CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Transcat, Inc.
35 Vantage Point Drive
Rochester, NY 14624

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 fields of

CALIBRATION AND DIMENSIONAL MEASUREMENT

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

Jason Stine, Vice President

Expiry Date: 07 September 2027
Certificate Number: AC-2489

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

AND

ANSI/NCSL Z540-1-1994 (R2002)
ANSI/NCSL Z540.3-2006 (R2013)

Transcat, Inc.
35 Vantage Point Drive
Rochester, NY 14624
Kevin O'Grady 585-352-9720

CALIBRATION AND DIMENSIONAL MEASUREMENT

ISO/IEC 17025 Accreditation Granted: **04 April 2025**

Certificate Number: **AC-2489** Certificate Expiry Date: **07 September 2027**

CALIBRATION

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH – Source [1]	4 pH 7 pH 10 pH	0.013 pH 0.013 pH 0.012 pH	Comparison to Accredited pH Solutions
Conductivity – Source	5 µS 10 µS 100 µS 1 000 µS 10 000 µS 100 000 µS 150 000 µS	0.3 µS 0.3 µS 0.88 µS 4.4 µS 46 µS 420 µS 710 µS	Comparison to Accredited Conductivity Solutions

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sine Wave Flatness – Measure [1]	Up to 3 V 10 Hz 10 Hz to 1 MHz (1 to 10) MHz (10 to 30) MHz (30 to 50) MHz (50 to 80) MHz (80 to 100) MHz	0.2 % of reading 0.11 % of reading 0.21 % of reading 0.32 % of reading 0.36 % of reading 0.48 % of reading 0.53 % of reading	Comparison to Thermal Voltage Converter, Keysight 3458A, Opt. 002 8.5 Digit Multimeter
DC Current – Source [1]	(0 to 220) µA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A	0.004 1 % of reading + 6 nA 0.003 5 % of reading + 7 nA 0.003 5 % of reading + 40 nA 0.004 5 % of reading + 0.7 µA 0.008 1 % of reading + 12 µA	Comparison to Fluke 5730A Multiproduct Calibrator
DC Current – Source [1]	(2.2 to 11) A	0.036 % of reading + 0.48 mA	Comparison to Fluke 5720A Multiproduct Calibrator, Fluke 5725 Amplifier
DC Current – Source [1]	(11 to 100) A	0.012 % of reading + 5 mA	Comparison to Fluke 5520A Multiproduct Calibrator, Fluke 52120A Transconductance Amplifier
DC Current – Measure [1]	(0 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	0.003 6 % of reading + 0.92 nA 0.002 9 % of reading + 5.8 nA 0.002 9 % of reading + 58 nA 0.004 6 % of reading + 0.58 µA 0.013 % of reading + 12 µA	Comparison to Keysight 3458A, Opt. 002 8.5 Digit Multimeter
DC Current – Measure [1]	(1 to 3) A (3 to 10) A	0.14 % of reading 0.18 % of reading + 0.8 mA	Comparison to Fluke 8846A 6.5 Digit Multimeter
DC Current – Measure [1]	(1 to 10) A	0.047 % of reading	Comparison to L&N 4361 Current Shunt, Keysight 3458A, Opt. 002 8.5 Digit Multimeter
DC Current – Measure [1]	Up to 100 A	0.012 % of reading + 0.58 mA	Comparison to Ohms Labs CS-100 Precision Shunt, Keysight 3458A, Opt. 002 8.5 Digit Multimeter

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Clamp-on Ammeter (Non-Toroidal Type) Hall Effect Sensor [1]	(20 to 150) A (150 to 1 000) A	0.5 % of reading + 0.14 A 0.52 % of reading + 0.5 A	Comparison to Fluke 5520A Multiproduct Calibrator, Fluke 5500A/Coil 50-turn Coil
DC Clamp-on Ammeter [1]	(1 000 to 5 000) A	0.58 % of reading	Comparison to Fluke 52120A Transconductance Amplifier, Fluke 5520A Multiproduct Calibrator, 3 kA or 6 kA Coil
AC Current – Source [1]	Up to 220 µA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (0.22 to 2.2) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (2.2 to 22) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (22 to 220) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (0.22 to 2.2) A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	 0.025 % of reading + 16 nA 0.02 % 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 0.012 % of reading + 35 nA 0.02 % of reading + 0.11 µA 0.11 % of reading + 0.65 µA 0.025 % of reading + 0.4 µA 0.022 % of reading + 0.35 µA 0.012 % of reading + 0.35 µA 0.023 % of reading + 0.55 µA 0.11 % of reading + 5 µA 0.025 % of reading + 4 µA 0.022 % of reading + 3.5 µA 0.014 % of reading + 2.5 µA 0.022 % of reading + 3.5 µA 0.11 % of reading + 10 µA 0.03 % of reading + 35 µA 0.05 % of reading + 80 µA 0.7 % of reading + 0.16 mA	Comparison to Fluke 5730A Multiproduct Calibrator

