



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Accura Calibration
2834 West Kingsley Road
Garland, TX 75041

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.

Jason Stine, Vice President

Expiry Date: 01 February 2028
Certificate Number: AC-2548



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)

Accura Calibration

2834 West Kingsley Road
Garland, TX 75041

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CALIBRATION

ISO/IEC 17025 Accreditation Granted: **1 April 2026**

Certificate Number: **AC-2548** Certificate Expiry Date: **01 February 2028**

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Accelerometers Frequency Response (1 g Reference)	(7 to 10) Hz (10 to 30) Hz (30 to 99) Hz 100 Hz (101 to 2 000) Hz (2 000 to 10 000) Hz	7 % of reading 4.6 % of reading 3.8 % of reading 3.6 % of reading 3.8 % of reading 5.3 % of reading	Comparisons to Modal Shop 9110D Workstation
Sound Level – Generate (Measuring Equipment)	1 kHz (94 to 114) dB	0.23 dB	Comparison to B&K 4231 Sound Level Calibrator
Sound Level – Measure Class 1 Sound Level Meter	1 kHz (94 to 114) dB	1 dB	Comparison to Sound Level Meter characterized with B&K 4231 Sound Level Meter

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Level – Measure Class 2 Sound Level Meter	1 kHz (94 to 114) dB	2 dB	Comparison to Sound Level Meter characterized with B&K 4231 Sound Level Meter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Clamp Meter ¹ Toroidal Clamp	(45 to 65) Hz (20 to 300) A (300 to 600) A (600 to 1 000) A	11 mA/A + 90 mA 9.8 mA/A + 90 mA 11 mA/A + 90 mA	Comparison to Fluke 5500A/Coil, Valhalla 2575A Current Shunt, Keysight 3458A 8.5 Digit Multimeter, Current Source
	400 Hz (20 to 300) A (300 to 600) A	19 mA/A + 0.1 A 18 mA/A + 0.1 A	
	200 Hz (600 to 1 000) A	18 mA/A + 0.1 A	
	(45 to 400) Hz (495 to 1 401) A	0.3 A	Comparison to Transmille 4010A Multiproduct Calibrator, Transmille EA002 2/10/50 Coil Adapter
AC Current – Clamp Meter ¹ Non-Toroidal Clamp	(45 to 65) Hz (20 to 300) A (300 to 600) A (600 to 1 000) A	15 mA/A + 0.9 A 14 mA/A + 0.9 A 14 mA/A + 0.9 A	Comparison to Fluke 5500A/Coil, Valhalla 2575A Current Shunt, Keysight 3458A 8.5 Digit Multimeter, Current Source
	400 Hz (20 to 300) A (300 to 600) A	22 mA/A + 0.9 A 21 mA/A + 0.9 A	
	200 Hz (600 to 1 000) A	22 mA/A + 0.9 A	
	(45 to 400) Hz (495 to 1 401) A	0.3 A	Comparison to Transmille 4010A Multiproduct Calibrator, Transmille EA002 2/10/50 Coil Adapter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source ¹ (Locked Ranges)	(0 to 329.999 9) mV (0 to 3.299 999) V (0 to 32.999 99) V (30 to 329.999 9) V (100 to 1 020) V	16 μ V/V + 0.78 μ V 9.1 μ V/V + 1.6 μ V 9.7 μ V/V + 16 μ V 14 μ V/V + 0.12 μ V 15 μ V/V + 1.2 μ V	Comparison to Fluke Multiproduct Calibrator
DC Voltage – Source (Fixed Artifact)	(0 to 220) mV (0 to 2.2) V (0 to 11) V (0 to 22) V (0 to 220) V (100 to 1 100) V	8 μ V/V + 0.6 μ V 7 μ V/V + 1 μ V 7 μ V/V + 6.5 μ V 7 μ V/V + 6.5 μ V 8- μ V/V + 80 μ V 9 μ V/V + 500 μ V	Comparison to Fluke 732B DC Voltage Reference Standard Fluke 5700A
DC Voltage – Measure ¹	Up to 120 mV (0.12 to 1.2) V (1.2 to 12) V (12 to 120) V (120 to 1 050) V	6.1 μ V/V + 0.3 μ V 5.1 μ V/V + 0.3 μ V 5.1 μ V/V + 0.5 μ V 7.3 μ V/V + 30 μ V 7.3 μ V/V + 0.1 mV	Comparison to Keysight 3458A 8.5 Digit Multimeter
DC High Voltage – Source/Measure ¹	(1 to 120) kV	0.78 mV/V	Comparison to Ross Engineering VD120-6.2Y-A-LB-AL High Voltage Divider, Keysight 3458A 8.5 Digit Multimeter
DC Current – Source ¹	(0 to 202) μ A (0.2 to 2.02) mA (2 to 20.2) mA (20 to 202) mA (0.2 to 2.02) A (2 to 20.2) A (20.2 to 30) A	6.1 μ A/A + 7.8 pA 55 μ A/ μ A + 23 nA 42 μ A/ μ A + 0.16 μ A 42 μ A/ μ A + 1.6 μ A 0.11 mA/A + 23 μ A 0.25 mA/A + 0.23 μ A 70 μ A/A + 0.35 mA	Comparison to Transmille 4010A Multiproduct Calibrator
DC Current – Source ¹	(> 30 to 100) A	12 mA/A	Comparison to Multiproduct Calibrator, Transconductance Amplifier monitored with Keysight 3458A 8.5 Digit Multimeter and Current Shunt

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Clamp Meter ¹	(10 to 1 400) A	0.46 % of reading + 0.42 A	Comparison to Transmille 4010A Multiproduct Calibrator, Transmille EA002 2/10/50 Coil Adapter
DC Current – Measure	(0 to 330) μ A (> 0.33 to 3.3) mA (> 3.3 to 33) mA (> 33 to 330) mA (> 0.33 to 3) A (> 3 to 20.5) A	0.68 nA 5 nA 37 nA 1.4 μ A 2.2 mA 22 mA	Comparison to Keysight 3458A 8.5 Digit Multimeter, Current Shunts, Standard Resistors
DC Current – Measure	(> 20.5 to 100) A	12 mA/A	Comparison to Keysight 3458A 8.5 Digit Multimeter, Current Shunt
DC Current – Measure	(1 to 2 000) A	12 mA/A	Comparison to Keysight 3458A & Danisense DL2000ID

