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Transcat - Houston
16115 Park Row, Suite 150
Houston, TX 77084

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.
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Jason Stine, Vice President

Expiry Date: 07 September 2027
Certificate Number: AC-2489.02



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)

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CALIBRATION

ISO/IEC 17025 Accreditation Granted: **07 September 2025**

Certificate Number: **AC-2489.02**

Certificate Expiry Date: **07 September 2027**

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source/Measure	Up to 1 pA (1 to 10) pA (10 to 100) pA (0.1 to 1) nA (1 to 10) nA (10 to 100) nA (0.1 to 1) μ A (1 to 10) μ A	1.1 % of reading + 7 fA 0.52 % of reading + 7 fA 0.16 % of reading + 3 fA 0.057 % of reading + 0.2 pA 0.055 % of reading + 2 pA 0.055 % of reading + 20 pA 0.051 % of reading + 0.3 nA 0.05 % of reading + 2 nA	Comparison to Keithley 6430 Sub-femtoamp Remote SourceMeter
DC Current – Source/Measure	Up to 100 nA (0.1 to 1) μ A (1 to 10) μ A (10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 10) A (10 to 20) A (20 to 30) A (30 to 100) A	1.5 pA 21 μ A/A 7.2 μ A/A 6.5 μ A/A 2.8 μ A/A 5.1 μ A/A 2 μ A/A 2.4 μ A/A 4.8 μ A/A 4 μ A/A 10 μ A/A 36 μ A/A	Comparison to Standard Shunts, Current Source

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source/Measure ¹	Up to 1.0 μ A (1 to 10) μ A (10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	25 μ A/A + 46 pA 25 μ A/A + 0.12 nA 33 μ A/A + 0.92 nA 29 μ A/A + 5.8 nA 29 μ A/A + 58 nA 46 μ A/A + 0.58 μ A 0.013 % of reading + 12 μ A	Comparison to HP 3458A opt 002 8.5 Digit Multimeter, Current Source
DC Clamp-on Ammeters (Non-Toroidal Type) Transformer Type Sensor ¹	(20 to 54.999 5) A (55 to 149.999 5) A (150 to 549.995) A (550 to 1 025) A (1 000 to 5 000) A	0.47 % of reading + 0.11 A 0.41 % of reading + 0.11 A 0.45 % of reading + 0.39 A 0.51 % of reading + 0.39 A 0.58 % of reading	Comparison to Fluke 5522A Multiproduct Calibrator, Fluke 5500A/COIL, Fluke 55120A Transconductance Amplifier, 1 kA and 6 kA Coils
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	0.025 % of reading + 16 nA 0.019 % of reading + 10 nA 0.016 % of reading + 8 nA 0.03 % of reading + 12 nA 0.11 % of reading + 65 nA 0.025 % of reading + 40 nA 0.016 % of reading + 35 nA 0.01 % of reading + 35 nA 0.021 % of reading + 0.11 μ A 0.11 % of reading + 0.65 μ A 0.025 % of reading + 0.4 μ A 0.022 % of reading + 0.35 μ A 0.012 % of reading + 0.35 μ A 0.023 % of reading + 0.55 μ A 0.11 % of reading + 5 μ A	Comparison to Fluke 5730A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(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 + 4 μ A 0.022 % of reading + 3.5 μ A 0.014 % of reading + 2.5 μ A 0.02 % of reading + 3.5 μ A 0.11 % of reading + 10 μ A 0.03 % of reading + 35 μ A 0.05 % of reading + 80 μ A 0.7 % of reading + 0.16 mA	Comparison to Fluke 5720A Multiproduct Calibrator
AC Current – Source ¹	(2.2 to 11) A 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.046 % of reading + 0.17 mA 0.095 % of reading + 0.38 mA 0.36 % of reading + 0.75 mA	Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier
AC Current – Source ¹	(11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	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 Multiproduct Calibrator
AC Current – Source ¹ (Extended Frequency Ranges)	(29 to 330) μ A (10 to 30) kHz (0.33 to 3.3) mA (10 to 30) kHz (3.3 to 33) mA (10 to 30) kHz (33 to 330) mA (10 to 30) kHz	1.2 % of reading + 0.31 μ A 0.78 % of reading + 0.47 μ A 0.31 % of reading + 3.1 μ A 0.31 % of reading + 0.16 mA	Comparison to Fluke 5522A Multiproduct Calibrator
AC Clamp-on Ammeter (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	0.3 % of reading + 26 mA 0.83 % of reading + 47 mA 0.35 % of reading + 0.12 A 1.1 % of reading + 0.22 A	Comparison to Fluke 5522A Multiproduct Calibrator, 1 kA Coil
AC Clamp-on Ammeter (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	0.57 % of reading + 0.25 A 1 % of reading + 0.25 A 0.6 % of reading + 0.9 A 1.3 % of reading + 0.92 A	Comparison to Fluke 5522A Multiproduct Calibrator, 1 kA Coil

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Clamp-on Ammeter (Non-Toroidal Type) Hall Effect Sensor ¹	(1 to 6) kA (10 to 300) Hz (1 to 2) kA (300 to 440) Hz (2 to 6) kA (300 to 440) Hz	0.6 % of reading 0.8 % of reading 0.66 % of reading	Comparison to Fluke 5520A Multiproduct Calibrator, Fluke 52120A Transconductance Amplifier, 6 kA Coil
AC Current – Measure ¹	(0.2 to 20) μ A 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (20 to 200) μ A 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (0.2 to 2) mA 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (2 to 20) mA 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (20 to 200) mA 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (0.2 to 2) A 1 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 (20 to 30) A 10 Hz to 2 kHz (2 to 10) kHz	0.2 % of reading + 2.5 nA 0.2 % of reading + 2.5 nA 0.2 % of reading + 2.5 nA 0.28 mA/A + 5 nA 0.53 mA/A + 5 nA 0.74 mA/A + 5 nA 4.1 mA/A + 10 nA 0.28 mA/A + 50 nA 0.53 mA/A + 50 nA 0.74 mA/A + 50 nA 4.1 mA/A + 0.1 μ A 0.28 mA/A + 0.5 μ A 0.53 mA/A + 0.5 μ A 0.74 mA/A + 0.5 μ A 4.1 mA/A + 1 μ A 0.28 mA/A + 5 μ A 0.52 mA/A + 5 μ A 0.74 mA/A + 5 μ A 0.3 mA/A + 0.1 mA 0.56 mA/A + 0.1 mA 0.8 mA/A + 0.1 mA 0.84 mA/A + 0.5 mA 0.86 mA/A + 0.5 mA 0.84 mA/A + 12 mA 1.2 mA/A + 12 mA	Comparison to Fluke 8588A Reference Multimeter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	10 A to 100 A (50 to 60) Hz 400 Hz 1 kHz	0.22 mA/A + 5 mA 0.26 mA/A + 5 mA 1.1 mA/A + 1.3 mA	Comparison to Agilent 3458A opt 002 8.5 Digit Multimeter, Ohms Lab CS-100 Current Shunt
DC Voltage – Source/Measure (Fixed Points)	0 V (floor) 100 mV 1 V 10 V 19 V 100 V 1 000 V	59 nV 0.81 μ V/V 0.31 μ V/V 0.24 μ V/V 1 μ V/V 0.26 μ V/V 0.81 μ V/V	Comparison to Ratio Metric with Zener
DC Voltage – Source/Measure (Fixed Points)	100 mV 1 V 10 V	5.5 μ V/V 0.5 μ V/V 0.2 μ V/V	Comparison to DC Reference Cells
DC Voltage – Measure	(0 to 200) mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1 050) V	1.9 μ V/V + 0.11 μ V 1.6 μ V/V + 0.39 μ V 1.4 μ V/V + 3.9 μ V 2.8 μ V/V + 39 μ V 2.9 μ V/V + 0.47 mV	Comparison to Fluke 8508 8.5 Digit Multimeter
DC Voltage – Source/Measure ¹ (Variable Points)	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 500) V (500 to 800) V (800 to 1 000) V	8.3 μ V/V + 0.58 μ V 5.3 μ V/V + 0.58 μ V 5.3 μ V/V + 0.58 μ V 7.7 μ V/V + 35 μ V 15 μ V/V + 0.12 mV 18 μ V/V + 0.12 mV 21 μ V/V + 0.12 mV	Comparison to Agilent 3458A opt 002 8.5 Digit Multimeter, Fluke 5720A Multiproduct Calibrator
DC High Voltage – Measure ¹	(1 to 10) kV (10 to 20) kV (20 to 30) kV (30 to 40) kV (40 to 50) kV (50 to 60) kV (60 to 70) kV (70 to 80) kV (80 to 90) kV (90 to 100) kV	0.039 % of reading + 92 mV 0.038 % of reading + 2.4 V 0.041 % of reading + 2.4 V 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 0.12 % of reading + 2.5 V 0.15 % of reading + 2.5 V 0.17 % of reading + 2.5 V	Comparison to Vitretek 4700 High Voltage Meter; HVL-35, HVL-70, HVL-100 High Voltage Probes

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	Up to 2.2 mV		Comparison to Fluke 5730A Multiproduct Calibrator
	(10 to 20) Hz	0.16 % of reading + 4 μ V	
	(20 to 40) Hz	0.1 % of reading + 4 μ V	
	40 Hz to 20 kHz	0.078 % of reading + 4 μ V	
	(20 to 50) kHz	0.13 % of reading + 4 μ V	
	(50 to 100) kHz	0.17 % of reading + 5 μ V	
	(100 to 300) kHz	0.33 % of reading + 10 μ V	
	(300 to 500) kHz	0.47 % of reading + 20 μ V	
	500 kHz to 1 MHz	0.58 % of reading + 20 μ V	
	(2.2 to 22) mV		
	(10 to 20) Hz	0.042 % of reading + 4 μ V	
	(20 to 40) Hz	0.03 % of reading + 4 μ V	
	40 Hz to 20 kHz	0.014 % of reading + 4 μ V	
	(20 to 50) kHz	0.03 % of reading + 4 μ V	
	(50 to 100) kHz	0.058 % of reading + 5 μ V	
	(100 to 300) kHz	0.12 % of reading + 10 μ V	
	(300 to 500) kHz	0.16 % of reading + 20 μ V	
	500 kHz to 1 MHz	0.27 % of reading + 20 μ V	
	(22 to 220) mV		
	(10 to 20) Hz	0.028 % of reading + 12 μ V	
	(20 to 40) Hz	0.011 % of reading + 7 μ V	
	40 Hz to 20 kHz	0.008 5 % of reading + 7 μ V	
	(20 to 50) kHz	0.021 % of reading + 7 μ V	
	(50 to 100) kHz	0.047 % of reading + 17 μ V	
	(100 to 300) kHz	0.091 % of reading + 20 μ V	
	(300 to 500) kHz	0.14 % of reading + 25 μ V	
	500 kHz to 1 MHz	0.28 % of reading + 45 μ V	
	(0.22 to 2.2) V		
	(10 to 20) Hz	0.027 % of reading + 40 μ V	
	(20 to 40) Hz	0.01 % of reading + 15 μ V	
	40 Hz to 20 kHz	0.005 % of reading + 8 μ V	
	(20 to 50) kHz	0.008 % of reading + 10 μ V	
	(50 to 100) kHz	0.012 % of reading + 30 μ V	
	(100 to 300) kHz	0.043 % of reading + 80 μ V	
	(300 to 500) kHz	0.1 % of reading + 0.2 mV	
	500 kHz to 1 MHz	0.18 % of reading + 0.3 mV	

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		Comparison to Fluke 5730A Multiproduct Calibrator
	(10 to 20) Hz	0.028 % of reading + 0.4 mV	
	(20 to 40) Hz	0.01 % of reading + 0.15 mV	
	40 Hz to 20 kHz	0.004 9 % of reading + 50 µV	
	(20 to 50) kHz	0.008 3 % of reading + 0.1 mV	
	(50 to 100) kHz	0.011 % of reading + 0.2 mV	
	(100 to 300) kHz	0.03 % of reading + 0.6 mV	
	(300 to 500) kHz	0.1 % of reading + 2 mV	
	500 kHz to 1 MHz	0.17 % of reading + 3.2 mV	
	(22 to 220) V		
	(10 to 20) Hz	0.028 % of reading + 4 mV	
	(20 to 40) Hz	0.01 % of reading + 1.5 mV	
	40 Hz to 20 kHz	0.006 % of reading + 0.6 mV	
	(20 to 50) kHz	0.009 3 % of reading + 1 mV	
	(50 to 100) kHz	0.016 % of reading + 2.5 mV	
	(22 to 220) V		
	(100 to 300) kHz	0.09 % of reading + 16 mV	
	(300 to 500) kHz	0.44 % of reading + 40 mV	
	500 kHz to 1 MHz	0.8 % of reading + 40 mV	
	(220 to 750) V		
	(30 to 50) kHz	0.061 % of reading + 11 mV	
	(50 to 100) kHz	0.23 % of reading + 45 mV	
	(220 to 1 100) V		
	40 Hz to 1 kHz	0.011 % of reading + 4 mV	
	(1 to 20) kHz	0.017 % of reading + 6 mV	
	(20 to 30) kHz	0.061 % of reading + 11 mV	

