz to 10 MHz (5 to 40) % Depth (40 to 99) % Depth	0.85 % Depth 2.3 % Depth	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor, HP 11792A Microwave Converter, HP 11793A Microwave Converter
	Rate: (20 to 50) Hz 150 kHz to 10 MHz (5 to 40) % Depth (40 to 99) % Depth	1.3 % Depth 3.3 % Depth	
	Rate: 50 Hz to 50 kHz 10 MHz to 1.3 GHz (5 to 40) % Depth (40 to 99) % Depth	0.45 % Depth 1.3 % Depth	
	Rate: 50 Hz to 50 kHz (1.3 to 26.5) GHz (5 to 40) % Depth (40 to 99) % Depth	0.65 % Depth 1.8 % Depth	
	Rate: (20 to 50) Hz or (50 to 100) kHz 10 MHz to 26.5 GHz (5 to 40) % Depth (40 to 99) % Depth	1.3 % Depth 3.3 % Depth	
Frequency Modulation – Measure ^{1.7}	Rate: 20 Hz to 10 kHz 250 kHz to 10 MHz Dev: ≤ 40 kHz pk	2 % of reading	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor, HP 11792A Microwave Converter, HP 11793A Microwave Converter
	Rate: 50 Hz to 100 kHz 10 MHz to 1.3 GHz Dev: ≤ 400 kHz pk 10 MHz to 26.5 GHz Dev: ≤ 400 kHz pk	1 % of reading 1 % of reading	
	Rate: 20 Hz to 200 kHz 10 MHz to 1.3 GHz Dev: ≤ 400 kHz pk	6 % of reading	
	10 MHz to 26.5 GHz Dev: ≤ 400 kHz pk	6 % of reading	



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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Phase Modulation – Measure ^{1,7} Rate: 200 Hz to 10 kHz Rate: 200 Hz to 20 kHz	150 kHz to 10 MHz	5 % of reading	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor, HP 11792A Microwave Converter, HP 11793A Microwave Converter
	10 MHz to 26.5 GHz	4 % of reading	
Power Range Accuracy – Measure	3 μ W to 100 mW	0.31 % of reading	Comparison to HP 11683A Power Meter
Distortion – Measure	20 Hz to 20 kHz (-80 to 0) dB	1.3 dB	Comparison to HP 8903B Audio Analyzer
	(20 to 100) kHz (-65 to 0) dB	2.4 dB	
RF Amplitude Frequency Response – Measure	9 kHz to 2.9 GHz (2.90 to 6.46) GHz (6.46 to 13) GHz (13 to 19.7) GHz (19.7 to 22) GHz	1.1 dB 1.5 dB 2.1 dB 3.1 dB 3.1 dB	Comparison to HP 8562A Spectrum Analyzer
Leveled Sine Wave Output – Absolute Amplitude Accuracy Level ³	10 Hz to 4 GHz (-130 to -94) dBm	1.1 dB	Comparison to Fluke 96720A RF Reference Source, Fluke 96040A-50 Low Phase Noise Reference Source
	(-94 to -74) dBm	0.68 dB	
	(-74 to -17) dBm	0.34 dB	
	(-17 to 24) dBm	0.2 dB	
Leveled Sine Wave Output – Absolute Amplitude Accuracy Level ³	10 Hz to 4 GHz (-120 to -100) dBm	1.1 dB	Comparison to Fluke 96720A RF Reference Source, Fluke 96040A-75 Low Phase Noise Reference Source
	(-100 to -80) dBm	0.67 dB	
	(-80 to 18) dBm	0.34 dB	