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(1 to 32.999) mV		Comparison to Fluke 5522A Multiproduct Calibrator
	(10 to 45) Hz	0.64 mV/V + 4.7 μV	
	45 Hz to 10 kHz	0.15 mV/V + 4.7 μV	
	(10 to 20) kHz	0.18 mV/V + 4.7 μV	
	(20 to 50) kHz	0.79 mV/V + 4.7 μV	
	(50 to 100) kHz	2.7 mV/V + 9.3 μV	
	(100 to 500) kHz	6.4 mV/V + 39 μV	
	(33 to 329.999) mV		
	(10 to 45) Hz	0.36 mV/V + 6.2 μV	
	45 Hz to 10 kHz	0.3 mV/V + 6.2 μV	
	(10 to 20) kHz	0.3 mV/V + 6.2 μV	
	(20 to 50) kHz	0.52 mV/V + 6.2 μV	
	(50 to 100) kHz	0.97 mV/V + 27 μV	
	(100 to 500) kHz	2.8 mV/V + 54 μV	
	(0.33 to 3.299 99) V		
	(10 to 45) Hz	0.23 mV/V + 39 μV	
	45 Hz to 10 kHz	0.12 mV/V + 47 μV	
	(10 to 20) kHz	0.15 mV/V + 47 μV	
	(20 to 50) kHz	0.24 mV/V + 39 μV	
	(50 to 100) kHz	0.55 mV/V + 97 μV	
	(100 to 500) kHz	1.9 mV/V + 0.47 mV	
	(3.3 to 32.999 9) V		
	(10 to 45) Hz	0.23 mV/V + 0.5 mV	
	45 Hz to 10 kHz	0.12 mV/V + 0.47 mV	
	(10 to 20) kHz	0.2 mV/V + 4.7 mV	
	(20 to 50) kHz	0.23 mV/V + 4.7 mV	
	(50 to 100) kHz	0.7 mV/V + 1.2 mV	
	(33 to 329.999) V		
45 Hz to 1 kHz	0.15 mV/V + 1.6 mV		
(1 to 10) kHz	0.16 mV/V + 4.7 mV		
(10 to 20) kHz	0.2 mV/V + 4.7 mV		
(20 to 50) kHz	0.25 mV/V + 4.7 mV		
(50 to 100) kHz	0.7 mV/V + 39 mV		
(330 to 1 020) V			
45 Hz to 1 kHz	0.24 mV/V + 7.8 mV		
(1 to 5) kHz	0.2 mV/V + 7.8 mV		
(5 to 10) kHz	0.24 mV/V + 7.8 mV		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	10 nV to 12 mV		Comparison to Keysight 3458A 8.5 Digit Multimeter
	(1 to 40) Hz	0.7 mV/V	
	40 Hz to 1 kHz	0.36 mV/V	
	(1 to 20) kHz	0.48 mV/V	
	(20 to 50) kHz	1.3 mV/V	
	(50 to 100) kHz	5.9 mV/V	
	(100 to 300) kHz	46 mV/V	
	12 mV to 12 V		
	(1 to 40) Hz	0.13 mV/V	
	40 Hz to 1 kHz	0.11 mV/V	
	(1 to 20) kHz	0.22 mV/V	
	(20 to 50) kHz	0.37 mV/V	
	(50 to 100) kHz	0.95 mV/V	
	(100 to 300) kHz	3.6 mV/V	
	(0.3 to 1) MHz	1.2 mV/V	
	(1 to 2) MHz	17 mV/V	
	(12 to 120) V		
	(1 to 40) Hz	0.28 mV/V	
	40 Hz to 1 kHz	0.26 mV/V	
	(1 to 20) kHz	0.26 mV/V	
	(20 to 50) kHz	0.43 mV/V	
(50 to 100) kHz	1.4 mV/V		
(100 to 300) kHz	4.7 mV/V		
(0.3 to 1) MHz	17 mV/V		
(120 to 700) V			
(1 to 40) Hz	0.53 mV/V		
40 Hz to 1 kHz	0.5 mV/V		
(1 to 20) kHz	0.73 mV/V		
(20 to 50) kHz	1.4 mV/V		
(50 to 100) kHz	3.5 mV/V		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	2.2 mV		Comparison to Fluke 5790B AC Measurement Standard
	(10 to 20) Hz	0.14 % of reading + 1 μ V	
	(20 to 40) Hz	0.067 % of reading + 1 μ V	
	40 Hz to 20 kHz	0.045 % of reading + 1 μ V	
	(20 to 50) kHz	0.072 % of reading + 1.6 μ V	
	(50 to 100) kHz	0.098 % of reading + 1.9 μ V	
	(100 to 300) kHz	0.18 % of reading + 3.1 μ V	
	(300 to 500) kHz	0.2 % of reading + 6.2 μ V	
	500 kHz to 1 MHz	0.27 % of reading + 6.2 μ V	
	7 mV		
	(10 to 20) Hz	0.067 % of reading + 1 μ V	
	(20 to 40) Hz	0.032 % of reading + 1 μ V	
	40 Hz to 20 kHz	0.021 % of reading + 1 μ V	
	(20 to 50) kHz	0.033 % of reading + 1.6 μ V	
	(50 to 100) kHz	0.05 % of reading + 1.9 μ V	
	(100 to 300) kHz	0.094 % of reading + 3.1 μ V	
	(300 to 500) kHz	0.11 % of reading + 6.2 μ V	
	500 kHz to 1 MHz	0.28 % of reading + 6.2 μ V	
	22 mV		
	(10 to 20) Hz	0.23 % of reading + 1 μ V	
	(20 to 40) Hz	0.015 % of reading + 1 μ V	
	40 Hz to 20 kHz	0.009 % of reading + 1 μ V	
	(20 to 50) kHz	0.016 % of reading + 1.6 μ V	
	(50 to 100) kHz	0.024 % of reading + 1.9 μ V	
(100 to 300) kHz	0.064 % of reading + 3.1 μ V		
(300 to 500) kHz	0.078 % of reading + 6.2 μ V		
500 kHz to 1 MHz	0.2 % of reading + 6.2 μ V		
70 mV			
(10 to 20) Hz	0.019 % of reading + 1.2 μ V		
(20 to 40) Hz	0.01 % of reading + 1.2 μ V		
40 Hz to 20 kHz	0.005 % of reading + 1.2 μ V		
(20 to 50) kHz	0.01 % of reading + 1.6 μ V		
(50 to 100) kHz	0.02 % of reading + 1.9 μ V		
(100 to 300) kHz	0.041 % of reading + 3.1 μ V		
(300 to 500) kHz	0.053 % of reading + 6.2 μ V		
500 kHz to 1 MHz	0.01 % of reading + 6.2 μ V		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	0.22 V		Comparison to Fluke 5790B AC Measurement Standard
	(10 to 20) Hz	0.017 % of reading + 1.2 μ V	
	(20 to 40) Hz	0.007 % of reading + 1.2 μ V	
	40 Hz to 20 kHz	0.003 % of reading + 1.2 μ V	
	(20 to 50) kHz	0.006 % of reading + 1.6 μ V	
	(50 to 100) kHz	0.012 % of reading + 1.9 μ V	
	(100 to 300) kHz	0.022 % of reading + 3.1 μ V	
	(300 to 500) kHz	0.031 % of reading + 6.2 μ V	
	500 kHz to 1 MHz	0.094 % of reading + 6.2 μ V	
	0.7 V		
	(10 to 20) Hz	0.016 % of reading + 1.2 μ V	
	(20 to 40) Hz	0.006 % of reading + 1.2 μ V	
	40 Hz to 20 kHz	0.003 % of reading + 1.2 μ V	
	(20 to 50) kHz	0.004 % of reading + 1.6 μ V	
	(50 to 100) kHz	0.006 % of reading + 1.9 μ V	
	(100 to 300) kHz	0.014 % of reading + 3.1 μ V	
	(300 to 500) kHz	0.023 % of reading + 6.2 μ V	
	500 kHz to 1 MHz	0.076 % of reading + 6.2 μ V	
	2.2 V		
	(10 to 20) Hz	0.016 % of reading	
	(20 to 40) Hz	0.006 % of reading	
	40 Hz to 20 kHz	0.002 % of reading	
	(20 to 50) kHz	0.004 % of reading	
	(50 to 100) kHz	0.006 % of reading	
(100 to 300) kHz	0.016 % of reading		
(300 to 500) kHz	0.024 % of reading		
500 kHz to 1 MHz	0.094 % of reading		
7 V			
(10 to 20) Hz	0.016 % of reading		
(20 to 40) Hz	0.006 % of reading		
40 Hz to 20 kHz	0.002 % of reading		
(20 to 50) kHz	0.004 % of reading		
(50 to 100) kHz	0.006 % of reading		
(100 to 300) kHz	0.016 % of reading		
(300 to 500) kHz	0.024 % of reading		
500 kHz to 1 MHz	0.094 % of reading		