Electrical – DC/Low Frequency

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

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(0.1 to 1) V (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	1.8 % of reading + 0.12 mV 4.6 % of reading + 0.81 mV 4.6 % of reading + 0.92 mV 17 % of reading + 1.2 mV	Comparison to Agilent 3458A opt 002 8.5 Digit Multimeter
	(1 to 10) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.009 5 % of reading + 0.46 mV 0.023 % of reading + 0.23 mV 0.017 % of reading + 0.23 mV 0.036 % of reading + 0.23 mV 0.093 % of reading + 0.23 mV 0.35 % of reading + 1.2 mV 1.2 % of reading + 1.2 mV 1.8 % of reading + 1.2 mV 4.6 % of reading + 8.1 mV 4.6 % of reading + 9.2 mV 17 % of reading + 12 mV	
AC High Voltage – Measure ¹	(10 to 100) V (1 to 40) Hz 40Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.024 % of reading + 4.6 mV 0.024 % of reading + 2.3 mV 0.024 % of reading + 2.3 mV 0.041 % of reading + 2.3 mV 0.14 % of reading + 2.3 mV 0.46 % of reading + 12 mV 1.7 % of reading + 12 mV	Comparison to Vitretek 4700 High Voltage Meter; HVL-35, HVL-70, HVL-100 High Voltage Probes
	(100 to 700) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.048 % of reading + 46 mV 0.048 % of reading + 23 mV 0.071 % of reading + 23 mV 0.19 % of reading + 23 mV 0.35 % of reading + 23 mV	
AC High Voltage – Measure ¹	(0.7 to 5) kV 10 mHz to 10 Hz	0.14 % of reading + 0.17 V 0.12 % of reading + 0.29 V	Comparison to Vitretek 4700 High Voltage Meter; HVL-35, HVL-70, HVL-100 High Voltage Probes
	(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	0.099 % 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 0.87 % of reading + 0.17 V	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC High Voltage – Measure ¹	(5 to 30) kV		Comparison to Vitretek 4700 High Voltage Meter; HVL-35, HVL-70, HVL-100 High Voltage Probes
	10 mHz to 10 Hz	0.19 % of reading + 2.4 V	
	(10 to 30) Hz	0.13 % of reading + 2.4 V	
	(30 to 50) Hz	0.11 % of reading + 2.4 V	
	(50 to 70) Hz	0.077 % of reading + 2.4 V	
	(70 to 100) Hz	0.11 % of reading + 2.4 V	
	(100 to 200) Hz	0.11 % of reading + 2.4 V	
	(200 to 450) Hz	0.7 % of reading + 2.4 V	
	(450 to 600) Hz	1.4 % of reading + 2.4 V	
	(30 to 50) kV		
	10 mHz to 10 Hz	0.24 % of reading + 2.5 V	
	(10 to 30) Hz	0.18 % of reading + 2.5 V	
	(30 to 50) Hz	0.13 % of reading + 2.5 V	
	(50 to 70) Hz	0.1 % of reading + 2.5 V	
	(70 to 100) Hz	0.13 % of reading + 2.5 V	
	(100 to 200) Hz	0.69 % of reading + 2.5 V	
	(200 to 450) Hz	2.9 % of reading + 2.5 V	
	(50 to 70) kV		
	10 mHz to 10 Hz	0.37 % of reading + 2.6 V	
	(10 to 30) Hz	0.26 % of reading + 2.6 V	
	(30 to 50) Hz	0.16 % of reading + 2.6 V	
	(50 to 70) Hz	0.16 % of reading + 2.6 V	
	(70 to 100) Hz	1.2 % of reading + 2.6 V	
	(100 to 200) Hz	1.2 % of reading + 2.6 V	
	(200 to 450) Hz	17 % of reading + 2.6 V	
Capacitance – Source ¹ (Simulation)	10 Hz to 10 kHz		Comparison to Fluke 5522A Multiproduct Calibrator
	(0.22 to 0.3999) nF	0.39% of reading + 7.8 pF	
	(0.40 to 1.0999) nF	0.39% of reading + 7.8 pF	
	10 Hz to 3kHz		
	(1.1 to 3.2999) nF	0.39% of reading + 7.8 pF	
	10 Hz to 1kHz		
	(3.3 to 10.9999) nF	0.21% of reading + 7.8 pF	
	(11 to 32.9999) nF	0.21% of reading + 78 pF	
	(33 to 109.999) nF	0.21% of reading + 78 pF	
	(110 to 329.999) nF	0.21% of reading + 0.23 nF	
	10 Hz to 600 Hz		
	(0.33 to 1.0999) μ F	0.21% of reading + 0.78 nF	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source ¹ (Simulation)	10 Hz to 300 Hz (1.1 to 3.29999) μ F 10 Hz to 150 Hz (3.3 to 10.9999) μ F 10 Hz to 120 Hz (11 to 32.9999) μ F 10 Hz to 80 Hz (33 to 109.999) μ F DC to 50 Hz (110 to 329.999) μ F DC to 20 Hz (0.33 to 10.9999) mF DC to 6 Hz (1.1 to 3.29999) mF DC to 2 Hz (3.3 to 10.9999) mF DC to 0.6 Hz (11 to 32.9999) mF DC to 0.2 Hz (33 to 110) mF	0.21% of reading + 2.3 nF 0.21% of reading + 7.8 nF 0.32% of reading + 23 nF 0.35% of reading + 78 nF 0.35% of reading + 0.23 μ F 0.35% of reading + 0.78 μ F 0.35% of reading + 2.3 μ F 0.35% of reading + 7.8 μ F 0.58% of reading + 23 μ F 0.85% of reading + 78 μ F	Comparison to Fluke 5522A Multiproduct Calibrator
Capacitance – Measure ¹ 10 Hz to 1 MHz (Fixed Points)	0.33 mF 0.8 mF 1 mF 1.2 mF 3 mF 3.3 mF 8 mF 10 mF 12 mF 30 mF 80 mF 100 mF	0.048 % of reading 0.027 % of reading 0.024 % of reading 0.023 % of reading 0.018 % of reading 0.017 % of reading 0.016 % of reading 0.016 % of reading 0.016 % of reading 0.015 % of reading 0.014 % of reading 0.014 % of reading	Comparison to Time/Charge Method utilizing the HP 3458A 8.5 Digit Multimeter.
Capacitance – Measure 10 Hz to 1 MHz (Fixed Points)	0.1 pF 100 kHz 1 MHz 1 pF 10 kHz 100 kHz 1 MHz 2 MHz	1.4 % of reading 1.8 % of reading 1.4 % of reading 0.37 % of reading 0.44 % of reading 1.1 % of reading	Comparison to Agilent E4980A LCR Meter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure 10 Hz to 1 MHz (Fixed Points)	10 pF		Comparison to Agilent E4980A LCR Meter
	1 kHz	1.4 % of reading	
	10 kHz	0.28 % of reading	
	100 kHz	0.28 % of reading	
	1 MHz	0.3 % of reading	
	2 MHz	0.75 % of reading	
	100 pF		
	100 Hz	2.1 % of reading	
	1 kHz	0.23 % of reading	
	10 kHz	0.17 % of reading	
	100 kHz	0.21 % of reading	
	1 MHz	0.23 % of reading	
	2 MHz	0.3 % of reading	
	1 nF		
	20 Hz	1.8 % of reading	
	100 Hz	0.3 % of reading	
	1 kHz	0.1 % of reading	
	10 kHz	0.1 % of reading	
	100 kHz	0.1 % of reading	
	1 MHz	0.14 % of reading	
	2 MHz	0.53 % of reading	
	10 nF		
	20 Hz	0.31 % of reading	
	100 Hz	0.12 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.092 % of reading	
	1 MHz	0.25 % of reading	
	2 MHz	0.67 % of reading	
	100 nF		
	20 Hz	0.16 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.18 % of reading	
	1 MHz	0.33 % of reading	
	2 MHz	0.97 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure 10 Hz to 1 MHz (Fixed Points)	1 μ F		Comparison to Agilent E4980A LCR Meter
	20 Hz	0.15 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.18 % of reading	
	100 kHz	0.25 % of reading	
	1 MHz	0.79 % of reading	
	10 μ F		
	20 Hz	0.15 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.16 % of reading	
	10 kHz	0.28 % of reading	
	100 kHz	0.73 % of reading	
	100 μ F		
	20 Hz	0.16 % of reading	
	100 Hz	0.17 % of reading	
	1 kHz	0.29 % of reading	
	10 kHz	0.8 % of reading	
DC Resistance – Source/Measure	Up to 100 $\mu\Omega$	0.63 n Ω	Comparison to Standard Resistors, Current Source, Digital Multimeter
	(0.1 Ω to 1) m Ω	7.1 $\mu\Omega/\Omega$	
	(1 to 10) m Ω	1.9 $\mu\Omega/\Omega$	
	(10 to 100) m Ω	3.8 $\mu\Omega/\Omega$	
	(0.1 to 1) Ω	0.49 $\mu\Omega/\Omega$	
DC Resistance – Source/Measure	(1 to 10) Ω	0.49 $\mu\Omega/\Omega$	Comparison to Standard Resistors, MI 6242B Resistance Bridge
	(10 to 100) Ω	0.98 $\mu\Omega/\Omega$	
	(0.1 to 1) k Ω	1.2 $\mu\Omega/\Omega$	
	(1 to 10) k Ω	2.7 $\mu\Omega/\Omega$	
	(10 to 100) k Ω	0.35 $\mu\Omega/\Omega$	
	(0.1 to 1) M Ω	1.9 $\mu\Omega/\Omega$	
	(1 to 10) M Ω	6.6 $\mu\Omega/\Omega$	
	(10 to 100) M Ω	14 $\mu\Omega/\Omega$	
Resistance Ratio	1 Ω to 1 k Ω	0.16 $\mu\Omega/\Omega$	Comparison to MI 6242B Resistance Bridge