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S11/S22 Reflection Magnitude – Measure ^{1,6} (Linear)	50 MHz to 2 GHz		Comparison to HP 8722ES Network Analyzer, Agilent 85056A Calibration Kit
	≤ 0.25 lin	0.013	
	(> 0.25 to 0.5) lin	0.012	
	(> 0.5 to ≤ 0.7) lin	0.012	
	(> 0.7 to ≤ 1) lin	0.013	
	(2 to 8) GHz		
≤ 0.25 lin	0.013		
(> 0.25 to 0.5) lin	0.012		
(> 0.5 to ≤ 0.7) lin	0.012		
(> 0.7 to ≤ 1) lin	0.014		
S11/S22 Reflection Magnitude – Measure ^{1,6} (Linear)	(8 to 20) GHz		Comparison to HP 8722ES Network Analyzer, Agilent 85056A Calibration Kit
	≤ 0.25 lin	0.013	
	(> 0.25 to 0.5) lin	0.012	
	(> 0.5 to ≤ 0.7) lin	0.012	
	(> 0.7 to ≤ 1) lin	0.014	
	(20 to 40) GHz		
≤ 0.25 lin	0.022		
(> 0.25 to 0.5) lin	0.022		
(> 0.5 to ≤ 0.7) lin	0.023		
(> 0.7 to ≤ 1) lin	0.026		
S11/S22 Reflection Phase – Measure ¹ (Linear)	50 MHz to 2 GHz		Comparison to HP 8722ES Network Analyzer, Agilent 85056A Calibration Kit
	≤ 0.25 lin	2.7°	
	(> 0.25 to 0.5) lin	1.4°	
	(> 0.5 to ≤ 0.7) lin	1°	
	(> 0.7 to ≤ 1) lin	0.9°	
	(2 to 8) GHz		
	≤ 0.25 lin	2.7°	
	(> 0.25 to 0.5) lin	1.4°	
	(> 0.5 to ≤ 0.7) lin	1.1°	
	(> 0.7 to ≤ 1) lin	1.1°	
	(8 to 20) GHz		
	≤ 0.25 lin	2.7°	
	(> 0.25 to 0.5) lin	1.4°	
	(> 0.5 to ≤ 0.7) lin	1.1°	
	(> 0.7 to ≤ 1) lin	1.1°	
(20 to 40) GHz			
≤ 0.25 lin	4.9°		
(> 0.25 to 0.5) lin	2.6°		
(> 0.5 to ≤ 0.7) lin	2.1°		
(> 0.7 to ≤ 1) lin	2°		



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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S21/S12 Transmission Magnitude – Measure ¹ (dB)	50 MHz to 2 GHz		Comparison to HP 8722ES Network Analyzer, Agilent 85056A Calibration Kit
	(-90 to ≤ -80) dB	0.35 dB	
	(-80 to ≤ -70) dB	0.18 dB	
	(-70 to ≤ -60) dB	0.15 dB	
	(-60 to ≤ -50) dB	0.15 dB	
	(-50 to ≤ -40) dB	0.14 dB	
	(-40 to ≤ -30) dB	0.14 dB	
	(-30 to ≤ -20) dB	0.14 dB	
	(-20 to ≤ -10) dB	0.14 dB	
(-10 to ≤ 0) dB	0.14 dB		
S21/S12 Transmission Magnitude – Measure ¹ (dB)	(2 to 8) GHz		Comparison to HP 8722ES Network Analyzer, Agilent 85056A Calibration Kit
	(-90 to ≤ -80) dB	0.36 dB	
	(-80 to ≤ -70) dB	0.19 dB	
	(-70 to ≤ -60) dB	0.17 dB	
	(-60 to ≤ -50) dB	0.17 dB	
	(-50 to ≤ -40) dB	0.16 dB	
	(-40 to ≤ -30) dB	0.16 dB	
	(-30 to ≤ -20) dB	0.16 dB	
	(-20 to ≤ -10) dB	0.16 dB	
	(-10 to ≤ 0) dB	0.16 dB	
	(8 to 20) GHz		
	(-90 to ≤ -80) dB	0.46 dB	
	(-80 to ≤ -70) dB	0.25 dB	
	(-70 to ≤ -60) dB	0.21 dB	
	(-60 to ≤ -50) dB	0.21 dB	
	(-50 to ≤ -40) dB	0.21 dB	
	(-40 to ≤ -30) dB	0.2 dB	
	(-30 to ≤ -20) dB	0.2 dB	
	(-20 to ≤ -10) dB	0.2 dB	
	(-10 to ≤ 0) dB	0.2 dB	
	(20 to 40) GHz		
	(-90 to ≤ -80) dB	0.84 dB	
	(-80 to ≤ -70) dB	0.44 dB	
	(-70 to ≤ -60) dB	0.37 dB	
	(-60 to ≤ -50) dB	0.36 dB	
	(-50 to ≤ -40) dB	0.36 dB	
	(-40 to ≤ -30) dB	0.36 dB	
(-30 to ≤ -20) dB	0.36 dB		
(-20 to ≤ -10) dB	0.36 dB		
(-10 to ≤ 0) dB	0.36 dB		