Electrical – DC/Low Frequency

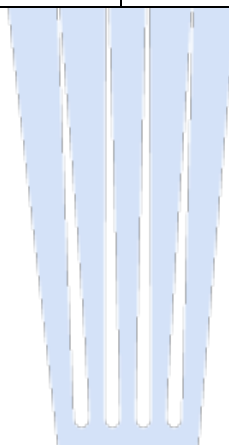
Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	22 V		Comparison to Fluke 5790B AC Measurement Standard
	(10 to 20) Hz	0.016 % of reading	
	(20 to 40) Hz	0.005 % of reading	
	40 Hz to 20 kHz	0.002 % of reading	
	(20 to 50) kHz	0.004 % of reading	
	(50 to 100) kHz	0.007 % of reading	
	(100 to 300) kHz	0.015 % of reading	
	(300 to 500) kHz	0.032 % of reading	
	500 kHz to 1 MHz	0.093 % of reading	
	70 V		
	(10 to 20) Hz	0.016 % of reading	
	(20 to 40) Hz	0.006 % of reading	
	40 Hz to 20 kHz	0.003 % of reading	
	(20 to 50) kHz	0.005 % of reading	
	(50 to 100) kHz	0.009 % of reading	
	(100 to 300) kHz	0.017 % of reading	
	(300 to 500) kHz	0.04 % of reading	
	500 kHz to 1 MHz	0.12 % of reading	
	220 V		
	(10 to 20) Hz	0.016 % of reading	
	(20 to 40) Hz	0.006 % of reading	
	40 Hz to 20 kHz	0.003 % of reading	
	(20 to 50) kHz	0.006 % of reading	
	(50 to 100) kHz	0.009 % of reading	
(100 to 300) kHz	0.02 % of reading		
(300 to 500) kHz	0.054 % of reading		
700 V			
(10 to 20) Hz	0.016 % of reading		
(20 to 40) Hz	0.009 % of reading		
40 Hz to 20 kHz	0.004 % of reading		
(20 to 50) kHz	0.012 % of reading		
(50 to 100) kHz	0.066 % of reading		
1 000 V			
(10 to 20) Hz	0.015 % of reading		
(20 to 40) Hz	0.009 % of reading		
40 Hz to 20 kHz	0.003 % of reading		
(20 to 50) kHz	0.012 % of reading		
(50 to 100) kHz	0.066 % of reading		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC High Voltage – Source/Measure ¹	60 Hz (1 to 120) kV	3.8 mV/V	Comparison to Ross Engineering VD120-6.2Y-A-LB-AL High Voltage Divider, Keysight 3458A 8.5 Digit Multimeter
AC Current – Source ¹	(29 to 329.99) μ A (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (0.33 to 3.299 99) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (3.3 to 32.999 9) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (33 to 329.999) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (0.33 to 1.099 99) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.6 nA/ μ A + 78 nA 1.2 nA/ μ A + 78 nA 0.97 nA/ μ A + 78 nA 2.3 nA/ μ A + 0.12 μ A 6.4 nA/ μ A + 0.16 μ A 12 nA/ μ A + 0.31 μ A 1.6 μ A/mA + 0.12 μ A 0.97 μ A/mA + 0.12 μ A 0.79 μ A/mA + 78 nA 1.5 μ A/mA + 0.16 μ A 3.9 μ A/mA + 0.23 μ A 7.9 μ A/mA + 0.47 μ A 1.4 μ A/mA + 1.6 μ A 0.7 μ A/mA + 1.6 μ A 0.3 μ A/mA + 0.16 μ A 0.64 μ A/mA + 0.16 μ A 1.5 μ A/mA + 2.3 μ A 3 μ A/mA + 3.1 μ A 1.4 μ A/mA + 16 μ A 0.7 μ A/mA + 16 μ A 0.33 μ A/mA + 16 μ A 0.79 μ A/mA + 39 μ A 1.6 μ A/mA + 78 μ A 3.3 μ A/mA + 0.16 mA 0.11 mA/A + 78 μ A 0.11 mA/A + 78 μ A 0.16 mA/A + 0.78 mA 0.4 mA/A + 3.9 mA	Comparison to Fluke 5522A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(1.1 to 2.999 99) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.4 mA/A + 78 μA 0.53 mA/A + 78 μA 4.7 mA/A + 0.78 mA 19 mA/A + 3.9 mA	Comparison to Fluke 5522A Multiproduct Calibrator
	(3 to 10.9999) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	1 mA/A + 1.6 mA 1.2 mA/A + 1.6 mA 23 mA/A + 1.6 mA	
	(3 to 10.9999) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	1 mA/A + 1.6 mA 1.2 mA/A + 1.6 mA 23 mA/A + 1.6 mA	
	(11 to 20.5) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	1.8 mA/A + 3.9 mA 1.9 mA/A + 3.9 mA 23 mA/A + 3.9 mA	
AC Current – Source ¹	(0.1 to 1) kHz (20 to 100) A	12 mA/A	Comparison to Transconductance Amp, HP 3458A, Current Shunt
AC Current – Source ¹	(20 to 1) kHz 100 Hz to 1 kHz	12 mA/A	Comparison to Transmille 4010A Multiproduct Calibrator, Transmille EA002 2/10/50 Coil Adapter



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure	Up to 330 μ A		Comparison to Fluke 5790B AC Measurement Standard, Current Shunts
	10 Hz to 1 kHz	9 nA	
	1 kHz to 30 kHz	4 nA	
	(> 0.33 to 3.29) mA		
	10 Hz to 1 kHz	32 μ A	
	1 kHz to 30 kHz	12 nA	
	(> 3.29 to 32.9 mA)		
	10 Hz to 1 kHz	29 μ A	
	1 kHz to 5 kHz	24 μ A	
	5 kHz to 30 kHz	39 μ A	
AC Current – Source/Measure ¹	(> 32.9 to 329 mA)		Comparison to Valhalla 2575A Current Shunt, Keysight 3458A 8.5 Digit Multimeter, Current Source
	10 Hz to 1 kHz	39 μ A	
	1 kHz to 5 kHz	25 μ A	
	5 kHz to 30 kHz	40 μ A	
	> 329 mA to 2.99 A		
	10 Hz to 1 kHz	59 μ A	
	1 kHz to 5 kHz	36 μ A	
	5 kHz to 30 kHz	85 μ A	
	45 Hz to 1 kHz		
	(0.1 to 2) mA	4.1 mA/A + 3 nA	
(2 to 20) mA	1.1 mA/A + 30 nA		
(20 to 200) mA	1 mA/A + 0.3 μ A		
(0.2 to 2) A	1 mA/A + 3 μ A		
(2 to 20) A	1 mA/A + 30 μ A		
(20 to 100) A	1 mA/A + 0.15 mA		
DC Power – Source ¹	33 mV to 1 020 V		Comparison to Fluke Multiproduct Calibrator
	0.33 mA to 2.9999 A 11 μ W to 3.06 kW	0.018 % of reading	
	33 mV to 1 020 V		
	(3 to 20.5) A 0.1 W to 20.9 kW	0.054 % of reading	
AC Power – Source ¹			Comparison to Fluke Multiproduct Calibrator
33 mV to 1 020 V (45 to 65) Hz Power Factor: PF=1	(3 to 20.5) A 0.11 mW to 20.9 kW	0.11 % of reading	



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source ¹ (Simulated)			
10 Hz to 10 kHz	(220 to 399.9) pF	0.55 % of reading + 7.8 pF	Comparison to Fluke 5522A Multiproduct Calibrator
10 Hz to 10 kHz	(0.4 to 1.099 9) nF	0.42 % of reading + 10 pF	
10 Hz to 3 kHz	(1.1 to 3.299 9) nF	0.39 % of reading + 10 pF	
10 Hz to 1 kHz	(3.3 to 10.999 9) nF	0.2 % of reading + 10 pF	
10 Hz to 1 kHz	(11 to 32.999 9) nF	0.2 % of reading + 8 pF	
10 Hz to 1 kHz	(33 to 109.999) nF	0.2 % of reading + 8 pF	
10 Hz to 1 kHz	(110 to 329.999) nF	0.27 % of reading + 0.23 nF	
(10 to 600) Hz	(0.33 to 1.099 99) μF	0.21 % of reading + 0.78 nF	
(10 to 300) Hz	(1.1 to 3.299 99) μF	0.2 % of reading + 2.3 nF	
(10 to 150) Hz	(3.3 to 10.999 9) μF	0.21 % of reading + 7.8 nF	
(10 to 120) Hz	(11 to 32.999 9) μF	0.3 % of reading + 23 nF	
(10 to 80) Hz	(33 to 109.999) μF	0.35 % of reading + 78 nF	
(DC to 50) Hz	(110 to 329.999) μF	0.36 % of reading + 0.23 μF	
(DC to 20) Hz	(0.33 to 1.099 99) mF	0.36 % of reading + 0.78 μF	
(DC to 6) Hz	(1.1 to 3.299 99) mF	0.36 % of reading + 2.3 μF	
(DC to 2) Hz	(3.3 to 10.999 9) mF	0.35 % of reading + 7.8 μF	
(DC to 0.6) Hz	(11 to 32.999 9) mF	0.58 % of reading + 23 μF	
(DC to 0.2) Hz	(33 to 110) mF	0.85 % of reading + 77 μF	
Capacitance – Source ^{1,4} (Fixed Artifact)	1 kHz		Comparison to Transmille 4010 Multiproduct Calibrator
	1 nF	0.42 % of reading + 10 pF	
	2 nF	0.39 % of reading + 10 pF	
	5 nF	0.2 % of reading + 10 pF	
	10 nF	0.2 % of reading + 80 pF	
	100 nF	0.2 % of reading + 80 pF	
	1 μF	0.27 % of reading + 0.23 nF	
	10 μF	0.21 % of reading + 0.78 nF	
Capacitance – Measure ¹	12 Hz to 100 kHz		Comparison to General Radio 1689M RLC Bridge
	1 pF to 6.4 nF	0.12 % of reading	
	(6.4 to 100) nF	0.38 % of reading	
	(0.1 to 1.6) μF	0.81 % of reading	
	(1.6 to 100) μF	0.57 % of reading	
Capacitance – Measure ¹	DC		Comparison to Fluke 5700A Multiproduct Calibrator, Keysight 3458A 8.5 Digit Multimeter; ΔV/ΔT Method
	200 μF to 0.11 F	0.023 % of reading	