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Resistance – Source/Measure ¹	Up to 10 Ω (10 to 100) Ω (0.1 to 1) k Ω (1 to 10) k Ω (10 to 100) k Ω (0.1 to 1) M Ω (1 to 10) M Ω (10 to 100) M Ω (0.1 to 1) G Ω	18 $\mu\Omega/\Omega$ + 58 $\mu\Omega$ 15 $\mu\Omega/\Omega$ + 0.58 m Ω 13 $\mu\Omega/\Omega$ + 0.58 m Ω 12 $\mu\Omega/\Omega$ + 5.8 m Ω 13 $\mu\Omega/\Omega$ + 58 m Ω 21 $\mu\Omega/\Omega$ + 2.3 Ω 62 $\mu\Omega/\Omega$ + 0.12 k Ω 0.59 % of reading + 1.2 k Ω 0.82 % of reading + 12 k Ω	Comparison to Agilent 3458A opt 002 8.5 Digit Multimeter, Decade Resistor
DC Resistance – Source/Measure ¹	(1 to 10) G Ω (10 to 100) G Ω (0.1 to 1) T Ω (1 to 10) T Ω (10 to 100) T Ω	0.73 % of reading + 10 k Ω 0.74 % of reading + 0.1 M Ω 0.75 % of reading + 1 M Ω 0.19 % of reading + 10 M Ω 0.59 % of reading + 0.1 G Ω	Comparison to Keithley 6430 Sub-Femtoamp Remote Sourcemeter, Voltage Source
DC Resistance – Source	1 G Ω	53 $\mu\Omega/\Omega$	Comparison to Standard Resistor
DC Resistance – Source ¹	100 Ω to 1 M Ω (1 to 10) M Ω (10 to 100) M Ω (0.1 to 1) G Ω (1 to 10) G Ω (10 to 100) G Ω (0.1 to 1) T Ω	0.037 % of reading 0.037 % of reading + 1.2 $\mu\Omega/\Omega/V$ 0.12 % of reading + 1.2 $\mu\Omega/\Omega/V$ 0.23 % of reading + 1.2 $\mu\Omega/\Omega/V$ 0.59 % of reading + 1.2 $\mu\Omega/\Omega/V$ 1.2 % of reading + 1.2 $\mu\Omega/\Omega/V$ 1.2 % of reading + 1.2 $\mu\Omega/\Omega/V$	Comparison to IET HRRS-B-7-100k-10kV High Resistance Substituter
DC Resistance – Measure	(0.1 to 1) G Ω (1 to 20) G Ω	53 $\mu\Omega/\Omega$ + 0.11 M Ω 0.23 m Ω/Ω + 1.1 M Ω	Double Substitution Method using Standard Resistors and Fluke 8508 8.5 Digit Multimeter.
Impedance – Measure ³	0.1 Ω 1 kHz 10 kHz 100 kHz 1 MHz 1 Ω 20 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz 2 MHz	1.8 % of reading 1.6 % of reading 1 % of reading 1.5 % of reading 0.67 % of reading 0.43 % of reading 0.33 % of reading 0.32 % of reading 0.31 % of reading 0.38 % of reading 0.92 % of reading	Comparison to Agilent E4980A LCR Meter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Impedance – Measure ³	10 Ω		Comparison to Agilent E4980A LCR Meter
	20 Hz	0.29 % of reading	
	100 Hz	0.2 % of reading	
	1 kHz	0.17 % of reading	
	10 kHz	0.19 % of reading	
	100 kHz	0.19 % of reading	
	1 MHz	0.27 % of reading	
	2 MHz	0.67 % of reading	
	100 Ω		
	20 Hz	0.16 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.12 % of reading	
	100 kHz	0.12 % of reading	
	1 MHz	0.2 % of reading	
	2 MHz	0.53 % of reading	
	1 k Ω		
	20 Hz	0.15 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.092 % of reading	
	1 MHz	0.14 % of reading	
	2 MHz	0.3 % of reading	
	10 k Ω		
	20 Hz	0.15 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.1 % of reading	
	1 MHz	0.29 of reading	
	2 MHz	0.87 of reading	
	100 k Ω		
	20 Hz	0.17 % of reading	
	100 Hz	0.1 % of reading	
	1 kHz	0.1 % of reading	
	10 kHz	0.17 % of reading	
	100 kHz	0.28 % of reading	
	1 MHz	0.38 % of reading	
	2 MHz	1.3 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 7 V / 3.2 V	10 Hz	0.009 % of reading	Comparison to Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.008 % of reading	
	50 Hz	0.006 % of reading	
	105 Hz	0.007 % of reading	
	200 Hz	0.006 % of reading	
	2 kHz	0.006 % of reading	
	10 kHz	0.006 % of reading	
	20 kHz	0.008 % of reading	
	50 kHz	0.007 % of reading	
	100 kHz	0.007 % of reading	
	200 kHz	0.007 % of reading	
	500 kHz	0.009 % of reading	
	700 kHz	0.013 % of reading	
	1 MHz	0.016 % of reading	
	1.2 MHz	0.016 % of reading	
	2 MHz	0.021 % of reading	
	3 MHz	0.024 % of reading	
	4 MHz	0.028 % of reading	
	6 MHz	0.031 % of reading	
	8 MHz	0.034 % of reading	
	9 MHz	0.034 % of reading	
	10 MHz	0.034 % of reading	
	12 MHz	0.042 % of reading	
	15 MHz	0.046 % of reading	
	17 MHz	0.052 % of reading	
	20 MHz	0.062 % of reading	
	23 MHz	0.087 % of reading	
	26 MHz	0.1 % of reading	
	28 MHz	0.11 % of reading	
	30 MHz	0.12 % of reading	
	35 MHz	0.15 % of reading	
	40 MHz	0.17 % of reading	
	45 MHz	0.20 % of reading	
	50 MHz	0.25 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 2.2 V / 2 V	10 Hz	0.012 % of reading	Comparison to Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.012 % of reading	
	50 Hz	0.007 % of reading	
	105 Hz	0.008 % of reading	
	200 Hz	0.006 % of reading	
	2 kHz	0.007 % of reading	
	10 kHz	0.007 % of reading	
	20 kHz	0.008 % of reading	
	50 kHz	0.007 % of reading	
	100 kHz	0.007 % of reading	
	200 kHz	0.007 % of reading	
	500 kHz	0.009 % of reading	
	700 kHz	0.014 % of reading	
	1 MHz	0.017 % of reading	
	1.2 MHz	0.017 % of reading	
	2 MHz	0.021 % of reading	
	3 MHz	0.026 % of reading	
	4 MHz	0.029 % of reading	
	6 MHz	0.033 % of reading	
	8 MHz	0.037 % of reading	
	9 MHz	0.036 % of reading	
	10 MHz	0.036 % of reading	
	12 MHz	0.045 % of reading	
	15 MHz	0.049 % of reading	
	17 MHz	0.054 % of reading	
	20 MHz	0.065 % of reading	
	23 MHz	0.045 % of reading	
	26 MHz	0.049 % of reading	
	28 MHz	0.054 % of reading	
	30 MHz	0.065 % of reading	
	35 MHz	0.089 % of reading	
	40 MHz	0.1 % of reading	
	45 MHz	0.12 % of reading	
	50 MHz	0.12 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 2.2 V / 1 V	10 Hz	0.014 % of reading	Comparison to Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.013 % of reading	
	50 Hz	0.008 % of reading	
	105 Hz	0.009 % of reading	
	200 Hz	0.007 % of reading	
	2 kHz	0.007 % of reading	
	10 kHz	0.007 % of reading	
	20 kHz	0.008 % of reading	
	50 kHz	0.007 % of reading	
	100 kHz	0.007 % of reading	
	200 kHz	0.007 % of reading	
	500 kHz	0.009 % of reading	
	700 kHz	0.014 % of reading	
	1 MHz	0.017 % of reading	
	1.2 MHz	0.017 % of reading	
	2 MHz	0.022 % of reading	
	3 MHz	0.027 % of reading	
	4 MHz	0.031 % of reading	
	6 MHz	0.035 % of reading	
	8 MHz	0.039 % of reading	
	9 MHz	0.04 % of reading	
	10 MHz	0.04 % of reading	
	12 MHz	0.049 % of reading	
	15 MHz	0.052 % of reading	
	17 MHz	0.056 % of reading	
	20 MHz	0.066 % of reading	
	23 MHz	0.049 % of reading	
	26 MHz	0.052 % of reading	
	28 MHz	0.056 % of reading	
	30 MHz	0.066 % of reading	
	35 MHz	0.09 % of reading	
	40 MHz	0.11 % of reading	
	45 MHz	0.12 % of reading	
	50 MHz	0.13 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 0.7 V / 0.64 V	10 Hz	0.017 % of reading	Comparison to Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.016 % of reading	
	50 Hz	0.009 % of reading	
	105 Hz	0.01 % of reading	
	200 Hz	0.008 % of reading	
	2 kHz	0.007 % of reading	
	10 kHz	0.007 % of reading	
	20 kHz	0.009 % of reading	
	50 kHz	0.008 % of reading	
	100 kHz	0.008 % of reading	
	200 kHz	0.008 % of reading	
	500 kHz	0.01 % of reading	
	700 kHz	0.015 % of reading	
	1 MHz	0.018 % of reading	
	1.2 MHz	0.018 % of reading	
	2 MHz	0.023 % of reading	
	3 MHz	0.028 % of reading	
	4 MHz	0.032 % of reading	
	6 MHz	0.037 % of reading	
	8 MHz	0.041 % of reading	
	9 MHz	0.042 % of reading	
	10 MHz	0.042 % of reading	
	12 MHz	0.052 % of reading	
	15 MHz	0.055 % of reading	
	17 MHz	0.059 % of reading	
	20 MHz	0.069 % of reading	
	23 MHz	0.052 % of reading	
	26 MHz	0.055 % of reading	
	28 MHz	0.059 % of reading	
	30 MHz	0.069 % of reading	
	35 MHz	0.093 % of reading	
	40 MHz	0.11 % of reading	
	45 MHz	0.12 % of reading	
	50 MHz	0.13 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 0.7 V / 0.32 V	10 Hz	0.014 % of reading	Comparison to Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.014 % of reading	
	50 Hz	0.008 % of reading	
	105 Hz	0.008 % of reading	
	200 Hz	0.007 % of reading	
	2 kHz	0.008 % of reading	
	10 kHz	0.007 % of reading	
	20 kHz	0.009 % of reading	
	50 kHz	0.008 % of reading	
	100 kHz	0.008 % of reading	
	200 kHz	0.008 % of reading	
	500 kHz	0.010 % of reading	
	700 kHz	0.015 % of reading	
	1 MHz	0.017 % of reading	
	1.2 MHz	0.018 % of reading	
	2 MHz	0.022 % of reading	
	3 MHz	0.028 % of reading	
	4 MHz	0.031 % of reading	
	6 MHz	0.034 % of reading	
	8 MHz	0.038 % of reading	
	9 MHz	0.038 % of reading	
	10 MHz	0.038 % of reading	
	12 MHz	0.049 % of reading	
	15 MHz	0.053 % of reading	
	17 MHz	0.060 % of reading	
	20 MHz	0.071 % of reading	
	23 MHz	0.049 % of reading	
	26 MHz	0.053 % of reading	
	28 MHz	0.06 % of reading	
	30 MHz	0.071 % of reading	
	35 MHz	0.094 % of reading	
	40 MHz	0.11 % of reading	
	45 MHz	0.12 % of reading	
	50 MHz	0.13 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 0.22 V / 0.1 V	10 Hz	0.018 % of reading	Comparison to Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.017 % of reading	
	50 Hz	0.01 % of reading	
	105 Hz	0.01 % of reading	
	200 Hz	0.008 % of reading	
	2 kHz	0.008 % of reading	
	10 kHz	0.008 % of reading	
	20 kHz	0.009 % of reading	
	50 kHz	0.009 % of reading	
	100 kHz	0.009 % of reading	
	200 kHz	0.009 % of reading	
	500 kHz	0.01 % of reading	
	700 kHz	0.016 % of reading	
	1 MHz	0.019 % of reading	
	1.2 MHz	0.019 % of reading	
	2 MHz	0.023 % of reading	
	3 MHz	0.03 % of reading	
	4 MHz	0.034 % of reading	
	6 MHz	0.038 % of reading	
	8 MHz	0.043 % of reading	
	9 MHz	0.043 % of reading	
	10 MHz	0.044 % of reading	
	12 MHz	0.055 % of reading	
	15 MHz	0.059 % of reading	
	17 MHz	0.064 % of reading	
	20 MHz	0.075 % of reading	
	23 MHz	0.055 % of reading	
	26 MHz	0.059 % of reading	
	28 MHz	0.064 % of reading	
	30 MHz	0.075 % of reading	
	35 MHz	0.098 % of reading	
	40 MHz	0.12 % of reading	
	45 MHz	0.13 % of reading	
	50 MHz	0.14 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 70 mV / 32 mV	10 Hz	0.019 % of reading	Comparison to Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.018 % of reading	
	50 Hz	0.009 % of reading	
	105 Hz	0.01 % of reading	
	200 Hz	0.008 % of reading	
	2 kHz	0.009 % of reading	
	10 kHz	0.009 % of reading	
	20 kHz	0.01 % of reading	
	50 kHz	0.009 % of reading	
	100 kHz	0.009 % of reading	
	200 kHz	0.01 % of reading	
	500 kHz	0.011 % of reading	
	700 kHz	0.016 % of reading	
	1 MHz	0.02 % of reading	
	1.2 MHz	0.02 % of reading	
	2 MHz	0.024 % of reading	
	3 MHz	0.031 % of reading	
	4 MHz	0.034 % of reading	
	6 MHz	0.039 % of reading	
	8 MHz	0.044 % of reading	
	9 MHz	0.044 % of reading	
	10 MHz	0.045 % of reading	
	12 MHz	0.057 % of reading	
	15 MHz	0.063 % of reading	
	17 MHz	0.07 % of reading	
	20 MHz	0.08 % of reading	
	23 MHz	0.057 % of reading	
	26 MHz	0.063 % of reading	
	28 MHz	0.07 % of reading	
	30 MHz	0.08 % of reading	
	35 MHz	0.1 % of reading	
	40 MHz	0.12 % of reading	
	45 MHz	0.13 % of reading	
	50 MHz	0.14 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 22 mV / 10 mV	10 Hz	0.022 % of reading	Comparison to Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.021 % of reading	
	50 Hz	0.011 % of reading	
	105 Hz	0.011 % of reading	
	200 Hz	0.009 % of reading	
	2 kHz	0.009 % of reading	
	10 kHz	0.009 % of reading	
	20 kHz	0.01 % of reading	
	50 kHz	0.01 % of reading	
	100 kHz	0.01 % of reading	
	200 kHz	0.01 % of reading	
	500 kHz	0.012 % of reading	
	700 kHz	0.017 % of reading	
	1 MHz	0.021 % of reading	
	1.2 MHz	0.021 % of reading	
	2 MHz	0.025 % of reading	
	3 MHz	0.033 % of reading	
	4 MHz	0.037 % of reading	
	6 MHz	0.043 % of reading	
	8 MHz	0.048 % of reading	
	9 MHz	0.049 % of reading	
	10 MHz	0.05 % of reading	
	12 MHz	0.063 % of reading	
	15 MHz	0.068 % of reading	
	17 MHz	0.073 % of reading	
	20 MHz	0.084 % of reading	
	23 MHz	0.063 % of reading	
	26 MHz	0.068 % of reading	
	28 MHz	0.073 % of reading	
	30 MHz	0.084 % of reading	
	35 MHz	0.11 % of reading	
	40 MHz	0.12 % of reading	
	45 MHz	0.14 % of reading	
	50 MHz	0.15 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 7 mV / 3.2 mV	10 Hz	0.022 % of reading	Comparison to Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.022 % of reading	
	50 Hz	0.01 % of reading	
	105 Hz	0.011 % of reading	
	200 Hz	0.009 % of reading	
	2 kHz	0.01 % of reading	
	10 kHz	0.01 % of reading	
	20 kHz	0.011 % of reading	
	50 kHz	0.01 % of reading	
	100 kHz	0.01 % of reading	
	200 kHz	0.01 % of reading	
	500 kHz	0.012 % of reading	
	700 kHz	0.018 % of reading	
	1 MHz	0.021 % of reading	
	1.2 MHz	0.021 % of reading	
	2 MHz	0.025 % of reading	
	3 MHz	0.034 % of reading	
	4 MHz	0.036 % of reading	
	6 MHz	0.042 % of reading	
	8 MHz	0.047 % of reading	
	9 MHz	0.048 % of reading	
	10 MHz	0.049 % of reading	
	12 MHz	0.063 % of reading	
	15 MHz	0.069 % of reading	
	17 MHz	0.076 % of reading	
	20 MHz	0.087 % of reading	
	23 MHz	0.063 % of reading	
	26 MHz	0.069 % of reading	
	28 MHz	0.076 % of reading	
	30 MHz	0.087 % of reading	
	35 MHz	0.11 % of reading	
	40 MHz	0.13 % of reading	
	45 MHz	0.14 % of reading	
	50 MHz	0.15 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 2.2 mV / 1 mV	10 Hz	0.025 % of reading	Comparison to Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.024 % of reading	
	50 Hz	0.011 % of reading	
	105 Hz	0.012 % of reading	
	200 Hz	0.01 % of reading	
	2 kHz	0.01 % of reading	
	10 kHz	0.01 % of reading	
	20 kHz	0.011 % of reading	
	50 kHz	0.01 % of reading	
	100 kHz	0.011 % of reading	
	200 kHz	0.011 % of reading	
	500 kHz	0.013 % of reading	
	700 kHz	0.018 % of reading	
	1 MHz	0.022 % of reading	
	1.2 MHz	0.022 % of reading	
	2 MHz	0.026 % of reading	
	3 MHz	0.036 % of reading	
	4 MHz	0.039 % of reading	
	6 MHz	0.045 % of reading	
	8 MHz	0.051 % of reading	
	9 MHz	0.052 % of reading	
	10 MHz	0.053 % of reading	
	12 MHz	0.068 % of reading	
	15 MHz	0.073 % of reading	
	17 MHz	0.079 % of reading	
	20 MHz	0.09 % of reading	
	23 MHz	0.068 % of reading	
	26 MHz	0.073 % of reading	
	28 MHz	0.079 % of reading	
	30 MHz	0.09 % of reading	
	35 MHz	0.11 % of reading	
	40 MHz	0.13 % of reading	
	45 MHz	0.14 % of reading	
	50 MHz	0.15 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Low Frequency – AC/DC Difference Measurement (Voltage)	2 mV		Comparison to Fluke 792A AC/DC Transfer Standard
	10 Hz	0.56 mV/V	
	20 Hz	0.35 mV/V	
	40 Hz	0.45 mV/V	
	100 Hz	0.39 mV/V	
	1 kHz	0.34 mV/V	
	10 kHz	0.32 mV/V	
	20 kHz	0.32 mV/V	
	50 kHz	0.35 mV/V	
	100 kHz	0.44 mV/V	
	300 kHz	0.51 mV/V	
	500 kHz	0.61 mV/V	
	800 kHz	0.75 mV/V	
	1 MHz	0.76 mV/V	
	6 mV		
	10 Hz	0.23 mV/V	
	20 Hz	0.23 mV/V	
	40 Hz	0.23 mV/V	
	100 Hz	0.19 mV/V	
	1 kHz	0.18 mV/V	
	10 kHz	0.17 mV/V	
	20 kHz	0.2 mV/V	
	50 kHz	0.22 mV/V	
	100 kHz	0.3 mV/V	
	300 kHz	0.41 mV/V	
	500 kHz	0.49 mV/V	
	800 kHz	0.58 mV/V	
	1 MHz	0.63 mV/V	