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S21/S12 Transmission Phase – Measure ¹	50 MHz to 2 GHz		Comparison to HP 8722ES Network Analyzer, Agilent 85056A Calibration Kit
	(-90 to ≤ -40) dB	180°	
	(-40 to ≤ -30) dB	30°	
	(-30 to ≤ -20) dB	9.2°	
	(-20 to ≤ -10) dB	2.9°	
	(-10 to ≤ 0) dB	1°	
	(2 to 8) GHz		
	(-80 to ≤ -40) dB	180°	
	(-40 to ≤ -30) dB	35°	
	(-30 to ≤ -20) dB	10°	
	(-20 to ≤ -10) dB	3.3°	
	(-10 to ≤ 0) dB	1.2°	
	(8 to 20) GHz		
	(-90 to ≤ -40) dB	180°	
	(-40 to ≤ -30) dB	47°	
	(-30 to ≤ -20) dB	13°	
(-20 to ≤ -10) dB	4.2°		
(-10 to ≤ 0) dB	1.5°		
(20 to 40) GHz			
(-80 to ≤ -30) dB	180°		
(-30 to ≤ -20) dB	24°		
(-20 to ≤ -10) dB	7.4°		
(-10 to ≤ 0) dB	2.6°		

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Micrometers, Calipers (Outside, Inside, Depth and Step) ¹	(0.01 to 0.04) in (0.05 to 1) in (1 to 4) in (4 to 15) in (15 to 40) in	13 μin (13 + 1L) μin (9 + 4L) μin (12 + 4L) μin (16 + 4L) μin	Comparison to Gage Blocks
Anvil Flatness ¹	Up to 1 in Diameter	14 μin	Comparison to Optical Flats
Spindle Parallelism	Up to 1 in Diameter	14 μin	Comparison to Optical Flats
Bore Gages ^{1,2}	Up to 1 in (1 to 6) in	(43 + 8L) μin (41 + 10L) μin	Comparison to Characterized Cylindrical Rings



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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
Single Axis Length – Outside ^{1,2}	Up to 1 in (1 to 4) in (4 to 15) in (15 to 20) in	(15 + 6L) μin (15 + 6L) μin (12 + 6.5L) μin (11 + 6.5L) μin	Comparison to Universal Length Measuring Machine	
Single Axis Length – Outside ^{1,2}	(20 to 40) in	(84 + 3L) μin	Comparison to Gage Amplifier/Check, Gage Blocks	
Single Axis Length – Inside ^{1,2}	Up to 1 in (1 to 4) in (4 to 7) in (7 to 14) in	(22 + 6L) μin (20 + 7L) μin (16 + 8L) μin (15 + 8L) μin	Comparison to Universal Length Measuring Machine	
Height Gages ^{1,2}	Up to 1 in (1 to 7) in (7 to 15) in (15 to 40) in	(37 + 0.3L) μin (36 + 2L) μin (33 + 3L) μin (22 + 4L) μin	Comparison to Gage Blocks, Grade AA Surface Plate	
Cylindrical Ring Gages ² Inside Diameter	Up to 16 in	(24 + 7.9L) μin	Comparison to Universal Length Measuring Machine, Master Ring Gages	
Thread Ring Gages ² Pitch Diameter	Up to 6 in	(22 + 4.7L) μin	Tactile fit using Set Plugs	
Cylindrical Plug Gages ² Outside Diameter	Up to 16 in	(18 + 8.2L) μin	Comparison to Universal Length Measuring Machine	
Thread Plug Gages Major Diameter (OD)	Up to 6 in	(18 + 7.3L) μin	Comparison to Universal Length Measuring Machine, Thread Wires	
	Pitch Diameter	Up to 1 in (1 to 6) in	88 μin 110 μin	
Surface Plates ^{1,2}				
Overall Flatness	Up to 161 inDL	95 μin	In accordance with ASME B89.3.7 using Planekator	
Local Area Flatness	Up to 0.001 in	29 μin	Repeat-O-Meter	
Coating Thickness Gages (Eddy Current, Magnetic Induction, Fixed Point)	Up to 3 000 μm Up to 118 mils	0.49 μm 0.019 mils	Comparison to Universal Length Measuring Machine, Shims	
Indicators ^{1,2} (Dial, Digital, Test)	Up to 1 in (1 to 4) in	(10 + 2L) μin (6.4 + 4.3L) μin	Comparison to Gage Blocks, Surface Plate	