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure ¹	1 kHz 1 pF to 1 μF	0.000 9 % of reading	Comparison to Andeen-Hagerling 2500A Capacitance Bridge
Inductance – Source/Measure ¹ (Variable Artifact)	100 Hz to 1 kHz 1 mH to 11.11 H	0.27 % of reading	Comparison to General Radio 1689M RLC Bridge, General Radio 1490D Decade Inductor
DC Resistance – Source ¹ (Simulated)	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ	33 μΩ/Ω + 0.78 mΩ 24 μΩ/Ω + 1.2 mΩ 22 μΩ/Ω + 1.1 mΩ 22 μΩ/Ω + 1.6 mΩ 23 μΩ/Ω + 1.6 μΩ 23 mΩ/Ω + 16 mΩ 23 mΩ/Ω + 16 mΩ 22 mΩ/Ω + 0.16 Ω 23 mΩ/Ω + 0.16 Ω 26 mΩ/Ω + 1.6 Ω	Comparison to Fluke 5522A Multiproduct Calibrator
DC Resistance – Source ¹ (Simulated)	(0.33 to 1.1) MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (330 to 1 100) MΩ	25 mΩ/Ω + 1.6 Ω 48 mΩ/Ω + 23 Ω 0.23 Ω/Ω + 39 Ω 0.2 Ω/Ω + 1.9 kΩ 0.4 Ω/Ω + 2.3 kΩ 2.3 Ω/kΩ + 78 kΩ 12 Ω/kΩ + 0.39 MΩ	Comparison to Fluke 5522A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Resistance – Source ¹ (Simulated-Fixed)	0 Ω	97 μΩ	Comparison to Fluke 5700A Multiproduct Calibrator
	1.9 Ω	0.18 mΩ	
	10 Ω	0.3 mΩ	
	19 Ω	0.55 mΩ	
	100 Ω	2 mΩ	
	190 Ω	3.4 mΩ	
	1 kΩ	16 mΩ	
	1.9 kΩ	30 mΩ	
	10 kΩ	0.16 Ω	
	19 kΩ	0.28 Ω	
	100 kΩ	1.7 Ω	
	190 kΩ	3.2 Ω	
	1 MΩ	24 Ω	
	1.9 MΩ	57 Ω	
	10 MΩ	0.18 kΩ	
19 MΩ	3.5 kΩ		
100 MΩ	19 kΩ		
DC Resistance – Source ⁴ (Fixed Values)	0.01 Ω	0.86 μΩ	Fluke Y5020 Shunt Comparison to Low Thermal Keithley series 700 Standard Resistors IET Standard Resistor
	0.02 Ω	0.21 μΩ	
	1.0 Ω	8.9 μΩ	
	10 Ω	21 μΩ	
	100 Ω	210 μΩ	
	1 kΩ	3.5 μΩ	
	10 kΩ	27 mΩ	
	10 MΩ	100 Ω	
	1 GΩ	250 μΩ/Ω	
1 TΩ	800 μΩ/Ω		
DC Resistance – Measure ¹	(0.01 to 1) Ω	73 μΩ/Ω	Comparison to Keysight 34420A
DC Resistance – Measure ¹	Up to 12 Ω	19 μΩ/ Ω + 50 μΩ	Comparison to Keysight 3458A 8.5 Digit Multimeter
	(12 to 120) Ω	15 μΩ/ Ω + 0.5 mΩ	
	(0.12 to 1.2) kΩ	13 μΩ/ Ω + 0.5 mΩ	
	(1.2 to 12) kΩ	12 μΩ/ Ω + 5 mΩ	
	(1.2 to 120) kΩ	13 μΩ/ Ω + 50 μΩ	
	(0.12 to 1.2) MΩ	24 μΩ/ Ω + 2 Ω	
	(1.2 to 12) MΩ	65 μΩ/ Ω + 100 Ω	
	(12 to 120) MΩ	0.58 mΩ/ Ω + 1 kΩ	
(0.12 to 1.2) GΩ	5.8 mΩ/ Ω + 10 kΩ		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes ^{1,2} Edge Characteristics into 50 Ω Rise Time Amplitude Frequency Wave Generator Amplitude (Square, Sine, Triangle) into 50Ω into 1 MΩ Frequency Input Resistance Measurement into 50 Ω into 1 MΩ Input Capacitance Measurement into 1 MΩ	≤ 300 ps 5 mV to 2.5 V 900 Hz to 11 MHz 1.8 mV to 2.5 Vp-p 1.8 mV to 55 Vp-p 10 Hz to 100 kHz (40 to 60) Ω 500 kΩ to 1.5 MΩ (5 to 50) pF	+ 0 ps / - 100 ps 2 % of reading + 0.2 mV 2.5 μHz/Hz 30 mV/V + 0.1 mV 30 mV/V + 0.1 mV 25 μHz/Hz + 15 mHz 0.1 % of reading 0.1 % of reading 5 % of reading + 0.5 pF	Comparison to Fluke 5522A Multiproduct Calibrator
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure ¹	Type B (600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °C Type C (0 to 150) °C (150 to 650) °C (650 to 1 000) °C (1 000 to 1 800) °C (1 800 to 2 316) °C Type E (-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1 000) °C	0.34 °C 0.27 °C 0.23 °C 0.26 °C 0.23 °C 0.2 °C 0.24 °C 0.39 °C 0.65 °C 0.39 °C 0.13 °C 0.11 °C 0.13 °C 0.17 °C	Comparison to Fluke 5522A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure ¹	Type J		Comparison to Fluke 5522A Multiproduct Calibrator
	(-210 to -100) °C	0.21 °C	
	(-100 to -30) °C	0.13 °C	
	(-30 to 150) °C	0.11 °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	0.14 °C	
	(-25 to 120) °C	0.13 °C	
	(120 to 1 000) °C	0.2 °C	
	(1 000 to 1 372) °C	0.31 °C	
	Type L		
	(-200 to -100) °C	0.29 °C	
	(-100 to 800) °C	0.2 °C	
	(800 to 900) °C	0.14 °C	
	Type N		
	(-200 to -100) °C	0.31 °C	
	(-100 to -25) °C	0.17 °C	
	(-25 to 120) °C	0.15 °C	
	(120 to 410) °C	0.14 °C	
	(410 to 1 300) °C	0.21 °C	
	Type R		
	(0 to 250) °C	0.44 °C	
	(250 to 400) °C	0.27 °C	
	(400 to 1 000) °C	0.26 °C	
	(1 000 to 1 767) °C	0.31 °C	
	Type S		
(0 to 250) °C	0.37 °C		
(250 to 1 000) °C	0.28 °C		
(1 000 to 1 400) °C	0.29 °C		
(1 400 to 1 767) °C	0.36 °C		
Type T			
(-250 to -150) °C	0.49 °C		
(-150 to 0) °C	0.19 °C		
(0 to 120) °C	0.13 °C		
(120 to 400) °C	0.11 °C		
Type U			
(-200 to 0) °C	0.44 °C		
(0 to 600) °C	0.21 °C		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
Electrical Simulation of RTD Indicating Devices – Source ¹	Pt 385, 100 Ω		Comparison to Fluke 5522A Multiproduct Calibrator	
	(-200 to -80) °C	0.04 °C		
	(-80 to 0) °C	0.04 °C		
	(0 to 100) °C	0.05 °C		
	(100 to 300) °C	0.07 °C		
	(300 to 400) °C	0.08 °C		
	(400 to 630) °C	0.09 °C		
	(630 to 800) °C	0.18 °C		
	Pt 3926, 100 Ω			
	(-200 to -80) °C	0.04 °C		
	(-80 to 0) °C	0.04 °C		
	(0 to 100) °C	0.05 °C		
	(100 to 300) °C	0.07 °C		
	(300 to 400) °C	0.08 °C		
	(400 to 630) °C	0.09 °C		
	Pt 3916, 100 Ω			
	(-200 to -190) °C	0.19 °C		
	(-190 to -80) °C	0.03 °C		
	(-80 to 0) °C	0.04 °C		
	(0 to 100) °C	0.05 °C		
	(100 to 260) °C	0.05 °C		
	(260 to 300) °C	0.06 °C		
	(300 to 400) °C	0.07 °C		
	(400 to 600) °C	0.08 °C		
	(600 to 630) °C	0.18 °C		
	Pt 385, 200 Ω			
	(-200 to -80) °C	0.03 °C		
	(-80 to 0) °C	0.03 °C		
(0 to 100) °C	0.03 °C			
(100 to 260) °C	0.04 °C			
(260 to 300) °C	0.09 °C			
(300 to 400) °C	0.1 °C			
(400 to 600) °C	0.11 °C			
(600 to 630) °C	0.12 °C			