Low Frequency – AC/DC Difference Measurement (Voltage)	10 mV	10 Hz 0.11 mV/V 20 Hz 0.11 mV/V 40 Hz 89 µV/V 100 Hz 0.14 mV/V 1 kHz 88 µV/V 10 kHz 0.11 mV/V 20 kHz 83 µV/V 50 kHz 0.1 mV/V 100 kHz 0.16 mV/V 300 kHz 0.22 mV/V 500 kHz 0.3 mV/V 800 kHz 0.33 mV/V 1 MHz 0.42 mV/V	Comparison to Fluke 792A AC/DC Transfer Standard
	20 mV	10 Hz 84 µV/V 20 Hz 68 µV/V 40 Hz 64 µV/V 100 Hz 0.11 mV/V 1 kHz 67 µV/V 10 kHz 81 µV/V 20 kHz 62 µV/V 50 kHz 0.11 mV/V 100 kHz 0.16 mV/V 300 kHz 0.22 mV/V 500 kHz 0.31 mV/V 800 kHz 0.38 mV/V 1 MHz 0.39 mV/V	
	60 mV	10 Hz 0.1 mV/V 20 Hz 45 µV/V 40 Hz 35 µV/V 100 Hz 33 µV/V 1 kHz 32 µV/V 10 kHz 37 µV/V 20 kHz 35 µV/V 50 kHz 40 µV/V 100 kHz 77 µV/V 300 kHz 0.15 mV/V 500 kHz 0.22 mV/V 800 kHz 0.29 mV/V 1 MHz 0.3 mV/V	
	0.1 V	10 Hz 46 µV/V 20 Hz 29 µV/V 40 Hz 21 µV/V	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
	100 Hz	15 $\mu\text{V/V}$	
	1 kHz	14 $\mu\text{V/V}$	
	10 kHz	26 $\mu\text{V/V}$	
	20 kHz	29 $\mu\text{V/V}$	
	50 kHz	30 $\mu\text{V/V}$	
	100 kHz	45 $\mu\text{V/V}$	
	300 kHz	90 $\mu\text{V/V}$	
	500 kHz	0.13 mV/V	
	800 kHz	0.19 mV/V	
	1 MHz	0.2 mV/V	
	0.2 V		
	10 Hz	35 $\mu\text{V/V}$	
	20 Hz	21 $\mu\text{V/V}$	
	40 Hz	29 $\mu\text{V/V}$	
	100 Hz	16 $\mu\text{V/V}$	
	1 kHz	12 $\mu\text{V/V}$	
	10 kHz	20 $\mu\text{V/V}$	
	20 kHz	17 $\mu\text{V/V}$	
	50 kHz	28 $\mu\text{V/V}$	
	100 kHz	48 $\mu\text{V/V}$	
	300 kHz	76 $\mu\text{V/V}$	
	500 kHz	0.11 mV/V	
	800 kHz	0.16 mV/V	
	1 MHz	0.19 mV/V	
	0.6 V		
	10 Hz	28 $\mu\text{V/V}$	
	20 Hz	24 $\mu\text{V/V}$	
	40 Hz	7.6 $\mu\text{V/V}$	
	100 Hz	8.7 $\mu\text{V/V}$	
	1 kHz	9.2 $\mu\text{V/V}$	
	10 kHz	7.8 $\mu\text{V/V}$	
	20 kHz	9.7 $\mu\text{V/V}$	
	50 kHz	8.6 $\mu\text{V/V}$	
	100 kHz	30 $\mu\text{V/V}$	
	300 kHz	26 $\mu\text{V/V}$	
	500 kHz	47 $\mu\text{V/V}$	
	800 kHz	60 $\mu\text{V/V}$	
	1 MHz	81 $\mu\text{V/V}$	



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Low Frequency – AC/DC Difference Measurement (Voltage)	1 V	10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz 100 kHz 300 kHz 500 kHz 800 kHz 1 MHz	29 $\mu\text{V/V}$ 18 $\mu\text{V/V}$ 6.5 $\mu\text{V/V}$ 6.7 $\mu\text{V/V}$ 7 $\mu\text{V/V}$ 6 $\mu\text{V/V}$ 6 $\mu\text{V/V}$ 8.2 $\mu\text{V/V}$ 14 $\mu\text{V/V}$ 22 $\mu\text{V/V}$ 35 $\mu\text{V/V}$ 36 $\mu\text{V/V}$ 48 $\mu\text{V/V}$	Comparison to Fluke 792A AC/DC Transfer Standard
	2 V	10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz 100 kHz 300 kHz 500 kHz 800 kHz 1 MHz	25 $\mu\text{V/V}$ 15 $\mu\text{V/V}$ 6.6 $\mu\text{V/V}$ 6.4 $\mu\text{V/V}$ 6.5 $\mu\text{V/V}$ 6.2 $\mu\text{V/V}$ 6.8 $\mu\text{V/V}$ 7.9 $\mu\text{V/V}$ 14 $\mu\text{V/V}$ 33 $\mu\text{V/V}$ 33 $\mu\text{V/V}$ 32 $\mu\text{V/V}$ 45 $\mu\text{V/V}$	
	6 V	10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz 100 kHz 300 kHz 500 kHz 800 kHz 1 MHz	32 $\mu\text{V/V}$ 16 $\mu\text{V/V}$ 5.6 $\mu\text{V/V}$ 6.1 $\mu\text{V/V}$ 5.8 $\mu\text{V/V}$ 6.3 $\mu\text{V/V}$ 5.8 $\mu\text{V/V}$ 6.5 $\mu\text{V/V}$ 9.4 $\mu\text{V/V}$ 20 $\mu\text{V/V}$ 27 $\mu\text{V/V}$ 33 $\mu\text{V/V}$ 42 $\mu\text{V/V}$	
	10 V	10 Hz 20 Hz 40 Hz	26 $\mu\text{V/V}$ 15 $\mu\text{V/V}$ 5.5 $\mu\text{V/V}$	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
	100 Hz	6.3 $\mu\text{V/V}$	
	1 kHz	5.9 $\mu\text{V/V}$	
	10 kHz	5.5 $\mu\text{V/V}$	
	20 kHz	5.6 $\mu\text{V/V}$	
	50 kHz	7.3 $\mu\text{V/V}$	
	100 kHz	9.6 $\mu\text{V/V}$	
	300 kHz	20 $\mu\text{V/V}$	
	500 kHz	35 $\mu\text{V/V}$	
	800 kHz	56 $\mu\text{V/V}$	
	1 MHz	81 $\mu\text{V/V}$	
	20 V		
	10 Hz	37 $\mu\text{V/V}$	
	20 Hz	17 $\mu\text{V/V}$	
	40 Hz	8 $\mu\text{V/V}$	
	100 Hz	7.9 $\mu\text{V/V}$	
	1 kHz	7.7 $\mu\text{V/V}$	
	10 kHz	7.9 $\mu\text{V/V}$	
	20 kHz	7.8 $\mu\text{V/V}$	
	50 kHz	8.9 $\mu\text{V/V}$	
	100 kHz	12 $\mu\text{V/V}$	
	300 kHz	22 $\mu\text{V/V}$	
	500 kHz	28 $\mu\text{V/V}$	
	800 kHz	37 $\mu\text{V/V}$	
	1 MHz	55 $\mu\text{V/V}$	
	60 V		
	10 Hz	36 $\mu\text{V/V}$	
	20 Hz	17 $\mu\text{V/V}$	
	40 Hz	7.1 $\mu\text{V/V}$	
	100 Hz	6.9 $\mu\text{V/V}$	
	1 kHz	7.3 $\mu\text{V/V}$	
	10 kHz	7.0 $\mu\text{V/V}$	
	20 kHz	7.7 $\mu\text{V/V}$	
	50 kHz	15 $\mu\text{V/V}$	
	100 kHz	11 $\mu\text{V/V}$	
	300 kHz	33 $\mu\text{V/V}$	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Low Frequency – AC/DC Difference Measurement (Voltage)	100 V		Comparison to Fluke 792A AC/DC Transfer Standard
	10 Hz	27 $\mu\text{V/V}$	
	20 Hz	15 $\mu\text{V/V}$	
	40 Hz	7.2 $\mu\text{V/V}$	
	100 Hz	6.9 $\mu\text{V/V}$	
	1 kHz	7 $\mu\text{V/V}$	
	10 kHz	7.1 $\mu\text{V/V}$	
	20 kHz	7.6 $\mu\text{V/V}$	
	50 kHz	12 $\mu\text{V/V}$	
	100 kHz	18 $\mu\text{V/V}$	
	200 V		
	10 Hz	44 $\mu\text{V/V}$	
	20 Hz	17 $\mu\text{V/V}$	
	40 Hz	10 $\mu\text{V/V}$	
	100 Hz	10 $\mu\text{V/V}$	
	1 kHz	9.7 $\mu\text{V/V}$	
	10 kHz	9.8 $\mu\text{V/V}$	
	20 kHz	10.3 $\mu\text{V/V}$	
	50 kHz	12 $\mu\text{V/V}$	
	100 kHz	19 $\mu\text{V/V}$	
	600 V		
	10 Hz	54 $\mu\text{V/V}$	
	20 Hz	29 $\mu\text{V/V}$	
	40 Hz	14 $\mu\text{V/V}$	
	100 Hz	15 $\mu\text{V/V}$	
	1 kHz	13 $\mu\text{V/V}$	
	10 kHz	18 $\mu\text{V/V}$	
	20 kHz	20 $\mu\text{V/V}$	
	50 kHz	32 $\mu\text{V/V}$	
	100 kHz	72 $\mu\text{V/V}$	
	1 000 V		
	10 Hz	54 $\mu\text{V/V}$	
	20 Hz	22 $\mu\text{V/V}$	
	40 Hz	13 $\mu\text{V/V}$	
	100 Hz	12 $\mu\text{V/V}$	
	1 kHz	13 $\mu\text{V/V}$	
	10 kHz	16 $\mu\text{V/V}$	
	20 kHz	22 $\mu\text{V/V}$	
	50 kHz	47 $\mu\text{V/V}$	
	100 kHz	67 $\mu\text{V/V}$	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure (Current w/ Voltage Output Reading)	0.1 mA		Comparison to Fluke 792A AC/DC Transfer Standard, Fluke A40 Current Shunts
	10 Hz	75 $\mu\text{V/V}$	
	20 Hz	70 $\mu\text{V/V}$	
	40 Hz	61 $\mu\text{V/V}$	
	400 Hz	59 $\mu\text{V/V}$	
	1 kHz	56 $\mu\text{V/V}$	
	5 kHz	73 $\mu\text{V/V}$	
	10 kHz	83 $\mu\text{V/V}$	
	20 kHz	0.12 mV/V	
	30 kHz	0.16 mV/V	
	0.2 mA		
	10 Hz	95 $\mu\text{V/V}$	
	20 Hz	56 $\mu\text{V/V}$	
	40 Hz	59 $\mu\text{V/V}$	
	400 Hz	45 $\mu\text{V/V}$	
	1 kHz	43 $\mu\text{V/V}$	
	5 kHz	69 $\mu\text{V/V}$	
	10 kHz	81 $\mu\text{V/V}$	
	20 kHz	0.12 mV/V	
	30 kHz	0.19 mV/V	
	0.3 mA		
	10 Hz	71 $\mu\text{V/V}$	
	20 Hz	70 $\mu\text{V/V}$	
	40 Hz	49 $\mu\text{V/V}$	
	400 Hz	47 $\mu\text{V/V}$	
	1 kHz	47 $\mu\text{V/V}$	
	5 kHz	47 $\mu\text{V/V}$	
	10 kHz	49 $\mu\text{V/V}$	
	20 kHz	68 $\mu\text{V/V}$	
	30 kHz	0.12 mV/V	
	1 mA		
	10 Hz	56 $\mu\text{V/V}$	
	20 Hz	47 $\mu\text{V/V}$	
	40 Hz	41 $\mu\text{V/V}$	
	400 Hz	34 $\mu\text{V/V}$	
	1 kHz	30 $\mu\text{V/V}$	
	5 kHz	34 $\mu\text{V/V}$	
	10 kHz	37 $\mu\text{V/V}$	
	20 kHz	43 $\mu\text{V/V}$	
	30 kHz	36 $\mu\text{V/V}$	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure (Current w/ Voltage Output Reading)	2 mA		Comparison to Fluke 792A AC/DC Transfer Standard, Fluke A40 Current Shunts
	10 Hz	54 $\mu\text{V/V}$	
	20 Hz	42 $\mu\text{V/V}$	
	40 Hz	46 $\mu\text{V/V}$	
	400 Hz	38 $\mu\text{V/V}$	
	1 kHz	38 $\mu\text{V/V}$	
	5 kHz	39 $\mu\text{V/V}$	
	10 kHz	41 $\mu\text{V/V}$	
	20 kHz	41 $\mu\text{V/V}$	
	30 kHz	48 $\mu\text{V/V}$	
	3 mA		
	10 Hz	51 $\mu\text{V/V}$	
	20 Hz	40 $\mu\text{V/V}$	
	40 Hz	35 $\mu\text{V/V}$	
	400 Hz	33 $\mu\text{V/V}$	
	1 kHz	33 $\mu\text{V/V}$	
	5 kHz	32 $\mu\text{V/V}$	
	10 kHz	32 $\mu\text{V/V}$	
	20 kHz	38 $\mu\text{V/V}$	
	30 kHz	44 $\mu\text{V/V}$	
	10 mA		
	10 Hz	0.1 mV/V	
	20 Hz	53 $\mu\text{V/V}$	
	40 Hz	38 $\mu\text{V/V}$	
	400 Hz	37 $\mu\text{V/V}$	
	1 kHz	32 $\mu\text{V/V}$	
	5 kHz	31 $\mu\text{V/V}$	
	10 kHz	32 $\mu\text{V/V}$	
	20 kHz	42 $\mu\text{V/V}$	
	30 kHz	63 $\mu\text{V/V}$	
	20 mA		
	10 Hz	0.14 mV/V	
	20 Hz	84 $\mu\text{V/V}$	
	40 Hz	78 $\mu\text{V/V}$	
	400 Hz	77 $\mu\text{V/V}$	
	1 kHz	76 $\mu\text{V/V}$	
	5 kHz	76 $\mu\text{V/V}$	
	10 kHz	76 $\mu\text{V/V}$	
	20 kHz	78 $\mu\text{V/V}$	
	30 kHz	93 $\mu\text{V/V}$	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure (Current w/ Voltage Output Reading)	30 mA		Comparison to Fluke 792A AC/DC Transfer Standard, Fluke A40 Current Shunts
	10 Hz	0.15 mV/V	
	20 Hz	92 μ V/V	
	40 Hz	72 μ V/V	
	400 Hz	66 μ V/V	
	1 kHz	66 μ V/V	
	5 kHz	67 μ V/V	
	10 kHz	73 μ V/V	
	20 kHz	85 μ V/V	
	30 kHz	0.11 mV/V	
	0.1 A		
	10 Hz	0.14 mV/V	
	20 Hz	64 μ V/V	
	40 Hz	53 μ V/V	
	400 Hz	51 μ V/V	
	1 kHz	48 μ V/V	
	5 kHz	48 μ V/V	
	10 kHz	49 μ V/V	
	20 kHz	61 μ V/V	
	30 kHz	78 μ V/V	
	0.2 A		
	10 Hz	0.15 mV/V	
	20 Hz	58 μ V/V	
	40 Hz	39 μ V/V	
	400 Hz	37 μ V/V	
	1 kHz	40 μ V/V	
	5 kHz	34 μ V/V	
	10 kHz	33 μ V/V	
	20 kHz	49 μ V/V	
	30 kHz	68 μ V/V	
	0.3 A		
	10 Hz	0.12 mV/V	
	20 Hz	56 μ V/V	
	40 Hz	43 μ V/V	
	400 Hz	33 μ V/V	
	1 kHz	32 μ V/V	
	5 kHz	31 μ V/V	
	10 kHz	36 μ V/V	
	20 kHz	43 μ V/V	
	30 kHz	72 μ V/V	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure (Current w/ Voltage Output Reading)	0.5 A		Comparison to Fluke 792A AC/DC Transfer Standard, Fluke A40 Current Shunts
	10 Hz	0.26 mV/V	
	20 Hz	51 μ V/V	
	40 Hz	75 μ V/V	
	400 Hz	50 μ V/V	
	1 kHz	45 μ V/V	
	5 kHz	37 μ V/V	
	10 kHz	29 μ V/V	
	20 kHz	47 μ V/V	
	30 kHz	79 μ V/V	
	1 A		
	10 Hz	98 μ V/V	
	20 Hz	50 μ V/V	
	40 Hz	38 μ V/V	
	400 Hz	39 μ V/V	
	1 kHz	35 μ V/V	
	5 kHz	39 μ V/V	
	10 kHz	48 μ V/V	
	20 kHz	80 μ V/V	
	30 kHz	0.12 mV/V	
	2 A		
	10 Hz	0.11 mV/V	
	20 Hz	56 μ V/V	
	40 Hz	42 μ V/V	
	400 Hz	37 μ V/V	
	1 kHz	35 μ V/V	
	5 kHz	42 μ V/V	
	10 kHz	43 μ V/V	
	20 kHz	55 μ V/V	
	30 kHz	0.11 mV/V	
	3 A		
	10 Hz	0.13 mV/V	
	20 Hz	66 μ V/V	
	40 Hz	57 μ V/V	
	400 Hz	56 μ V/V	
	1 kHz	55 μ V/V	
	5 kHz	61 μ V/V	
	10 kHz	63 μ V/V	
	20 kHz	83 μ V/V	
	30 kHz	0.14 mV/V	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure (Current w/ Voltage Output Reading)	5 A		Comparison to Fluke 792A AC/DC Transfer Standard, Fluke A40 Current Shunts
	10 Hz	0.13 mV/V	
	20 Hz	67 μ V/V	
	40 Hz	56 μ V/V	
	400 Hz	61 μ V/V	
	1 kHz	53 μ V/V	
	5 kHz	58 μ V/V	
	10 kHz	69 μ V/V	
	20 kHz	88 μ V/V	
	30 kHz	0.18 mV/V	
	10 A		
	10 Hz	0.15 mV/V	
	20 Hz	84 μ V/V	
	40 Hz	65 μ V/V	
	400 Hz	64 μ V/V	
	1 kHz	62 μ V/V	
	5 kHz	62 μ V/V	
	10 kHz	62 μ V/V	
	20 kHz	0.1 mV/V	
	30 kHz	0.15 mV/V	
	20 A		
	10 Hz	0.15 mV/V	
	20 Hz	0.12 mV/V	
	40 Hz	81 μ V/V	
	400 Hz	81 μ V/V	
	1 kHz	77 μ V/V	
	5 kHz	77 μ V/V	
	10 kHz	77 μ V/V	
	20 kHz	0.13 mV/V	
	30 kHz	0.18 mV/V	
	100 A		
	10 Hz	0.16 mV/V	
	20 Hz	0.16 mV/V	
	40 Hz	96 μ V/V	
	400 Hz	86 μ V/V	
	1 kHz	86 μ V/V	
	5 kHz	0.12 mV/V	