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Air/Nitrogen Flow Meters	Up to 100 slpm	0.73 % of reading	Comparison to CME FCS Laminar Flow Elements
Liquid Flow Meters	Up to 250 gpm	0.33 % of reading	Comparison to FT-32 Turbine Flow System
Low Pressure Gages (Gauge)	(0 to 2) inH ₂ O	0.008 inH ₂ O	Comparison to Dwyer 1430 Microtector
Pneumatic Pressure Gages, Vacuum Gages ⁴ (Gauge)	(-14.7 to 10) psig (10 to 1 000) psig	0.002 1 psig 0.02% of reading + 0.002 3 psig	Comparison to DHI PPC4EX-7M Pressure Controller
Pneumatic Pressure Gages, Vacuum Gages ⁴ (Absolute)	Up to 10 psia (10 to 1 000) psia	0.007 6 psia 0.02% of reading + 0.003 psia	Comparison to DHI PPC4EX-7M Pressure Controller
Pneumatic Pressure Gages (Absolute or Gauge)	(0.2 to 718) psi	0.003 % of reading	Comparison to Ruska 2465 Gas Piston Gauge
Hydraulic Pressure Gages (Gauge)	(100 to 50 000) psig	0.008 % of reading	Comparison to DHI 5306 Liquid Piston Gauge
Pressure/Vacuum Gages ¹ (Pneumatic and Hydraulic Gauge)	(0 to 900) mmHg (15 to 30) psig (30 to 300) psig (300 to 500) psig (500 to 3 000) psig (3 000 to 10 000) psig	0.29 mmHg 0.023 psi 0.16 psi 0.15 psi 1.8 psi 8.3 psi	Comparison to Meriam DAI0900 Fluke 700PD5 Fluke 700P27 Meriam DGI0500-11-1 Meriam GGI3000-11-1 Fluke 700P31
Scales and Balances ^{1,5}	Up to 500 mg (0.5 to 5) g (5 to 10) g (10 to 20) g (20 to 100) g (100 to 210) g	12 µg 40 µg 59 µg 89 µg 0.000 31 % of reading 0.000 41 % of reading	ASTM E617 Class 1 weights and internal calibration procedure utilized for the calibration of the weighing system.
Scales and Balances ^{1,5}	100 g to 10 kg	0.000 59 % of reading	ASTM E617 Class 2 Weights and internal calibration procedure utilized for the calibration of the weighing system.