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicating Devices – Source ¹	Pt 385, 500 Ω		Comparison to Fluke 5522A Multiproduct Calibrator
	(-200 to -80) °C	0.03 °C	
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.04 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.06 °C	
	(300 to 400) °C	0.06 °C	
	(400 to 600) °C	0.07 °C	
	(600 to 630) °C	0.09 °C	
	Pt 385, 1 000 Ω		
	(-200 to -80) °C	0.02 °C	
	(-80 to 0) °C	0.02 °C	
	(0 to 100) °C	0.03 °C	
	(100 to 260) °C	0.04 °C	
	(260 to 300) °C	0.05 °C	
	(300 to 400) °C	0.05 °C	
(400 to 600) °C	0.05 °C		
(600 to 630) °C	0.18 °C		
Ni 385, 120 Ω			
(-80 to 0) °C	0.06 °C		
(0 to 100) °C	0.06 °C		
(100 to 260) °C	0.01 °C		
Cu 427, 10 Ω			
(-100 to 260) °C	0.31 °C		
Phase Measurement ¹ (0 to 360)°	(0.0.1 to 100) Vrms 10 Hz to 10 KHz (10 to 50) kHz (50 to 100) kHz	0.2° 0.15° 1.5°	Comparison to Clarke-Hess 6000
Phase Measurement ¹ (0 to 360)°	5 Vrms (Equal Amplitude) 1 Hz to 1 kHz (1 to 6.25) kHz (6.251 to 50) kHz (50.01 o 100) kHz	0.005° 0.01° 0.25° 0.05°	Comparison to Clarke-Hess 5000
	20 mVrms to 120 Vrms (Unequal Amplitude) 1 Hz to 1 kHz (1 to 6.25) kHz (6.251 to 50) kHz (50.01 o 100) kHz	0.011° 0.022° 0.055° 0.1°	

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF/Microwave Power – Source/Measure ¹	(0.1 to 26.5) GHz (-35 to 20) dBm	1.8% of reading	Comparison to HP 8485A
	(0.1 to 18) GHz (-70 to -20) dBm	1.4 % of reading	HP 8481D
	(-30 to 20) dBm	1.1 % of reading	HP 8481A
	100 kHz to 4.2 GHz (-30 to 20) dBm	1.6 % of reading	HP 8482A
	(0.1 to 18) GHz (-60 to 20) dBm	0.97 % of reading	HP E9300A
	9 kHz to 6 GHz (-60 to 20) dBm	0.93% of reading	HP E9304A
	(0.01 to 18) GHz (-30 to 0) dBm	0.7 % of reading	HP 8478B
	25 MHz to 1 GHz (1 to 110) W	0.3 W	R&S NAP-Z4
Attenuation – Measure or Tuned RF Power 2.5 MHz to 18 GHz	(0 to 10) dB	0.15 dB	Comparison to Keysight 8902A Measuring Receiver, Keysight 11793A Microwave Converter
	(-10 to 0) dB	0.15 dB	
	(-20 to -10) dB	0.15 dB	
	(-30 to -20) dB	0.15 dB	
	(-40 to -30) dB	0.15 dB	
	(-50 to -40) dB	0.15 dB	
(-60 to -50) dB	0.17 dB		
Attenuation – Measure or Tuned RF Power 2.5 MHz to 18 GHz	(-70 to -60) dB	0.17 dB	Comparison to Keysight 8902A Measuring Receiver, Keysight 11793A Microwave Converter
	(-80 to -70) dB	0.2 dB	
	(-90 to -80) dB	0.22 dB	
	(-100 to -90) dB	0.22 dB	
	(-110 to -100) dB	0.33 dB	
	(-120 to -110) dB	0.43 dB	
(-127 to -120) dB	0.43 dB		

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation – Measure 150 kHz to 10 MHz 10 MHz to 1.3 GHz 10 MHz to 1.3 GHz (1.3 to 26.5) GHz (1.3 to 26.5) GHz	Rate: 50 Hz to 10 kHz Depths: (5 to 99) % Rate: 50 Hz to 50 kHz Depths: (5 to 99) % Rate: 20 Hz to 100 kHz Depths: (5 to 99) % Rate: 20 Hz to 100 kHz Depths: (5 to 99) % Rate: 20 Hz to 100 kHz Depths: (5 to 99) %	2.3 % of reading 1.2 % of reading 3.5 % of reading 1.8 % of reading 3.5 % of reading	Comparison to Agilent 8902A Measuring Receiver
Frequency Modulation – Measure Carrier Frequency: 250 kHz to 10 MHz 10 MHz to 1.3 GHz	Rate: 20 Hz to 10 kHz Dev.: ≤ 40 kHz peak Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	2.3 % of reading 5.8 % of reading	Comparison to Keysight 8902A Measuring Receiver
Frequency Modulation – Measure Carrier Frequency: (1.3 to 26.5) GHz	Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	5.8 % of reading	Comparison to Keysight 8902A Measuring Receiver
Phase Modulation – Measure 10 MHz to 1.3 GHz 1.3 GHz to 26.5 GHz	Rate: 200 Hz 20 kHz Dev.: .1 to 400 rad Rate: 200 Hz 20 kHz Dev.: > .1 to 400 rad	3.5 % of reading 4.6 % of reading	Comparison to Agilent 8902A Measuring Receiver, Keysight 11722A / 11792A Sensor Modules
Harmonic Distortion	9 kHz to 6.5 GHz (6.5 to 26.5) GHz (26.5 to 40) GHz	1.7 dB 2.6 dB 3.4 dB	Comparison to Keysight 8565E Spectrum Analyzer
Total Harmonic Distortion	(-80 to 0) dBm 20 Hz to 20 kHz (20 to 100) kHz	1.2 dB 2.3 dB	Comparison to HP 8903B Distortion Analyzer