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AC Voltage – Measure	2 mV	10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz 100 kHz 300 kHz 500 kHz 800 kHz 1 MHz	0.56 mV/V 0.35 mV/V 0.45 mV/V 0.39 mV/V 0.34 mV/V 0.32 mV/V 0.32 mV/V 0.35 mV/V 0.44 mV/V 0.51 mV/V 0.61 mV/V 0.75 mV/V 0.76 mV/V	Comparison to Fluke 792A AC/DC Transfer Standard
	6 mV	10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz 100 kHz 300 kHz 500 kHz 800 kHz 1 MHz	0.23 mV/V 0.23 mV/V 0.23 mV/V 0.19 mV/V 0.18 mV/V 0.17 mV/V 0.2 mV/V 0.22 mV/V 0.3 mV/V 0.41 mV/V 0.49 mV/V 0.58 mV/V 0.63 mV/V	
	10 mV	10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz 100 kHz 300 kHz 500 kHz 800 kHz 1 MHz	0.11 mV/V 0.11 mV/V 89 μ V/V 0.14 mV/V 88 μ V/V 0.11 mV/V 83 μ V/V 0.1 mV/V 0.16 mV/V 0.22 mV/V 0.3 mV/V 0.33 mV/V 0.42 mV/V	
	20 mV	10 Hz 20 Hz 40 Hz	84 μ V/V 68 μ V/V 64 μ V/V	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
	100 Hz	0.11 mV/V	
	1 kHz	67 μ V/V	
	10 kHz	81 μ V/V	
	20 kHz	62 μ V/V	
	50 kHz	0.11 mV/V	
	100 kHz	0.16 mV/V	
	300 kHz	0.22 mV/V	
	500 kHz	0.31 mV/V	
	800 kHz	0.38 mV/V	
	1 MHz	0.39 mV/V	
	60 mV		
	10 Hz	0.1 mV/V	
	20 Hz	45 μ V/V	
	40 Hz	35 μ V/V	
	100 Hz	33 μ V/V	
	1 kHz	32 μ V/V	
	10 kHz	37 μ V/V	
	20 kHz	35 μ V/V	
	50 kHz	40 μ V/V	
	100 kHz	77 μ V/V	
	300 kHz	0.15 mV/V	
	500 kHz	0.22 mV/V	
	800 kHz	0.29 mV/V	
	1 MHz	0.3 mV/V	
	0.1 V		
	10 Hz	46 μ V/V	
	20 Hz	29 μ V/V	
	40 Hz	21 μ V/V	
	100 Hz	15 μ V/V	
	1 kHz	14 μ V/V	
	10 kHz	26 μ V/V	
	20 kHz	29 μ V/V	
	50 kHz	30 μ V/V	
	100 kHz	45 μ V/V	
	300 kHz	90 μ V/V	
	500 kHz	0.13 mV/V	
	800 kHz	0.19 mV/V	
	1 MHz	0.2 mV/V	



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AC Voltage – Measure	0.2 V	10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz 100 kHz 300 kHz 500 kHz 800 kHz 1 MHz	35 $\mu\text{V/V}$ 21 $\mu\text{V/V}$ 29 $\mu\text{V/V}$ 16 $\mu\text{V/V}$ 12 $\mu\text{V/V}$ 20 $\mu\text{V/V}$ 17 $\mu\text{V/V}$ 28 $\mu\text{V/V}$ 48 $\mu\text{V/V}$ 76 $\mu\text{V/V}$ 0.11 mV/V 0.16 mV/V 0.19 mV/V	Comparison to Fluke 792A AC/DC Transfer Standard
	0.6 V	10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz 100 kHz 300 kHz 500 kHz 800 kHz 1 MHz	28 $\mu\text{V/V}$ 24 $\mu\text{V/V}$ 7.6 $\mu\text{V/V}$ 8.7 $\mu\text{V/V}$ 9.2 $\mu\text{V/V}$ 7.8 $\mu\text{V/V}$ 9.7 $\mu\text{V/V}$ 8.6 $\mu\text{V/V}$ 30 $\mu\text{V/V}$ 26 $\mu\text{V/V}$ 47 $\mu\text{V/V}$ 60 $\mu\text{V/V}$ 81 $\mu\text{V/V}$	
	1 V	10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz 100 kHz 300 kHz 500 kHz 800 kHz 1 MHz	29 $\mu\text{V/V}$ 18 $\mu\text{V/V}$ 6.5 $\mu\text{V/V}$ 6.7 $\mu\text{V/V}$ 7 $\mu\text{V/V}$ 6 $\mu\text{V/V}$ 6 $\mu\text{V/V}$ 8.2 $\mu\text{V/V}$ 14 $\mu\text{V/V}$ 22 $\mu\text{V/V}$ 35 $\mu\text{V/V}$ 36 $\mu\text{V/V}$ 48 $\mu\text{V/V}$	
AC Voltage – Measure	2 V	10 Hz 20 Hz 40 Hz	25 $\mu\text{V/V}$ 15 $\mu\text{V/V}$ 6.6 $\mu\text{V/V}$	Comparison to Fluke 792A AC/DC Transfer Standard

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
	100 Hz	6.4 μ V/V	
	1 kHz	6.5 μ V/V	
	10 kHz	6.2 μ V/V	
	20 kHz	6.8 μ V/V	
	50 kHz	7.9 μ V/V	
	100 kHz	14 μ V/V	
	300 kHz	33 μ V/V	
	500 kHz	33 μ V/V	
	800 kHz	32 μ V/V	
	1 MHz	45 μ V/V	
	6 V		
	10 Hz	32 μ V/V	
	20 Hz	16 μ V/V	
	40 Hz	5.6 μ V/V	
	100 Hz	6.1 μ V/V	
	1 kHz	5.8 μ V/V	
	10 kHz	6.3 μ V/V	
	20 kHz	5.8 μ V/V	
	50 kHz	6.5 μ V/V	
	100 kHz	9.4 μ V/V	
	300 kHz	20 μ V/V	
	500 kHz	27 μ V/V	
	800 kHz	33 μ V/V	
	1 MHz	42 μ V/V	
	10 V		
	10 Hz	26 μ V/V	
	20 Hz	15 μ V/V	
	40 Hz	5.5 μ V/V	
	100 Hz	6.3 μ V/V	
	1 kHz	5.9 μ V/V	
	10 kHz	5.5 μ V/V	
	20 kHz	5.6 μ V/V	
	50 kHz	7.3 μ V/V	
	100 kHz	9.6 μ V/V	
	300 kHz	20 μ V/V	
	500 kHz	35 μ V/V	
	800 kHz	56 μ V/V	
	1 MHz	81 μ V/V	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	20 V		Comparison to Fluke 792A AC/DC Transfer Standard
	10 Hz	37 μ V/V	
	20 Hz	17 μ V/V	
	40 Hz	8 μ V/V	
	100 Hz	7.9 μ V/V	
	1 kHz	7.7 μ V/V	
	10 kHz	7.9 μ V/V	
	20 kHz	7.8 μ V/V	
	50 kHz	8.9 μ V/V	
	100 kHz	12 μ V/V	
	300 kHz	22 μ V/V	
	500 kHz	28 μ V/V	
	800 kHz	37 μ V/V	
	1 MHz	55 μ V/V	
	60 V		
	10 Hz	36 μ V/V	
	20 Hz	17 μ V/V	
	40 Hz	7.1 μ V/V	
	100 Hz	6.9 μ V/V	
	1 kHz	7.3 μ V/V	
	10 kHz	7.0 μ V/V	
	20 kHz	7.7 μ V/V	
	50 kHz	15 μ V/V	
	100 kHz	11 μ V/V	
	300 kHz	33 μ V/V	
	100 V		
	10 Hz	27 μ V/V	
	20 Hz	15 μ V/V	
	40 Hz	7.2 μ V/V	
	100 Hz	6.9 μ V/V	
	1 kHz	7 μ V/V	
	10 kHz	7.1 μ V/V	
	20 kHz	7.6 μ V/V	
	50 kHz	12 μ V/V	
	100 kHz	18 μ V/V	
	200 V		
	10 Hz	44 μ V/V	
	20 Hz	17 μ V/V	
	40 Hz	10 μ V/V	
	100 Hz	10 μ V/V	
	1 kHz	9.7 μ V/V	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	200 V		Comparison to Fluke 792A AC/DC Transfer Standard
	10 kHz	9.8 μ V/V	
	20 kHz	10 μ V/V	
	50 kHz	12 μ V/V	
	100 kHz	19 μ V/V	
	600 V		
	10 Hz	54 μ V/V	
	20 Hz	29 μ V/V	
	40 Hz	14 μ V/V	
	100 Hz	15 μ V/V	
	1 kHz	13 μ V/V	
	10 kHz	18 μ V/V	
	20 kHz	20 μ V/V	
	50 kHz	32 μ V/V	
	100 kHz	72 μ V/V	
	1 000 V		
	10 Hz	54 μ V/V	
	20 Hz	22 μ V/V	
	40 Hz	13 μ V/V	
	100 Hz	12 μ V/V	
	1 kHz	13 μ V/V	
	10 kHz	16 μ V/V	
	20 kHz	22 μ V/V	
	50 kHz	47 μ V/V	
	100 kHz	67 μ V/V	
Inductance – Measure ³	1 μ H		Comparison to Agilent E4980A LCR Meter
	10 kHz	1.6 % of reading	
	100 kHz	0.36 % of reading	
	1 MHz	0.27 % of reading	
	2 MHz	0.66 % of reading	
	10 μ H		
	10 kHz	0.37 % of reading	
	100 kHz	0.2 % of reading	
	1 MHz	0.2 % of reading	
	2 MHz	0.3 % of reading	
	100 μ H		
	1 kHz	0.4 % of reading	
	10 kHz	0.2 % of reading	
	100 kHz	0.12 % of reading	
	1 MHz	0.14 % of reading	
	2 MHz	0.72 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure ³	1 mH		Comparison to Agilent E4980A LCR Meter
	100 Hz	0.55 % of reading	
	1 kHz	0.18 % of reading	
	10 kHz	0.12 % of reading	
	100 kHz	0.092 % of reading	
	1 MHz	0.23 % of reading	
	2 MHz	0.88 % of reading	
	10 mH		
	20 Hz	0.85 % of reading	
	100 Hz	0.22 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.1 % of reading	
	1 MHz	0.35 % of reading	
	2 MHz	1.3 % of reading	
	100 mH		
	20 Hz	0.28 % of reading	
	100 Hz	0.1 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.21 % of reading	
	1 MHz	0.88 % of reading	
	1 H		
	20 Hz	0.16 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.1 % of reading	
	100 kHz	0.31 % of reading	
	10 H		
	20 Hz	0.15 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.1 % of reading	
	10 kHz	0.21 % of reading	
	100 kHz	0.69 % of reading	
	100 H		
	20 Hz	0.15 % of reading	
	100 Hz	0.10 % of reading	
	1 kHz	0.15 % of reading	
	10 kHz	0.62 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current Harmonics – Source ^{1,3}			
Carrier Range: 0.25 A	Up to 75 mA (16 to 850) Hz 850 Hz to 6.5 kHz	61 μ A/A + 21 μ A 0.46 mA/A + 22 μ A	Comparison to Fluke 6105A Electrical Power Quality Calibrator
Carrier Range: 0.5 A	Up to 0.15 A (16 to 850) Hz 850 Hz to 6.5 kHz	70 μ A/A + 21 μ A 0.46 mA/A + 23 μ A	
Carrier Range: 1 A	Up to 0.3 A (16 to 850) Hz 850 Hz to 6.5 kHz	70 μ A/A + 29 μ A 0.46 mA/A + 29 μ A	
Carrier Range: 2 A	Up to 0.6 A (16 to 850) Hz 850 Hz to 6.5 kHz	70 μ A/A + 0.1 mA 0.46 mA/A + 0.1 mA	
Carrier Range: 5 A	Up to 1.5 A (16 to 850) Hz 850 Hz to 6.5 kHz	70 μ A/A + 0.1 mA 0.46 mA/A + 0.1 mA	
Carrier Range: 10 A	Up to 3 A (16 to 850) Hz 850 Hz to 6.5 kHz	74 μ A/A + 0.29 mA 0.46 mA/A + 0.29 mA	
Carrier Range: 20 A	Up to 6 A (16 to 850) Hz 850 Hz to 6.5 kHz	75 μ A/A + 0.45 mA 0.46 mA/A + 0.45 mA	
AC Voltage Harmonics – Source ^{1,3}			
Carrier Range: 23 V	Up to 6.9 V (16 to 850) Hz 850 Hz to 6.5 kHz	58 μ V/V + 1 mV 0.52 mV + 1 mV	Comparison to Fluke 6105A Electrical Power Quality Calibrator
Carrier Range: 90 V	Up to 90 V (16 to 850) Hz 850 Hz to 6.5 kHz	69 μ V/V + 6 mV 0.52 mV + 6 mV	
Carrier Range: 360 V	Up to 108 V (16 to 850) Hz 850 Hz to 6.5 kHz	69 μ V/V + 13 mV 0.52 mV + 13 mV	
Carrier Range: 650 V	Up to 195 V (16 to 850) Hz 850 Hz to 6.5 kHz	70 μ V/V + 22 mV 0.52 mV/V + 22 mV	
Carrier Range: 1 008 V	Up to 302 V (16 to 850) Hz 850 Hz to 6.5 kHz	70 μ V/V + 33 mV 0.52 mV/V + 33 mV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes ^{1,4}			
Amplitude – DC into 50 Ω load	(-5 to 5) V	0.023 % of reading + 19 μ V	Comparisons to Fluke 9500B Oscilloscope Calibrator, Fluke 9530 3.2 GHz Active Head, Fluke 9550 Active Head w/ 25 ps Capability, Fluke 9560 Active Head w/ 70 ps Capability, Tektronix 067-1330-000 Calibration Fixture
into 1 M Ω load	(-200 to 200) V	0.023 % of reading + 19 μ V	
Amplitude – Square Wave Rate: 10 Hz to 10 kHz into 50 Ω load	40 μ Vp-p to 1 mVp-p 1 mVp-p to 5 Vp-p	0.78 % of reading + 7.8 μ V 0.078 % of reading + 7.8 μ V	
into 1 M Ω load	40 μ Vp-p to 1 mVp-p	0.78 % of reading + 7.8 μ V	
Rate: 10 Hz to 100 kHz into 50 Ω load	1 mVp-p to 5 Vp-p	0.16 % of reading + 7.8 μ V	
into 1 M Ω load	1 mVp-p to 200 Vp-p	0.78 % of reading + 7.8 μ V	
Time Markers 100 mVp-p to 1 Vp-p into 50 Ω load			
Square Wave	9.009 1 ns to 83 μ s 83 μ s to 55s	0.19 μ s/s 2.3 μ s/s	
Sine Wave	450.5 ps to 9.009 ns	0.19 μ s/s	
Pulse	900.91 ns to 83 μ s 83 μ s to 55s	0.19 μ s/s 2.3 μ s/s	
Triangle Wave	900.91 ns to 83 μ s 83 μ s to 55s	0.19 μ s/s 2.3 μ s/s	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes ^{1,4} Rise Time into 50 Ω load Rate: 10 Hz to 2 MHz	5 mVp-p to 3 Vp-p 500 ps (nominal) 150 ps (nominal)	290 ps 34 ps	Comparisons to Fluke 9500B Oscilloscope Calibrator, Fluke 9530 3.2 GHz Active Head, Fluke 9550 Active Head w/ 25 ps Capability, Fluke 9560 Active Head w/ 70 ps Capability, Tektronix 067-1330-000 Calibration Fixture
Rate: 10 Hz to 1 MHz	25 mVp-p to 2 Vp-p 70 ps (nominal) 425 mVp-p to 575 mVp-p 25 ps (nominal) 200 mVp-p 16 ps (nominal)	21 ps 5.7 ps 2.1 ps	
Leveled Sine Wave 50 kHz Reference into 50 Ω load	5 mVp-p to 5 Vp-p 50 kHz to 10 MHz	1.2 % of reading	
Input Impedance Measure	(10 to 40) Ω (40 to 90) Ω (90 to 150) Ω (50 to 800) k Ω (0.8 to 1.2) M Ω (1.2 to 12) M Ω	0.39 % of reading 0.083 % of reading 0.39 % of reading 0.39 % of reading 0.083 % of reading 0.39 % of reading	
Input Capacitance Measure	(1 to 35) pF (35 to 95) pF	1.6 % of reading + 0.19 pF 2.3 % of reading + 0.19 pF	
Bandwidth Flatness Measure ¹ into VSWR (1.2:1) (wrt Reference Frequency)	5 mVp-p to 5 Vp-p 100 Hz to 300 MHz (300 to 550) MHz 5 mVp-p to 3 Vp-p 550 MHz to 1.1 GHz (1.1 to 2.5) GHz 5 mVp-p to 2 Vp-p (2.5 to 3.2) GHz	1.6 % of reading 1.9 % of reading 2.7 % of reading 3.1 % of reading 3.1 % of reading	Comparisons to Fluke 9500B/3200 Oscilloscope Calibrator, Fluke 9530 3.2 GHz Active Head