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales and Balances ^{1,5}	Up to 7 g (7 to 453) g 453 g to 2.2 kg (2.2 to 454) kg	0.12 % of reading 0.024 % of reading 0.019 % of reading 0.012 % of reading	NIST Class F Weights and internal calibration procedure utilized for the calibration of the weighing system.
Scales and Balances ^{1,5}	Up to 30 lb (30 to 40) lb (40 to 70) lb (70 to 90) lb	0.012 % of reading 0.01 % of reading 0.009 % of reading 0.008 % of reading	ASTM E617 Class 6 Weights and internal calibration procedure utilized for the calibration of the weighing system.
Scales and Balances ^{1,5}	Up to 0.5 lb (0.5 to 1) lb (1 to 5) lb (5 to 1 000) lb	0.12 % of reading 0.024 % of reading 0.019 % of reading 0.012 % of reading	NIST Class F Weights and internal calibration procedure utilized for the calibration of the weighing system.
Force Measuring Equipment – Compression ¹	Up to 10 lbf (10 to 25) lbf (25 to 50) lbf (50 to 150) lbf (150 to 250) lbf (250 to 500) lbf	0.001 5 lbf 0.002 1 lbf 0.008 3 lbf 0.023 lbf 0.065 lbf 0.13 lbf	Comparison to NIST Class F Weights
Force Measuring Equipment – Compression ¹	(500 to 1 000) lbf	0.77 lbf	Comparison to Optima OP-312 Load Cell
Force Measuring Equipment – Compression ¹	(1 000 to 5 000) lbf	2.8 lbf	Comparison to Optima OP-312 Load Cell
Force Measuring Equipment – Compression ¹	(5 000 to 20 000) lbf	8.1 lbf	Comparison to Transcell BSS-20K Load Cell
Force Measuring Equipment – Tension ¹	Up to 10 lbf (10 to 25) lbf (25 to 50) lbf (50 to 150) lbf (150 to 250) lbf (250 to 500) lbf	0.001 5 lbf 0.002 1 lbf 0.008 3 lbf 0.023 lbf 0.065 lbf 0.13 lbf	Comparison to NIST Class F Weights
Force Measuring Equipment – Tension ¹	(500 to 1 000) lbf	0.77 lbf	Comparison to Optima OP-312 Load Cell

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Force Measuring Equipment – Tension ¹	(1 000 to 5 000) lbf	2.8 lbf	Comparison to Optima OP-312 Load Cell
Force Measuring Equipment – Tension ¹	(5 000 to 10 000) lbf	4.2 lbf	Comparison to Transcell BSS-10K Load Cell
Force Measuring Equipment – Tension ¹	(10 000 to 20 000) lbf	8.1 lbf	Comparison to Transcell BSS-20K Load Cell
Force Measuring Equipment – Tension ¹	(20 000 to 50 000) lbf	23 lbf	Comparison to Optima OP-351 Load Cell
Force Measuring Equipment – Tension ¹	(50 000 to 100 000) lbf	44 lbf	Comparison to Rinstrument TLWS-100K Load Cell
Torque Devices	2 ozf·in to 2 000 lbf·ft	0.24 % of reading	Comparison to AKO TSD2050 Torque Master
Torque Transducers	20 ozf·in to 100 lbf·in 100 lbf·in to 125 lbf·ft (125 to 2 000) lbf·ft	0.05 % of reading 0.06 % of reading 0.08 % of reading	Comparison to Torque Arms, Master Weights

Photometry and Radiometry

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Illuminance – Lux Meters	(180 to 1 792) lux (1 792 to 17 000) lux	1.8 % of reading 1.7 % of reading	Comparison to FEL 1000W Lamp with Power Supply Unit

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity – Source/Measure	(10 to 30) °C (10 to 90) %RH	1.3 %RH	Comparison to Vaisala HMI-41/HMP-46 Temp/Humidity Indicator/Probe

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measure ¹	(-196 to 0) °C (0 to 100) °C (100 to 420) °C	0.062 °C 0.061 °C 0.061 °C	Comparison to Digital Thermometer, SPRT Probe
Temperature – Measure ¹	(420 to 960) °C	0.091 °C	Comparison to Digital Thermometer, Ceramic SPRT Probe
Temperature – Source ¹ (Temperature Measuring Devices)	(-30 to 0) °C (0 to 150) °C (150 to 420) °C	0.069 °C 0.084 °C 0.41 °C	Comparison to Digital Thermometer, SPRT Probe, Metrology Wells
Temperature – Source ¹ (Temperature Measuring Devices)	(420 to 960) °C	0.59 °C	Comparison to Digital Thermometer, Ceramic SPRT Probe, Metrology Wells
Infrared Measuring Devices ¹	(35 to 200) °C (200 to 350) °C (350 to 500) °C	0.95 °C 1.6 °C 2.1 °C	Comparison to Black Body Source (Flat Plate) $\epsilon = 0.95$, $\lambda = (8 \text{ to } 14) \mu\text{m}$