Electrical – RF/Microwave

Parameter/Equipment	Frequency		Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S-Parameters (Reflection & Transmission)	(0.045 to 50) GHz		See tables below	Comparison to Keysight 8510C VNA with 85056K & 85057B calibration kits
Type 2.4 mm: Reflection S21/S12 Log Magnitude (dB)				
rho	(0.045 to 2) GHz	(2 to 20) GHz	(20 to 40) GHz	(40 to 50) GHz
(10 to -10) db	0.087 dB	0.096 dB	0.18 dB	0.19 dB
(-10 to -20) db	0.087 dB	0.096 dB	0.18 dB	0.18 dB
(-20 to -30) db	0.011 dB	0.096 dB	0.18 dB	0.18 dB
(-30 to -40) db	0.011 dB	0.096 dB	0.18 dB	0.2 dB
(-40 to -50) db	0.011 dB	0.096 dB	0.19 dB	0.36 dB
(-50 to -60) db	0.016 dB	0.1 dB	0.35 dB	1.1 dB

Electrical – RF/Microwave

Parameter/Equipment	Frequency		Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S-Parameters (Reflection & Transmission)	(0.045 to 50) GHz		See tables below	Comparison to Keysight 8510C VNA with 85056K & 85057B calibration kits
Type 2.4 mm: Reflection S11/S22 Linear Magnitude (ρ)				
rho	(0.045 to 2) GHz	(2 to 20) GHz	(20 to 40) GHz	(40 to 50) GHz
0.05	0.013 lin. mag.	0.013 lin. mag.	0.021 lin. mag.	0.022 lin. mag.
0.1	0.013 lin. mag.	0.013 lin. mag.	0.021 lin. mag.	0.021 lin. mag.
0.2	0.013 lin. mag.	0.013 lin. mag.	0.02 lin. mag.	0.021 lin. mag.
0.4	0.011 lin. mag.	0.012 lin. mag.	0.018 lin. mag.	0.019 lin. mag.
0.6	0.011 lin. mag.	0.011 lin. mag.	0.017 lin. mag.	0.018 lin. mag.
0.8	0.012 lin. mag.	0.012 lin. mag.	0.021 lin. mag.	0.021 lin. mag.
1.0	0.017 lin. mag.	0.018 lin. mag.	0.032 lin. mag.	0.032 lin. mag.

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Transmission S21/S12 Log Magnitude (dB) 2.4 mm connector	(0.045 to 2) GHz		Comparison to Keysight 8510C VNA with 85056K calibration kit and 85057B calibration kit
	(10 to 0) dB	0.082 dB	
	(0 to -10) dB	0.087 dB	
	(-10 to -20) dB	0.087 dB	
	(-20 to -30) dB	0.11 dB	
	(-30 to -40) dB	0.11 dB	
	(-40 to -50) dB	0.11 dB	
	(-50 to -60) dB	0.16 dB	
	(2 to 20) GHz		
	(10 to 0) dB	0.096 dB	
	(0 to -10) dB	0.087 dB	
	(-10 to -20) dB	0.096 dB	
	(-20 to -30) dB	0.096 dB	
	(-30 to -40) dB	0.096 dB	
	(-40 to -50) dB	0.096 dB	
	(-50 to -60) dB	0.1 dB	
	(20 to 40) GHz		
	(10 to 0) dB	0.18 dB	
	(0 to -10) dB	0.18 dB	
	(-10 to -20) dB	0.18 dB	
	(-20 to -30) dB	0.18 dB	
	(-30 to -40) dB	0.18 dB	
	(-40 to -50) dB	0.19 dB	
	(-50 to -60) dB	0.35 dB	
	(40 to 50) GHz		
	(10 to 0) dB	0.19 dB	
	(0 to -10) dB	0.18 dB	
	(-10 to -20) dB	0.18 dB	
	(-20 to -30) dB	0.18 dB	
	(-30 to -40) dB	0.2 dB	
(-40 to -50) dB	0.36 dB		
(-50 to -60) dB	1.1 dB		



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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Transmission S11/S22 Linear Magnitude (ρ) 2.4 mm connector	(0.045 to 2) GHz		Comparison to Keysight 8510C VNA with 85056K calibration kit and 85057B calibration kit
	$\rho < 0.05$	0.013 lin. mag.	
	$0.05 < \rho < 0.10$	0.013 lin. mag.	
	$0.10 < \rho < 0.20$	0.013 lin. mag.	
	$0.20 < \rho < 0.40$	0.011 lin. mag.	
	$0.40 < \rho < 0.60$	0.011 lin. mag.	
	$0.60 < \rho < 0.80$	0.012 lin. mag.	
	$0.80 < \rho < 1.0$	0.017 lin. mag.	
	(2 to 20) GHz		
	$\rho < 0.05$	0.013 lin. mag.	
	$0.05 < \rho < 0.10$	0.013 lin. mag.	
	$0.10 < \rho < 0.20$	0.013 lin. mag.	
	$0.20 < \rho < 0.40$	0.012 lin. mag.	
	$0.40 < \rho < 0.60$	0.011 lin. mag.	
	$0.60 < \rho < 0.80$	0.012 lin. mag.	
	$0.80 < \rho < 1.0$	0.018 lin. mag.	
	(20 to 40) GHz		
	$\rho < 0.05$	0.021 lin. mag.	
	$0.05 < \rho < 0.10$	0.021 lin. mag.	
	$0.10 < \rho < 0.20$	0.02 lin. mag.	
	$0.20 < \rho < 0.40$	0.018 lin. mag.	
	$0.40 < \rho < 0.60$	0.017 lin. mag.	
	$0.60 < \rho < 0.80$	0.021 lin. mag.	
	$0.80 < \rho < 1.0$	0.032 lin. mag.	
	(40 to 50) GHz		
	$\rho < 0.05$	0.022 lin. mag.	
	$0.05 < \rho < 0.10$	0.021 lin. mag.	
	$0.10 < \rho < 0.20$	0.021 lin. mag.	
$0.20 < \rho < 0.40$	0.019 lin. mag.		
$0.40 < \rho < 0.60$	0.018 lin. mag.		
$0.60 < \rho < 0.80$	0.021 lin. mag.		
$0.80 < \rho < 1.0$	0.032 lin. mag.		

Electrical – RF/Microwave

Parameter/Equipment	Frequency	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S-Parameters (Reflection & Transmission)	(0.045 to 50) GHz	See tables below	Comparison to Keysight 8510C VNA with 85052K & 85053B calibration kits
Type 3.5 mm: Reflection S21/S12 Log Magnitude (dB)			
rho	(0.045 to 2) GHz	(2 to 20) GHz	(20 to 26.5) GHz
(10 to -10) db	0.087 dB	0.096 dB	0.18 dB
(-10 to -20) db	0.087 dB	0.096 dB	0.18 dB
(-20 to -30) db	0.011 dB	0.096 dB	0.18 dB
(-30 to -40) db	0.011 dB	0.096 dB	0.18 dB
(-40 to -50) db	0.011 dB	0.096 dB	0.19 dB
(-50 to -60) db	0.016 dB	0.1 dB	0.35 dB

Electrical – RF/Microwave

Parameter/Equipment	Frequency	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S-Parameters (Reflection & Transmission)	(0.045 to 26.5) GHz	See tables below	Comparison to Keysight 8510C VNA with 85056K & 85053B calibration kits
Type 3.5 mm: Reflection S11/S22 Linear Magnitude (ρ)			
rho	(0.045 to 2) GHz	(2 to 20) GHz	(20 to 26.5) GHz
0.05	0.013 lin. mag.	0.013 lin. mag.	0.021 lin. mag.
0.1	0.013 lin. mag.	0.013 lin. mag.	0.021 lin. mag.
0.2	0.013 lin. mag.	0.013 lin. mag.	0.02 lin. mag.
0.4	0.011 lin. mag.	0.012 lin. mag.	0.018 lin. mag.
0.6	0.01 lin. mag.	0.011 lin. mag.	0.017 lin. mag.
0.8	0.011 lin. mag.	0.012 lin. mag.	0.019 lin. mag.
1.0	0.015 lin. mag.	0.018 lin. mag.	0.03 lin. mag.