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Bandwidth Flatness Measure ¹ into VSWR (1.2:1) (wrt Reference Frequency)	5 mVp-p to 5 Vp-p 100 Hz to 300 MHz (300 to 550) MHz 5 mVp-p to 3 Vp-p 550 MHz to 1.1 GHz (1.1 to 2.5) GHz 5 mVp-p to 2 Vp-p (2.5 to 3.2) GHz 25 mVp-p to 2 Vp-p (3 to 6) GHz	1.6 % of reading 1.9 % of reading 2.3 % of reading 2.3 % of reading 2.3 % of reading 3.1 % of reading	Comparisons to Fluke 9500B/1100 Oscilloscope Calibrator, Fluke 9560 Active Head w/ 70 ps Capability
Risetime – Source	≥ 14 ps	2.9 ps	Comparisons to Pulser System
Risetime – Measure	≤ 500 ps	2.5 ps	Comparisons to Agilent 83484A, 86100C Oscilloscope Mainframe
Electrical Simulation of Thermocouple Indicating Devices – Measure/Source ¹	Type B (250 to 350) °C (350 to 445) °C (445 to 580) °C (580 to 750) °C (750 to 1 000) °C (1 000 to 1 820) °C Type C (0 to 250) °C (250 to 1 000) °C (1 000 to 1 500) °C (1 500 to 1 800) °C (1 800 to 2 000) °C (2 000 to 2 250) °C (2 250 to 2 315) °C Type E (-270 to -245) °C (-245 to -195) °C (-195 to -155) °C (-155 to -90) °C (-90 to 0) °C (0 to 15) °C (15 to 890) °C (890 to 1 000) °C	1.2 °C 0.9 °C 0.71 °C 0.55 °C 0.45 °C 0.35 °C 0.24 °C 0.19 °C 0.21 °C 0.24 °C 0.27 °C 0.33 °C 0.37 °C 1.6 °C 0.24 °C 0.12 °C 0.09 °C 0.08 °C 0.08 °C 0.06 °C 0.07 °C	Comparison to Ectron 1140A Thermocouple Calibrator/Simulator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Measure/Source ¹	Type J		Comparison to Ectron 1140A Thermocouple Calibrator/Simulator
	(-210 to -180) °C	0.15 °C	
	(-180 to -120) °C	0.12 °C	
	(-120 to -50) °C	0.093 °C	
	(-50 to 990) °C	0.08 °C	
	(990 to 1 200) °C	0.094 °C	
	Type K		
	(-270 to -255) °C	2.5 °C	
	(-255 to -195) °C	0.85 °C	
	(-195 to -115) °C	0.16 °C	
	(-115 to -55) °C	0.12 °C	
	(-55 to 1 000) °C	0.09 °C	
	(1 000 to 1 372) °C	0.1 °C	
	Type N		
	(-270 to -260) °C	5.4 °C	
	(-260 to -200) °C	1.5 °C	
	(-200 to -140) °C	0.29 °C	
	(-140 to -70) °C	0.18 °C	
	(-70 to 25) °C	0.14 °C	
	(25 to 160) °C	0.12 °C	
	(160 to 1 300) °C	0.11 °C	
	Type R		
	(-50 to -30) °C	0.8 °C	
	(-30 to 45) °C	0.69 °C	
	(45 to 160) °C	0.49 °C	
	(160 to 380) °C	0.35 °C	
	(380 to 775) °C	0.3 °C	
	(775 to 1 768) °C	0.26 °C	
	Type S		
	(-50 to -30) °C	0.76 °C	
	(-30 to 45) °C	0.68 °C	
	(45 to 105) °C	0.49 °C	
	(105 to 310) °C	0.41 °C	
	(310 to 615) °C	0.35 °C	
	(615 to 1 768) °C	0.31 °C	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Measure/Source ¹	Type T (-270 to -255) °C (-255 to -240) °C (-240 to -210) °C (-210 to -150) °C (-150 to -40) °C (-40 to 100) °C (100 to 400) °C	1.9 °C 0.6 °C 0.36 °C 0.22 °C 0.15 °C 0.09 °C 0.08 °C	Comparison to Ectron 1140A Thermocouple Calibrator/Simulator
DC Power – Source ^{1,5} (0.33 to 330) mA (0.33 to 3) A (3 to 20.5) A	11 µW to 330 µW 11 W to 3 kW 99 mW to 20.9 kW	0.018 % of reading 0.017 % of reading 0.054 % of reading	Comparison to Fluke 5520A Multiproduct Calibrator
AC Power – Source ^{1,5} PF = 1 3.3 mA to 3 A 3.3 mA to 20.5 A 33 mA to 3 A 33 mA to 20.5 A (3 to 20.5) A	(10 to 45) Hz 0.11 mW to 99 W (45 to 65) Hz 0.11 mW to 20.9 kW (65 to 500) Hz 11 mW to 3.06 kW 500 Hz to 1 kHz 11 mW to 20.9 kW (65 to 500) Hz 9.9 W to 20.9 kW	0.18 % of reading 0.14 % of reading 0.16 % of reading 0.17 % of reading 0.16 % of reading	Comparison to Fluke 5520A Multiproduct Calibrator
AC Power – Source ^{1,4} PF = 1 (0.5 to 20) A	(16 to 850) Hz 23 W to 13 kW	0.024 % of reading	Comparison to Fluke 6105A Electrical Power Quality Calibrator
Phase – Source ¹	(0 to 180)° (10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.11° 0.2° 0.39° 1.9° 3.9° 7.8°	Comparison to Fluke 5520A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Phase – Source 5 V	(0 to 360)° 1 Hz to 5 kHz (5 to 50) kHz (50 to 200) kHz	0.004° 0.008 4° 0.033°	Comparison to Clark-Hess 5600 Phase Standard (equal amplitude)
Phase – Source 50 mV to 100 V (100 to 120) V	(0 to 360)° 1 Hz to 1 kHz (1 to 5) kHz (5 to 50) kHz (50 to 200) kHz 1 Hz to 1 kHz (1 to 5) kHz (5 to 50) kHz (50 to 200) kHz	0.004 4° 0.007 7° 0.012° 0.028° 0.012° 0.024° 0.036° 0.094°	Comparison to Clark-Hess 5600 Phase Standard (ratio independent)
Phase – Measure	(0 to 360)° 1 Hz to 10 kHz (10 to 50) kHz (50 to 100) kHz (100 to 200) kHz	0.002 3° 0.002 7° 0.01° 0.012°	Comparison to Phase Verification Bridge Set (1:1)
ESD Simulators Rise Time Air Discharge Voltage (Positive and Negative) Peak Current Measure Delayed Current Measure	Up to 2 ns Up to 25 kV (25 to 30) kV Up to 40 A Up to 40 A	120 ps 1.2 % of reading + 2.3 V 1.2 % of reading + 23 V 6.8 % of reading 6.8 % of reading	Oscilloscope, IEC ESD Target, Electrostatic Voltmeter; IEC/EN 61000-4-2:2008, ISO 10605:2008
Dips and Interrupts – Measure	Ratio: (0 to 100) % (0 to 360) °	1.3 % of reading	Agilent Infinity Comparison to Oscilloscope
Electrical Fast Transients – Measure	(0.25 to 4) kV	2.6 % of reading	Comparison to Agilent Infinity Oscilloscope, Haefely HV Attenuators

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Harmonic Flicker – Measure	(100 to 230) V (50 to 400) Hz	3.6 % of reading	Comparison to Tektronix TDS1012B Oscilloscope, Keysight DMM, CNS HFC-II Load, Ohms Lab CS100 Shunt
Surge – Measure (Open)	(0.25 to 4) kV	1.3 % of reading	Comparison to Agilent Infinity Oscilloscope, Tektronix 6015A HV Probe
Surge – Measure (Short)	(0.25 to 4) kV	1.4 % of reading	Comparison to Agilent Infinity Oscilloscope, Tegam RF Current Probe
Impulse – Source (60 dBu nominal)	Band A (10 to 150) kHz	13 % of reading	Comparison to Schwarzbeck IGLK 2914 High Power Pulse Generator
	Band B 150 kHz to 30 MHz	13 % of reading	
	Band C & D 30 MHz to 1 GHz	20 % of reading	

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation – Measure Rate: 50 Hz to 10 kHz 20 Hz to 10 kHz	(5 to 99) % Depth 150 kHz to 10 MHz	2.4 % Depth	Comparison to HP 8902 Measuring Receiver