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Reference ¹	10 MHz	38 μHz	Comparison to Fluke 910R GPS Rubidium Frequency Standard
Frequency – Source ¹	(1 to 70) Hz	58 nHz/Hz	Comparison to Agilent 33250A Function Generator, Fluke 910R GPS Frequency Standard
Frequency – Source ¹	70 Hz to 27 GHz	0.18 nHz/Hz + 3.9 μHz	Fluke 96270A Reference Source, Fluke 910R GPS Frequency Standard

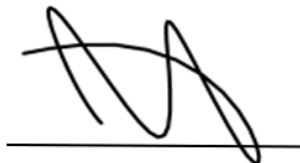
Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Measure ¹	1 Hz to 10 kHz 10 kHz to 10 MHz (10 to 225) MHz 225 MHz to 1.1 GHz	1 nHz/Hz + 4.7 μHz 1 nHz/Hz + 0.31 mHz 1 nHz/Hz + 6.4 mHz 1.3 nHz/Hz	Comparison to Agilent 53131A Universal Counter, Fluke 910R GPS Frequency Standard
Frequency – Measure ¹	(1.1 to 26.5) GHz	0.18 nHz/Hz + 1.2 Hz	HP 5343A Microwave Counter, Fluke 910R GPS Frequency Standard
Stopwatches, Timers	Up to 19.99 s/d	58 ms/d	Comparison to Helmut Klein TM-4500 Timometer
Optical Rotational Speed – Source ²	Up to 100 000 rpm	0.000 13 % of reading + 0.021 rpm	Comparison to Agilent 33250A Function Generator
Non-Contact Rate of Rotation ^{1,2}	Up to 600 rpm (600 to 100 000) rpm	0.000 13 % of reading + 1.2 rpm 0.006 9 % of reading + 2.1 rpm	Comparison to Optical Tachometer
AC Duty Cycle – Source ¹ Square Wave: < 3.3 Vp-p Freq: 10 mHz 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	0.039 % of reading + 78 ns 0.62 % of reading + 78 ns 0.001 6 % of reading + 78 ns 0.62 % of reading + 78 ns 0.039 % of reading + 78 ns	Comparison to Fluke 55xxA Multiproduct Calibrator

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. t = time in seconds; L = length in inches; DL = diagonal length in inches; rpm = revolutions per minute; PF = power factor.
3. CMC does not include the Mismatch value. It will be added in the Measurement Uncertainty reported on the Certificate of Calibration.
4. The span is user set on the unit. The minimum range for this unit is 10 psi.
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 Measurement Uncertainty presented here is a unitless measurement.
7. For this parameter, 1 Digit will be added to the Measurement Uncertainty (MU) at the time of calibration.
8. The uncertainties shown are for the most favorable conditions. There is an increase in uncertainty that corresponds to the laboratory's AC voltage and current uncertainties at different frequencies other than the ones shown. Power factors (PF) other than the one shown contribute to the power uncertainty. PF is related to the cosine of phase. Therefore, uncertainties track the laboratory's phase uncertainty closely at PF near one but are magnified heavily as PF approaches zero. The lab may also report reactive power, apparent power, and power factor under this accreditation. If needed, contact laboratory for more information regarding uncertainties at frequency and power factor combinations other than the ones shown.
9. Unless otherwise specified in the far-right column, the laboratory is utilizing an in-house developed calibration procedure.
10. The legal entity for this laboratory is Transcat, Inc.
11. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2489.21.



Jason Stine, Vice President