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Transmission S21/S12 Log Magnitude (dB) 3.5 mm connector	(0.045 to 2) GHz		Comparison to Keysight 8510C VNA with 85052K calibration kit and 85053B calibration kit
	(10 to 0) dB	0.082 dB	
	(0 to -10) dB	0.087 dB	
	(-10 to -20) dB	0.087 dB	
	(-20 to -30) dB	0.11 dB	
	(-30 to -40) dB	0.11 dB	
	(-40 to -50) dB	0.11 dB	
	(-50 to -60) dB	0.16 dB	
	(2 to 20) GHz		
	(10 to 0) dB	0.096 dB	
	(0 to -10) dB	0.087 dB	
	(-10 to -20) dB	0.096 dB	
	(-20 to -30) dB	0.096 dB	
	(-30 to -40) dB	0.096 dB	
	(-40 to -50) dB	0.096 dB	
	(-50 to -60) dB	0.1 dB	
	(20 to 26.5) GHz		
	(10 to 0) dB	0.18 dB	
	(0 to -10) dB	0.18 dB	
	(-10 to -20) dB	0.18 dB	
	(-20 to -30) dB	0.18 dB	
(-30 to -40) dB	0.18 dB		
(-40 to -50) dB	0.19 dB		
(-50 to -60) dB	0.35 dB		

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Transmission S11/S22 Linear Magnitude (ρ) 3.5 mm connector	(0.045 to 2) GHz		Comparison to Keysight 8510C VNA with 85056K calibration kit and 85053B calibration kit
	$\rho < 0.05$	0.013 lin. mag.	
	$0.05 < \rho < 0.10$	0.013 lin. mag.	
	$0.10 < \rho < 0.20$	0.013 lin. mag.	
	$0.20 < \rho < 0.40$	0.011 lin. mag.	
	$0.40 < \rho < 0.60$	0.01 lin. mag.	
	$0.60 < \rho < 0.80$	0.011 lin. mag.	
	$0.80 < \rho < 1.0$	0.015 lin. mag.	
	(2 to 20) GHz		
	$\rho < 0.05$	0.013 lin. mag.	
	$0.05 < \rho < 0.10$	0.013 lin. mag.	
	$0.10 < \rho < 0.20$	0.013 lin. mag.	
	$0.20 < \rho < 0.40$	0.012 lin. mag.	
	$0.40 < \rho < 0.60$	0.011 lin. mag.	
	$0.60 < \rho < 0.80$	0.012 lin. mag.	
	$0.80 < \rho < 1.0$	0.018 lin. mag.	
	(20 to 26.5) GHz		
	$\rho < 0.05$	0.021 lin. mag.	
	$0.05 < \rho < 0.10$	0.021 lin. mag.	
	$0.10 < \rho < 0.20$	0.02 lin. mag.	
	$0.20 < \rho < 0.40$	0.018 lin. mag.	
$0.40 < \rho < 0.60$	0.017 lin. mag.		
$0.60 < \rho < 0.80$	0.019 lin. mag.		
$0.80 < \rho < 1.0$	0.03 lin. mag.		

Electrical – RF/Microwave

Parameter/Equipment	Frequency	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S-Parameters (Reflection & Transmission)	(0.045 to 18) GHz	See tables below	Comparison to Keysight 8510C VNA with 85032F calibration kit and 85053B calibration kit
Type N: Reflection S21/S12 Log Magnitude (dB)			
rho	(0.045 to 2) GHz	(2 to 18) GHz	
(10 to -10) db	0.087 dB	0.096 dB	
(-10 to -20) db	0.087 dB	0.096 dB	
(-20 to -30) db	0.011 dB	0.096 dB	
(-30 to -40) db	0.011 dB	0.096 dB	
(-40 to -50) db	0.011 dB	0.096 dB	
(-50 to -60) db	0.016 dB	0.1 dB	

Electrical – RF/Microwave

Parameter/Equipment	Frequency	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S-Parameters (Reflection & Transmission)	(0.045 to 18) GHz	See tables below	Comparison to Keysight 8510C VNA with 85032F & 85053B calibration kits
Type 3.5 mm: Reflection S11/S22 Linear Magnitude (ρ)			
rho	(0.045 to 2) GHz	(2 to 18) GHz	
0.05	0.013 lin. mag.	0.013 lin. mag.	
0.1	0.013 lin. mag.	0.013 lin. mag.	
0.2	0.013 lin. mag.	0.013 lin. mag.	
0.4	0.011 lin. mag.	0.012 lin. mag.	
0.6	0.01 lin. mag.	0.011 lin. mag.	
0.8	0.011 lin. mag.	0.013 lin. mag.	
1.0	0.015 lin. mag.	0.02 lin. mag.	

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Transmission S21/S12 Log Magnitude (dB) Type N Connector	(0.045 to 2) GHz		Comparison to Keysight 8510C VNA with 85032F calibration kit and 85053B calibration kit
	(10 to 0) dB	0.082 dB	
	(0 to -10) dB	0.087 dB	
	(-10 to -20) dB	0.087 dB	
	(-20 to -30) dB	0.11 dB	
	(-30 to -40) dB	0.11 dB	
	(-40 to -50) dB	0.11 dB	
	(-50 to -60) dB	0.16 dB	
	(2 to 18) GHz		
	(10 to 0) dB	0.096 dB	
	(0 to -10) dB	0.087 dB	
	(-10 to -20) dB	0.096 dB	
	(-20 to -30) dB	0.096 dB	
	(-30 to -40) dB	0.096 dB	
(-40 to -50) dB	0.096 dB		
(-50 to -60) dB	0.1 dB		

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Transmission S11/S22 Linear Magnitude (ρ) Type N Connector	(0.045 to 2) GHz		Comparison to Keysight 8510C VNA with 85032F calibration kit and 85053B calibration kit
	$\rho < 0.05$	0.013 lin. mag.	
	$0.05 < \rho < 0.10$	0.013 lin. mag.	
	$0.10 < \rho < 0.20$	0.013 lin. mag.	
	$0.20 < \rho < 0.40$	0.011 lin. mag.	
	$0.40 < \rho < 0.60$	0.01 lin. mag.	
	$0.60 < \rho < 0.80$	0.011 lin. mag.	
	$0.80 < \rho < 1.0$	0.015 lin. mag.	
	(2 to 18) GHz		
	$\rho < 0.05$	0.013 lin. mag.	
	$0.05 < \rho < 0.10$	0.013 lin. mag.	
	$0.10 < \rho < 0.20$	0.013 lin. mag.	
	$0.20 < \rho < 0.40$	0.012 lin. mag.	
	$0.40 < \rho < 0.60$	0.011 lin. mag.	
$0.60 < \rho < 0.80$	0.013 lin. mag.		
$0.80 < \rho < 1.0$	0.02 lin. mag.		

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Height Gage ^{1,2}	Up to 24 in	(22 + 13L) μin	Comparison to Gage Blocks, Height Gage, Repeat-O-Meter
Micrometer ^{1,2,3}	Up to 12 in	(47 + 4.8L) μin	Comparison to Gage Blocks
Calipers ^{1,2}	Up to 36 in	(345 + 5L) μin	Comparison to Gage Blocks
Caliper – Parallelism ¹	(0.15 to 0.5) in	8.8 μin/in	Comparison to Gage Ball
Depth Micrometers ^{1,3}	Up to 6 in	(30 + 4.9L) μin	Comparison to Gage Blocks
External Diameter ² Pin Gages, Set Plugs	Up to 12 in	(4.5 + 5.6L) μin	Comparison to Universal Length Measuring Machine
Internal Diameter ²	(0.04 to 3) in	(9.4 + 3.2L) μin	Comparison to Universal Length Measuring Machine
Length Standards ²	(1 to 8) in	(5 + 1.8L) μin	Comparison to Universal Length Measuring Machine, Gage Blocks
Radius Gages ²	(0.031 25 to 1) in	(291 + 98L) μin	Comparison to Keyence
Gage Blocks ²	Up to 12 in	(1.5 + 5.7L) μin	Comparison to Universal Length Measuring Machine, Master Gage Blocks
Angle Measurement ² Digital Protractors, Levels, Inclinometers	Up to 90°	22" (0.006°)	Comparisons to Sine Bar, Gage Blocks, Surface Plate, Right Angles
Steel Rules, Tape Measure	Up to 80 in	0.002 5 in	Comparison to DRO Linear Recorder
	Up to 300 ft	0.07 in	Fluke 721A Laser Distance Meter