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation – Measure Rate: 20 Hz to 10 kHz Rate: 50 Hz to 50 kHz Rate: 20 Hz to 100 kHz Rate: 50 Hz to 50 kHz Rate 20 Hz to 100 kHz	(> 0 to 99) % Depth 150 kHz to 10 MHz (5 to 99) % Depth (0.01 to 1.3) GHz (> 0 to 99) % Depth (0.01 to 1.3) GHz (5 to 99) % Depth (1.3 to 26.5) GHz (> 0 to 99) % Depth (1.3 to 26.5) GHz	3.5 % Depth 1.4% Depth 3.5% Depth 1.9% Depth 3.5% Depth	Comparison to HP 8902 Measuring Receiver
Frequency Modulation – Measure Rate: 50 Hz to 10 kHz Rate: 50 Hz to 100 kHz Rate: 20 Hz to 200 kHz	≤ 40 kHz peak 250 kHz to 10 MHz ≤ 400 kHz peak 10 MHz to 26.5 GHz ≤ 400 kHz peak 10 MHz to 26.5 GHz	2.4 % Deviation 1.4 % Deviation 5.8 % Deviation	Comparison to HP 8902 Measuring Receiver
Phase Modulation – Measure Rate: 200 Hz to 10 kHz Rate: 200 Hz to 20 kHz	< 40 Rad Deviation 250 kHz to 10 MHz < 40 Rad Deviation 10 MHz to 26.5 GHz	4.9 % Deviation 3.8 % Deviation	Comparison to HP 8902 Measuring Receiver
RF Power – Measure (Noise Figure)	(-40 to 0) dB 10 MHz to 26.5 GHz	0.4 dB	Comparison to Keysight E4440A Spectrum Analyzer w/ Opt 219 Personality Module, Keysight 346C Noise Source
RF Power – Transfer Measure	(-20 to 10) dBm 9 kHz to 18 GHz > 10 MHz to 10 GHz (> 10 to 18) GHz	0.97 % of reading 1.2 % of reading 1.5 % of reading	Comparison to Tegam 2505A Microwave Calibration Feed-thru Standard Tegam 1830A Network Analyzer Calibration Kit

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Transfer Measure	(-20 to 10) dBm (10 to 50) MHz > 50 MHz to 4.2 GHz (> 4.2 GHz to 12.2) GHz (> 12.2 to 17.75) GHz (> 17.75 to 33) GHz (> 33 to 44) GHz (> 44 to 50) GHz	1.5 % of reading 1.5 % of reading 1.8 % of reading 2 % of reading 2.7 % of reading 3.4 % of reading 4.8 % of reading	Comparison to Tegam 2510A Microwave Calibration Feed-thru Standard Tegam 1830A Network Analyzer Calibration Kit
Absolute RF Power – Measure	50 MHz 1 mW Reference	3.5 μ W	Comparison to HP 478A Thermistor, Tegam 1830A RF Power Meter
Absolute RF Power – Measure ¹	(-35 to 20) dBm DC to 100 MHz > 100 MHz to 2.4 GHz (> 2.4 to 12.4) GHz (> 12.4 to 18) GHz (> 18 to 26.5) GHz (> 26.5 to 40) GHz (> 40 to 50) GHz	0.08 dB 0.08 dB 0.09 dB 0.1 dB 0.11 dB 0.13 dB 0.17 dB	Comparison to Rhode & Schwarz NRP50T Power Sensors; NRX Power Meter
Relative RF Power – Measure ⁸	(-30 to 20) dBm DC to 50 GHz	0.04 dB	Rhode & Schwarz NRP50T Power Sensors; NRX Power Meter
Tuned RF Power – Measure	30 MHz to 26.5 GHz (-114 to -78) dBm (-78 to -58) dBm (-58 to 0) dBm	4.8 % of reading 4 % of reading 3.5 % of reading	Comparison to Keysight E4440A Spectrum Analyzer, Agilent E4419B Power Meter, Keysight N5532A Power Sensor
Tuned Relative RF Power – Measure	30 MHz to 26.5 GHz (-114 to -78) dBm (-78 to -58) dBm (-58 to 0) dBm	3.4 % of reading 2.3 % of reading 1.1 % of reading	Comparison to Keysight E4440A Spectrum Analyzer, Agilent E4419B Power Meter, Keysight N5532A Power Sensor

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Attenuation – Source	30 MHz 10 dB 20 dB 30 dB 40 dB 50 dB	0.016 dB 0.023 dB 0.026 dB 0.026 dB 0.026 dB	Comparison to Agilent 11812A Verification Kit
Sine Flatness (RF)	9 kHz to 6 GHz	0.073 dB	Comparison to Agilent E4418B Power Meter, Agilent E9304A Power Sensor
Signal Source Phase Noise – Measure 1 MHz to 50 GHz	10 mHz ≤ offset ≤ 1 MHz 1 MHz ≤ offset ≤ 30 MHz offset > 30 MHz	1.6 dB 2 dB 3 dB	Comparison to Rhode & Schwarz FSWP Phase Noise Analyzer
Spectral Analysis – Measure (Amplitude) (w/o pre-amp)	(-127 to 30) dBm 3 Hz to 3 GHz (3.0 to 6.6) GHz (6.6 to 13.2) GHz (13.2 to 22) GHz (22 to 26.5) GHz (26.5 to 40) GHz (33 to 50) GHz	0.9 dB 1.1 dB 1.4 dB 1.4 dB 1.7 dB 3.6 dB 3.6 dB	Comparison to Keysight E4440A Spectrum Analyzer, Keysight 11970A/11970Q Mixers
Thermal Noise – Source ENR	5 dB, 15 dB, or 21 dB 10 MHz 100 MHz 1 GHz 2 GHz 3 GHz 4 GHz 5 GHz 6 GHz 7 GHz 8 GHz 9 GHz 10 GHz 11 GHz 12 GHz 13 GHz 14 GHz	0.15 dB 0.14 dB 0.14 dB 0.15 dB 0.13 dB 0.13 dB 0.15 dB 0.14 dB 0.14 dB 0.14 dB 0.19 dB 0.18 dB 0.18 dB 0.18 dB 0.19 dB 0.19 dB	Comparison to HP 346C Noise Source, Noise Test Set, Noise Figure Analyzer

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thermal Noise – Source ENR	5 dB, 15 dB, or 21 dB		Comparison to HP 346C Noise Source, Noise Test Set, Noise Figure Analyzer
	15 GHz	0.2 dB	
	16 GHz	0.2 dB	
	17 GHz	0.19 dB	
	18 GHz	0.2 dB	
	19 GHz	0.2 dB	
	20 GHz	0.21 dB	
	21 GHz	0.2 dB	
	22 GHz	0.21 dB	
	23 GHz	0.24 dB	
	24 GHz	0.21 dB	
	25 GHz	0.2 dB	
	26 GHz	0.21 dB	
	26.5 GHz	0.21 dB	
Tuned RF Absolute Power – Measure ¹	2.5 MHz to 26.5 GHz		Comparison to Agilent 8902A Opt 50 Measuring Receiver, Agilent 11722A Power Sensor, Agilent 11792A Microwave Converter, Agilent 11793A Microwave Converter
	(-127 to -120) dBm	0.26 dB	
	(-120 to -110) dBm	0.26 dB	
	(-110 to -100) dBm	0.26 dB	
	(-100 to -90) dBm	0.26 dB	
	(-90 to -80) dBm	0.26 dB	
	(-80 to -70) dBm	0.25 dB	
	(-70 to -60) dBm	0.25 dB	
	(-60 to -50) dBm	0.25 dB	
	(-50 to -40) dBm	0.25 dB	
	(-40 to -30) dBm	0.14 dB	
	(-30 to -20) dBm	0.14 dB	
	(-20 to -10) dBm	0.14 dB	
	(-10 to 0) dBm	0.14 dB	

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Tuned RF Relative Power – Measure ¹	2.5 MHz to 26 GHz (-127 to -120) dB (-120 to -110) dB (-110 to -100) dB (-100 to -90) dB (-90 to -80) dB (-80 to -70) dB (-70 to -60) dB (-60 to -50) dB (-50 to -40) dB (-40 to -30) dB (-30 to -20) dB (-20 to -10) dB (-10 to 0) dB	0.23 dB 0.23 dB 0.23 dB 0.23 dB 0.22 dB 0.084 dB 0.081 dB 0.074 dB 0.071 dB 0.068 dB 0.064 dB 0.06 dB 0.056 dB	Comparison to Agilent 8902A Opt 50 Measuring Receiver, Agilent 11722A Power Sensor, Agilent 11792A Microwave Converter, Agilent 11793A Microwave Converter
RF Impedance – Measure	5 Hz to 3 GHz 1 Ω to 2 k Ω	3 % of reading	Comparison to Keysight E5061B Vector Network Analyzer
RF Current – Measure (Insertion Loss)	(-90 to 10) dB 10 kHz to 400 MHz	2.9 dB	Comparison to Keysight E5061B Vector Network Analyzer, FCC BCICF-1 Cal Fixture
RF Current – Measure (Transfer Z)	(-90 to 10) dB 10 kHz to 400 MHz	2.2 dB	Comparison to Keysight E5061B Vector Network Analyzer, FCC BCICF-1 Cal Fixture
Transmission Longitudinal Conversion Loss	(-90 to 10) dB 10 kHz to 100 MHz	5.6 % of reading	Comparison to Schaffner BCS-1000 Bridge, Keysight E5061B Vector Network Analyzer
S-Parameter S11-S22 – Measure ⁶ (0 to 1) Lin Mag (BNC)	(-90 to 10) dB 10 Hz to 100 kHz 100 kHz to 10 MHz	0.03 0.03	Comparison to Agilent E5061B Vector Network Analyzer, Agilent 8550CK Calibration Kit
S-Parameter S11-S22 – Measure ⁶ (0 to 1) Lin Mag (7 mm)	(-90 to 10) dB 300 kHz to 1.3 GHz (1.3 to 3) GHz (3 to 6) GHz	0.006 0.007 0.013	Comparison to Agilent 8753ES Network Analyzer, Agilent 8550C Calibration Kit

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S-Parameter S11-S22 – Measure ⁶ (0 to 1) Lin Mag (N-type)	(-90 to 10) dB (10 to 500) MHz 500 MHz to 2 GHz	0.025 0.017	Comparison to Agilent N5230A Network Analyzer, Agilent N4690C Ecal Calibration Kit
S-Parameter S11-S22 – Measure ⁶ (0 to 1) Lin Mag (3.5 mm)	(-90 to 10) dB (10 to 500) MHz 500 MHz to 2 GHz (2 to 26.5) GHz	0.026 0.025 0.076	Comparison to Agilent N5230A Network Analyzer, Agilent N4692C Ecal Calibration Kit
S-Parameter S11-S22 – Measure ⁶ (0 to 1) Lin Mag (2.9 mm)	(-90 to 10) dB (10 to 500) MHz 500 MHz to 2 GHz (2 to 26.5) GHz	0.026 0.025 0.076	Comparison to Agilent N5230A Network Analyzer, Agilent N4692C Ecal Calibration Kit
S-Parameter S11-S22 – Measure ⁶ (0 to 1) Lin Mag (2.4 mm)	(-90 to 10) dB 50 MHz to 50 GHz	0.22	Comparison to Agilent N5225A Microwave Network Analyzer, Agilent N4692C Ecal Calibration Kit
S-Parameter S21-S12 – Measure (BNC)	(-50 to 10) dB 10 Hz to 100 kHz 100 kHz to 10 MHz (10 to 500) MHz	0.57 dB 0.37 dB 0.36 dB	Comparison to Agilent E5061B Vector Network Analyzer, Agilent 8550CK Calibration Kit
S-Parameter S21-S12 – Measure (7 mm)	(-50 to 10) dB 300 kHz to 1.3 GHz (1.3 to 3) GHz	0.24 dB 0.25 dB	Comparison to Agilent 8753ES Network Analyzer, Agilent 85050C Calibration Kit
S-Parameter S21-S12 – Measure (N-type)	(-30 to 10) dB (10 to 500) MHz (-50 to 10) dB (10 to 500) MHz (-50 to 10) dB 500 MHz to 2 GHz (2 to 18) GHz	0.43 dB 2.6 dB 0.17 dB 0.39 dB	Comparison to Agilent N5230A Network Analyzer, Agilent N4690C Ecal Calibration Kit

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S-Parameter S21-S12 – Measure (3.5 mm)	(-30 to 10) dB (10 to 500) MHz (-50 to 10) dB (10 to 500) MHz (-50 to 10) dB 500 MHz to 2 GHz (2 to 26.5) GHz	0.5 dB 2.6 dB 0.28 dB 0.79 dB	Comparison to Agilent N5230A Network Analyzer, Agilent N4692C Ecal Calibration Kit
S-Parameter S21-S12 – Measure (2.9 mm)	(-30 to 10) dB (10 to 500) MHz (-50 to 10) dB (10 to 500) MHz (-50 to 10) dB 500 MHz to 2 GHz (2 to 26.5) GHz (26.5 to 40) GHz	0.49 dB 2.7 dB 0.28 dB 0.79 dB 0.82 dB	Comparison to Agilent N5230A Network Analyzer, Agilent N4692C Ecal Calibration Kit
S-Parameter S21-S12 – Measure (2.4 mm)	(-30 to 10) dB (50 to 500) MHz (-50 to 10) dB (50 to 500) MHz (-50 to 10) dB 500 MHz to 2 GHz (2 to 26.5) GHz (26.5 to 50) GHz	0.24 dB 0.93 dB 0.14 dB 0.56 dB 0.86 dB	Comparison to Agilent N5225A Microwave Network Analyzer, Agilent 85056D Calibration Kit
Harmonic Distortion – Measure	20 Hz to 20 kHz (20 to 100) kHz	1.2 dB 2.3 dB	Comparison to 8903A Audio Analyzer
Risetime – Measure	≤ 500 ps	2.5 ps	Comparison to Agilent 83484A, 86100C Oscilloscope Mainframe
Total Harmonic Distortion CW, Modulation	5 Hz to 500 kHz 500 kHz to 1 MHz	18 % of reading + 0.13 % THD 29 % of reading + 0.7 % THD	Comparison to Krohn-Hite 6900B Distortion Analyzer
Harmonic Distortion	3 Hz to 3 GHz (3.3 to 6.6) GHz (6.6 to 13.2) GHz (13.2 to 22) GHz (22 to 26.5) GHz (26.5 to 40) GHz	0.9 dB 1.1 dB 1.5 dB 1.4 dB 1.7 dB 3.6 dB	Comparison to Keysight E4440 PSA Spectrum Analyzer