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness	Up to 3 in	4.5 μ in	Comparison to Optical Flat, Monochromatic Light
Dial Indicators ²	(0.1 to 6) in	(4.5 + 5.6L) μ in	Comparison to P&W Universal Length Measuring Machine

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Class I Balances ¹ (0.000 01 g resolution)	Up to 100 g	0.29 mg	ASTM E617 Class 1 Weights and NIST Handbook 44 utilized for the calibration of the weighing system.
(0.000 02 g resolution)	Up to 100 g	0.29 mg	
(0.000 05 g resolution)	Up to 100 g	0.3 mg	
(0.000 1 g resolution)	Up to 200 g	0.6 mg	
(0.000 2 g resolution)	Up to 200 g	0.6 mg	
(0.000 5 g resolution)	Up to 200 g	0.87 mg	
Class II Balances ¹ (0.001 g resolution)	Up to 100 g	1.3 mg	ASTM E617 Class 1 Weights and NIST Handbook 44 utilized for the calibration of the weighing system.
(0.002 g resolution)	Up to 200 g	2.6 mg	
(0.005 g resolution)	Up to 500 g	6.6 mg	
(0.01 g resolution)	Up to 1 kg	13 mg	
(0.02 g resolution)	Up to 2 kg	29 mg	
(0.05 g resolution)	Up to 5 kg	0.15 g	
(0.1 g resolution)	Up to 10 kg	0.31 g	
(0.2 g resolution)	Up to 20 kg	0.36 g	

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Class III Light Capacity Scales ¹ (0.000 5 lb resolution)	Up to 5 lb	0.000 87 lb	NIST Class F Weights and NIST Handbook 44 utilized for the calibration of the weighing system.
(0.001 lb resolution)	Up to 10 lb	0.001 7 lb	
(0.002 lb resolution)	Up to 20 lb	0.002 6 lb	
Class III Light Capacity Scales ¹ (0.005 lb resolution)	Up to 50 lb	0.008 7 lb	NIST Class F Weights and NIST Handbook 44 utilized for the calibration of the weighing system.
(0.01 lb resolution)	Up to 100 lb	0.018 lb	
(0.02 lb resolution)	Up to 200 lb	0.036 lb	
(0.05 lb resolution)	Up to 500 lb	0.087 lb	
(0.1 lb resolution)	Up to 500 lb	0.14 lb	
Force Gages – Tension ¹	(1 to 110) lbf	0.06 lb	Comparison to NIST Class F Weights, Hangers
Durometers – Spring Force Types A, B, O, C, D, DO	209.04 gf to 4.079 kgf	0.01 % of reading	
Durometer Spring Force Indenter Angle (A, C) Indenter Angle (B, D) Indenter Length and Diameter Indenter Tip Width (A, C)	(10 to 90) duro (0 to 35)° (0 to 30)° (0 to 2.5) mm (0 to 0.79) mm	1.16 duro 0.31° 0.59° 0.05 mm 0.04 mm	Comparison to Durometer Calibrator Keyence Optical Comparator
Vacuum – Measure/Generate ¹	(-14 to 0) psi	0.003 7 psi	Comparison to Additel ADT681-02 Digital Vacuum Gage
Pressure – Source/Measure ¹	(-2 to 2) inH ₂ O	0.002 5 inH ₂ O	Comparison to Additel ADT681-DP2 Digital Compound Gage
Pressure – Source/Measure ¹	(0 to 10) inH ₂ O	0.001 5 inH ₂ O	Comparison to Fluke 700P01 Pressure Module

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure – Source/Measure ¹	(-5 to 5) psi	0.004 3 psi	Comparison to Fluke 700PD3 Pressure Module
Pressure – Source/Measure ¹	(0 to 30) psi	0.008 8 psi	Comparison to Additel 681-GP30 Digital Pressure Gage
Pressure – Source/Measure ¹	(0 to 100) psi	0.17 psi	Comparison to Fluke 700G06 Pressure Module
Pressure – Source/Measure ¹	(0 to 500) psi	0.11 psi	Comparison to Additel 681-GP500 Digital Pressure Gage
Pressure – Source/Measure ¹	(0 to 1 000) psi	0.66 psi	Comparison to Crystal XP2i-1000 Digital Pressure Gage
Pressure – Source/Measure ¹	(0 to 3 000) psi	1.7 psi	Comparison to GE Druck DPI104-3K Digital Pressure Gage
Pressure – Source/Measure ¹	(0 to 10 000) psi	5.8 psi	Comparison to GE Druck DPI104-10K Digital Pressure Gage
Pressure – Source/Measure ¹	(0 to 30 000) psi	18 psi	Comparison to Additel 681-GP30K Digital Pressure Gage
Pressure – Source/Measure ¹	(> 499 to < 1 104) hPa	0.003 1 % of reading	Comparison to Vaisala PTU200/HMP45 Barometric Pressure Transducer
Torque Indicating Devices ¹	(5 to 200) ozf·in (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 (200 to 2 000) lbf·ft	0.29 % of reading 0.29 % of reading 0.29 % of reading 0.3 % of reading 0.34 % of reading 0.59 % of reading 0.59 % of reading	Comparison to Torque Transducers, Torque Display

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Analyzers, Torque Transducers	(5 to 200) ozf·in (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 (200 to 2 000) lbf·ft	0.044 % of reading 0.044 % of reading 0.044 % of reading 0.044 % of reading 0.054 % of reading 0.096 % of reading 0.12 % of reading	Comparison to Torque Wheels/Arms, Weight Hanger, Master Weights

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Generate/Measure ¹	(-25 to 420) °C	0.04 °C	Comparison to Fluke Blackstack Readout, SPRT, Heat Source
Temperature – Generate/Measure ¹	(400 to 1 200) °C	0.32 °C	Comparison to Fluke Blackstack Readout, Type-S Thermocouple Probe, Heat Source
Infrared Thermometers ¹	100 °C 300 °C 500 °C	0.6 °C 0.85 °C 1.2 °C	Comparison to SPRT w/ Fluke 9132A Blackbody Calibrator (flat plate) $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$
Humidity – Generate ⁵	@ 25 °C 11.3 %RH 32.78 %RH 57.57 %RH 75.29 %RH	0.27 %RH 0.16 %RH 0.40 %RH 0.12 %RH	Certified Humidity Salts and Reference Thermometer per Journal of Research of the National Bureau of Standards – A. Physics and Chemistry Volume 81 A, No. 1, January/February 1977.
Humidity – Measure ¹	11.3 %RH 33 %RH 75.4 %RH 90 %RH	0.6 %RH 0.72 %RH 0.9 %RH 0.9 %RH	Comparison to Vaisala M170/HMP75 Measurement Indicator with Temp/Humidity Probe

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source/Measure	10 Hz to 40 GHz	50 pHz/Hz	Comparison to GPS Disciplined Oscillator, Signal Generators, Universal Counters
Timers, Stopwatches	(2 to 86 000) s	1 sec/day	Comparison to Timometer
Optical Tachometer ²	(1 to 100 000) rpm	0.001 2 % of reading	Comparison to Signal Generator, GPS Disciplined Oscillator, LED

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. L = length in inches, T = time in seconds; " = arc-second; rpm = revolutions per minute.
3. Resolution is not included on the CMC as the best device may not have been available for repeatability studies/ The Resolution will be add as $0.6R$, where R = resolution, at the time of calculating Measurement Uncertainty (MU) during calibration.
4. These values listed in the Range column are Nominal, but the calibrator will display the actual value. The Expanded Uncertainty of Measurement lists the percentage of output (actual value on the display) plus the floor.
5. The values presented in the Range column are nominal. The actual values will be listed at the time of calibration along with the corresponding Measurement Uncertainty (MU).
6. ρ = reflection coefficient
7. Unless otherwise specified in the far-right column, the calibration procedure utilized was written internally.



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