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Angle Measuring Devices Protractors, Inclometers, Squares, Angle Gages ⁷	0.005 6" to 5° (5 to 20)° (20 to 35)° (35 to 45)° (45 to 60)° (60 to 75)° (75 to 85)° 90°	1.9" 2.8" 4.5" 6.1" 10.3" 22" 67" 2.8"	Comparison to 10 in Sine Bar, Gage Blocks Granite Master Square
Micrometers and Calipers ^{1,2} (Outside, Inside, Depth)	(0.05 to 1) in (1 to 9) in (9 to 15) in (15 to 40) in	(13 + 1L) µin (9 + 4L) µin (10 + 4L) µin (16 + 4L) µin	Comparison to Gage Blocks
Anvil Flatness ¹	Up to 1 in Diameter	4.5 µin	Comparison to Optical Flats
Anvil Parallelism ¹	Up to 1 in	4.5 µin	Comparison to Optical Parallels
Bore Gages ^{1,2}	(0.125 to 0.25) in (0.25 to 1) in (1 to 6) in	33 µin 33 µin (26 + 7L) µin	Comparison to Characterized Rings
Dial Indicators ^{1,2}	Up to 1 (1 to 6) in	(10 + 2L) µin (5 + 5L) µin	Comparison to Gage Blocks
Length Single Axis ² Outside Dimension	(0 to 1) in (1.0 to 7) in (7 to 21) in	(6 + 1L) µin (4.3 + 3.5L) µin (1 + 4L) µin	Direct Measure using Universal Length Measuring Machine
Length Single Axis Inside Dimension	(0.04 to 0.125) in (0.125 to 0.25) in (0.25 to 1) in (1 to 2.5) in (2.5 to 10) in (10 to 14) in	(9 + 1L) µin (9 + 1L) µin (9 + 1L) µin (10 + 3L) µin (14 + 3L) µin (23 + 3L) µin	Direct Measure using Universal Length Measuring Machine
Height Gages ^{1,2}	Up to 1 in (1 to 9) in (9 to 15) in (15 to 40) in	(13 + 1L) µin (9 + 4L) µin (10 + 4L) µin (14 + 4L) µin	Comparison to Gage Blocks
Thread Wires	2 TPI to 120 TPI (0.008 to 0.5) in	12 µin	Comparison to Universal Length Measuring Machine

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Cylindrical Plug Gages ² Outside Diameter	Up to 1 in (1 to 7) in	12 μ in (10 + 3L) μ in	Comparison to Universal Length Measuring Machine
Cylindrical Ring Gages ² Inside Diameter	(0.04 to 0.125) in (0.125 to 0.25) in (0.25 to 1) in (1 to 2.5) in (2.5 to 10) in (10 to 14) in	(9 + 3L) μ in (9 + 3L) μ in (9 + 3L) μ in (9 + 3L) μ in (14 + 3L) μ in (25 + 3L) μ in	Comparison to Universal Length Measuring Machine, Working Reference Rings
Pin Gages Outside Diameter	(0.004 to 0.5) in (0.5 to 1) in	53 μ in 53 μ in	Direct Measure using Laser Micrometer
Step Height	Up to 1 in	32 μ in	Comparison to Gage Amplifier, Probe, Gage Blocks
Thread Plug Gages ² Pitch Diameter 60° Thread Major Diameter	Up to 1 in (1 to 4) in (4 to 7) in Up to 1 in (1 to 7) in	79 μ in 80 μ in 83 μ in 13 μ in (10 + 3L) μ in	Comparison to Universal Length Measuring Machine, Thread Wires
Tapered Thread Plug Gage Pitch Diameter Standoff	Up to 3 in Up to 1 in	90 μ in 31 μ in	Comparison to Universal Length Measuring Machine Gage Blocks, Amplifier
Thread Ring Gages Inner Pitch Diameter	Up to 1 in (1 to 4) in (4 to 7) in	79 μ in 80 μ in 83 μ in	Tactile fit using Master Set Plugs.

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass Determination (Metric)	1 mg	64 µg	Double Substitution Method; ASTM E617 Class 2 Weights, Electronic Balances.
	2 mg	64 µg	
	5 mg	97 µg	
	10 mg	84 µg	
	20 mg	73 µg	
	50 mg	64 µg	
	100 mg	65 µg	
	200 mg	76 µg	
	500 mg	78 µg	
	1 g	83 µg	
	2 g	0.16 mg	
	5 g	0.13 mg	
	10 g	0.14 mg	
	20 g	0.16 mg	
	50 g	0.11 mg	
	100 g	0.35 mg	
	200 g	0.39 mg	
	500 g	1 mg	
	1 kg	1.6 mg	
	2 kg	10 mg	
	4 kg	12 mg	
	5 kg	13 mg	
	6 kg	15 mg	
	7 kg	16 mg	
	8 kg	18 mg	
	16 kg	98 mg	
	32 kg	0.21 g	
Balances and Scales ^{1,7}	Up to 1 g	76 µg	ASTM E617 Class 1 & Class 2 weights and internal calibration procedure utilized in the calibration of the weighing system.
	(1 to 50) g	0.15 mg	
	(50 to 100) g	0.35 mg	
	(100 to 200) g	0.56 mg	
	(200 to 500) g	1 mg	
	(500 to 1) kg	1.6 mg	
	(1 to 2) kg	10 mg	
	(2 to 4) kg	12 mg	
	(4 to 5) kg	13 mg	
	(5 to 6) kg	15 mg	
	(6 to 7) kg	16 mg	

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Balances and Scales ^{1,7}	(7 to 8) kg (8 to 16) kg (16 to 32) kg (32 to 64) kg (64 to 114) kg	18 mg 98 mg 0.21 g 0.45 g 0.6 g	ASTM E617 Class 1 & Class 2 weights and internal calibration procedure utilized in the calibration of the weighing system.
Force Measuring Instruments (Tension Only)	Up to 2 lbf (2 to 5) lbf (5 to 10) lbf (10 to 20) lbf (20 to 50) lbf (50 to 100) lbf (100 to 200) lbf (200 to 300) lbf	0.0013 lbf 0.002 lbf 0.004 lbf 0.011 lbf 0.042 lbf 0.06 lbf 0.078 lbf 0.11 lbf	Comparison to NIST Class F Weights, Hangers
Wire Crimpers/Dies Pull Test	Up to 200 lbf	0.51 lbf	Comparison to Mark 10 Pull Tester
Crimp Height	Up to 0.8 in	180 μ in	Mitutoyo 342-371-30 Class Z Pin Gauge Set
Die Diameter	(0.011 to 0.5) in	0.001 2 in	
Pneumatic Absolute Pressure Devices	(0.2 to 1.45) psia (0.2 to 100) psia (0.2 to 1 000) psia	0.001 7 % of reading + 0.000 29 psi 0.001 7 % of reading + 0.000 29 psi 0.001 9 % of reading	Comparison to Ruska 2465 Gas Piston Gauge
Pneumatic Absolute Pressure Devices	(1.45 to 50) psia (50 to 1 000) psia	0.001 7 % of reading + 0.000 014 psi 0.002 2 % of reading	Comparison to DHI FPG 7601 Absolute Piston Gauge
Pneumatic Pressure Devices	(-14.7 to -0.2) psig (0.2 to 100) psig (100 to 1 000) psig	0.001 7 % of reading + 0.000 008 psi 0.001 7 % of reading + 0.000 008 psi 0.001 9 % of reading	Comparison to Ruska 2465 Gas Piston Gauge
Pneumatic Pressure Devices	(-60 to 60) inH ₂ O	0.002 9 % of reading	Comparison to DHI FPG 7601 Absolute Piston Gauge
Hydraulic Pressure Devices	(72.5 to 7 250) psig (200 to 20 000) psig (20 000 to 72 500) psig	0.002 % of reading + 0.002 9 psi 0.003 % of reading + 0.007 3 psi 0.006 % of reading + 0.015 psi	Comparison to DHI PG7000 Piston Gauge
Determination of Piston Area	(0.2 to 100) psi (100 to 1 000) psi	0.001 1 % of reading 0.001 7 % of reading	Comparison to Ruska 2465 Gas Piston Gauge

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Determination of Piston Area	(72.5 to 7 250) psig (200 to 20 000) psig (20 000 to 72 500) psig	0.001 7 % of reading 0.002 6 % of reading 0.005 1 % of reading	Comparison to DHI PG7000 Piston Gauge (Gas to 6 000 psi)
Hydraulic Pressure Devices ¹	(00 to 16 200) psig	0.001 % of reading	Comparison to Hydraulic Deadweight Tester
Pneumatic Absolute Pressure – Source	(0.000 27 to 0.005 1) Pa (0.000 7 to 0.027) Pa	22 % of reading 8 % of reading	Comparison to Ion Gauge
	(0.028 to 2 500) Pa	0.05 % of reading + 0.07 Pa	Comparison to Capacitive Diaphragm Gauge
Gas Flow Devices	(1 to 10) sccm	0.22 % of reading + 0.004 2 sccm	Comparison to Fluke Molbloc 1E1 Mass Flow Calibration System
Gas Flow Devices	(0 to 20) sccm (20 to 200) sccm	0.05 sccm 0.25 % of reading + 0.001 7 sccm	Comparison to Fluke Molbloc 1E2 Mass Flow Calibration System
Gas Flow Devices	(0 to 0.2) slpm (0.2 to 2) slpm	0.000 5 slpm 0.25 % of reading + 0.000 02 slpm	Comparison to Fluke Molbloc 1E3 Mass Flow Calibration System
Gas Flow Devices	(0 to 2) slpm (2 to 20) slpm	0.005 slpm 0.25 % of reading + 0.001 6 slpm	Fluke Molbloc 1E4 Mass Flow Calibration System
Gas Flow Devices	(0 to 5) slpm (5 to 50) slpm	0.017 slpm 0.34 % of reading	Comparison to Fluke Molbloc 3E4 Mass Flow Calibration System
Gas Flow Devices	(50 to 100) slpm	0.48 % of reading	Comparison to (2) Fluke Molbloccs 3E4 Mass Flow Calibration System
Liquid Flow Devices	(0.01 to 400) gpm	0.05 % of reading	Comparison to Liquid Flow Ballistic Prover

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Driver, Torque Wrenches ¹	15 lbf·oz to 400 lbf·in (15 to 200) lbf·oz (4 to 50) lbf·in (30 to 400) lbf·in (80 to 1 000) lbf·in (20 to 250) lbf·ft (60 to 600) lbf·ft	1.15 % of reading 0.68 % of reading 0.46 % of reading 0.46 % of reading 0.46 % of reading 0.46 % of reading 0.48 % of reading	Comparison to CDI Torque System

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity – Measure ¹	(-40 to 10) °C (10 to 90) %RH (90 to 99) %RH (10 to 30) °C (10 to 90) %RH (90 to 99) %RH (30 to 180) °C (10 to 90) %RH (90 to 99) %RH	3.5 % RH 4.6 % RH 1.3 % RH 2.4 % RH 3.5 % RH 4.6 % RH	Comparison to Master Thermohygrometer
Humidity Measuring Instruments	(-10 to 15) °C (10 to 75) %RH (75 to 95) %RH (15 to 35) °C (10 to 95) %RH (35 to 70) °C (10 to 50) %RH (50 to 70) %RH (70 to 95) %RH	0.5 %RH 0.65 %RH 0.5 %RH 0.5 %RH 0.7 %RH 0.85 %RH	Comparison to Thunder Scientific 2900 Two-Pressure Humidity Generator
Humidity Measuring Instruments ¹	(5 to 40) °C (10 to 95) %RH	2.1 %RH	Comparison to HygroCal 100 Humidity Calibrator, BioMerieux 416045 Humidity Sensor
Temperature Measuring Instruments	(-20 to 100) °C (100 to 300) °C (300 to 420) ° (420 to 660) °C	0.019 °C 0.039 °C 0.41 °C 0.59 °C	Comparison to Metrology Wells, SPRT, Super Thermometer

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measure ¹	(-195 to 0) °C (0 to 160) °C (160 to 420) °C (420 to 660) °C	0.015 °C 0.015 °C 0.02 °C 0.032 °C	Comparison to SPRT, Super Thermometer
Temperature – Measure ¹	(660 to 1 000) °C	8.7 °C	Comparison to Type K Thermocouple Probe w/ Reader
Infrared Temperature Measuring Devices ¹	(-15 to 0) °C (0 to 50) °C (50 to 100) °C (100 to 120) °C (120 to 200) °C (200 to 350) °C (350 to 500) °C	0.8 °C 0.65 °C 0.7 °C 0.76 °C 0.95 °C 1.6 °C 2.1 °C	Comparison to Black Body Source (Flat Plate) $\epsilon = (0.9 \text{ to } 1)$, $\lambda = (8 \text{ to } 14) \mu\text{m}$
Isothermal Block Verification ¹	Ambient (~ 23 °C)	0.02 °C	Comparison to Thermocouple Half Junction

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source/Measure ⁸	10 MHz	3.7 pHz/Hz	Comparison to Fluke 910R GPS Frequency Standard
Non-contact Rate of Rotation ^{1,2}	(5 to 100) rpm (100 to 1 000) rpm (1 000 to 10 000) rpm (10 000 to 100 000) rpm (100 000 to 200 000) rpm	0.012 % of reading + 0.001 2 rpm 0.012 % of reading + 0.012 rpm 0.012 % of reading + 0.12 rpm 0.014 % of reading + 1.2 rpm 0.014 % of reading + 12 rpm	Comparison to Master Non-contact/Laser Tachometer
Frequency – Measure	1 Hz to 10 kHz 10 kHz to 10 MHz (10 to 225) MHz 225 MHz to 50 GHz	19 pHz/Hz + 4.5 μ Hz 19 pHz/Hz + 18 μ Hz 19 pHz/Hz + 0.64 mHz 0.21 μ Hz/Hz + 0.12 Hz	Comparison to Agilent 53132A Universal Counter, Fluke 910R GPS Frequency Standard, Keysight PSA E4440A Spectrum Analyzer

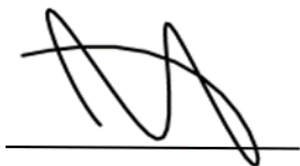
Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Period – Measure	(1 to 100) s	45 μ s	Comparison to Agilent 53132A Universal Counter, Fluke 910R GPS Frequency Standard
Stopwatches, Timers	Up to 19.99 s/d	58 ms/d	Comparison to Helmut Klein/Vibrograf TM-4500 Timometer
AC Duty Cycle – Source ¹ Square Wave < 3.3 Vp-p Freq: 10 mHz to 100 kHz	10 μ s to 100 s (1 to 10) % Duty Cycle (10 to 49) % Duty Cycle 50 % Duty Cycle (51 to 90) % Duty Cycle (90 to 99) % Duty Cycle	0.039 % 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 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:

- 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.
- L = length in inches; " = arc-second; rpm = revolutions per minute.
- As frequency & amplitude deviate from the listed values, uncertainty may be higher than stated. If needed, contact laboratory for more information regarding uncertainties at frequency and range combinations other than the ones shown.
- The stated uncertainty is the laboratory's ability to source a fast rise pulse that is approximately 500 ps, 125 ps, and 25 ps. In the typical application of measuring rise time of an oscilloscope, this value is one of the contributing factors, but other factors are derived from the DUT. The known source rise time is mathematically removed from the total measured rise time measured on the DUT.
- 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.
- This parameter is a unitless measurement.
- 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.
- Uncertainty values of derivatives of 10 MHz will differ due to resolution, noise, and gating errors.
- Unless otherwise specified in the far-right column, the calibration procedure or method was written internally.
- The legal entity for this location is Transcat, Inc.



Jason Stine, Vice President

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