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
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 + 0.85 mA 0.095 % of reading + 0.19 mA 0.36 % of reading + 0.8 mA	Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 5725 Amplifier
AC Current – Source [1]	(11 to 20.5) A (10 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	 0.097 % of reading + 3.9 mA 0.12 % of reading + 3.9 mA 2.3 % of reading + 3.9 mA	Comparison to Fluke 5520A Multiproduct Calibrator
AC Current – Source [1]	(20.5 to 40) A (10 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	 0.13 % of reading + 11 mA 0.17 % of reading + 11 mA 2.3 % of reading + 11 mA	Comparison to (2) Fluke 5520A Multiproduct Calibrators in Parallel configuration.
AC Current – Source [1]	(10 to 65) Hz (20 to 33) A (33 to 40) A (40 to 60) A (60 to 100) A (65 to 300) Hz (20 to 33) A (33 to 60) A (60 to 100) A 300 Hz to 1 kHz (20 to 33) A (33 to 60) A (60 to 100) A	 0.032 % of reading + 24 mA 0.04 % of reading + 36 mA 0.04 % of reading + 36 mA 0.037 % of reading + 36 mA 0.044 % of reading + 36 mA 0.052 % of reading + 45 mA 0.037 % of reading + 45 mA 0.12 % of reading + 0.12 A 0.12 % of reading + 0.12 A 0.12 % of reading + 0.12 A	Comparison to Fluke 52120A Transconductance Amplifier, Fluke 5520A Multiproduct Calibrator
AC Current – Source [1] Extended Frequency Ranges	(10 to 30) kHz (29 to 330) µA (0.33 to 3.3) mA (3.3 to 33) mA (33 to 330) mA	 1.2 % of reading + 0.31 µA 0.78 % of reading + 0.47 µA 0.31 % of reading + 3.1 µA 0.31 % of reading + 0.16 mA	Comparison to Fluke 5520A Multiproduct Calibrator
AC Clamp-on Ammeters (Toroidal Type) Transformer Type Sensor [1]	(20 to 150) A (45 to 65) Hz (65 to 440) Hz (150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	 0.3 % 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 5520A Multiproduct Calibrator, Fluke 5500A/COIL 50-turn Coil

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Clamp-on Ammeters (Non-Toroidal Type) Hall Effect Sensor [1]	(20 to 150) A (45 to 65) Hz (65 to 440) Hz (150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	 0.57 % of reading + 0.26 A 1 % of reading + 0.29 A 0.6 % of reading + 0.9 A 1.3 % of reading + 0.92 A	Comparison to Fluke 5520A Multiproduct Calibrator, Fluke 5500A/COIL 50-turn Coil
AC Clamp-on Ammeters (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 52120A Transconductance Amplifier, Fluke 5520A Multiproduct Calibrator, 3 kA or 6 kA Coil
AC Current – Measure [1]	Up to 100 µA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz (0.1 to 1) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz 100 mA to 1 A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	 0.46 % of reading + 35 nA 0.17 % of reading + 35 nA 0.072 % of reading + 35 nA 0.072 % of reading + 35 nA 0.46 % of reading + 0.23 µA 0.17 % of reading + 0.23 µA 0.07 % of reading + 0.23 µA 0.038 % of reading + 0.23 µA 0.46 % of reading + 2.3 µA 0.17 % of reading + 2.3 µA 0.071 % of reading + 2.3 µA 0.038 % of reading + 2.3 µA 0.48 % of reading + 23 µA 0.17 % of reading + 23 µA 0.071 % of reading + 23 µA 0.037 % of reading + 23 µA 0.46 % of reading + 0.23 mA 0.19 % of reading + 0.23 mA 0.097 % of reading + 0.23 mA 0.12 % of reading + 0.23 mA	Comparison to Keysight 3458A, Opt. 002 8.5 Digit Multimeter

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure [1]	(1 to 3) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz (5 to 10) kHz (3 to 10) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz (5 to 10) kHz	 1.3 % of reading + 2 mA 0.41 % of reading + 2 mA 0.18 % of reading + 2 mA 0.41 % of reading + 24 mA 1.1 % of reading + 13 mA 0.41 % of reading + 7 mA 0.18 % of reading + 7 mA 0.42 % of reading + 81 mA	Comparison to Fluke 8846A 6.5 Digit Multimeter
AC Current – Measure [1]	Up to 60 Hz Up to 10 A (10 to 20) A (20 to 40) A (40 to 60) A (60 to 100) A	 0.019 % of reading + 2.3 mA 0.02 % of reading + 2.3 mA 0.029 % of reading + 2.3 mA 0.03 % of reading + 2.3 mA 0.025 % of reading + 2.3 mA	Comparison to Current Shunt, Keysight 3458A, Opt. 002 8.5 Digit Multimeter
AC Current – Measure [1]	(60 to 100) Hz Up to 5 A (5 to 20) A (20 to 60) A (60 to 100) A 100 Hz to 1 kHz Up to 100 A	 0.023 % of reading + 2.3 mA 0.024 % of reading + 2.3 mA 0.032 % of reading + 2.3 mA 0.037 % of reading + 2.3 mA 0.12 % of reading + 2.3 mA	Comparison to Ohms Labs CS-100 Current Shunt, Keysight 3458A, Opt. 002 8.5 Digit Multimeter
DC Resistance – Source/Measure [1]	Up to 10 Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ	0.001 8 % of reading + 58 μΩ 0.001 5 % of reading + 0.58 mΩ 0.001 3 % of reading + 0.58 mΩ 0.001 2 % of reading + 5.8 mΩ 0.001 3 % of reading + 58 mΩ 0.002 1 % of reading + 2.3 Ω 0.006 2 % of reading + 0.12 kΩ 0.059 % of reading + 1.2 kΩ 0.82 % of reading + 12 kΩ	Comparison to Keysight 3458A, Opt. 002 8.5 Digit Multimeter, Decade Resistor
DC Resistance – Source [1] (Fixed Artifact)	1 mΩ	0.12 μΩ	Comparison to Ohms Labs CS-100 Current Shunt
DC Resistance – Source [1] (Fixed Artifact)	1 Ω	12 μΩ	Comparison to Leeds & Northrup 4020-B Standard Resistor

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Resistance – Source [1] (Variable Artifact)	10 mΩ 0.1 Ω	1 μΩ 10 μΩ	Comparison to Guideline 9200 Multiple Standard Resistor
DC Resistance – Source [1] (Variable Artifact)	1 GΩ 10 GΩ	5.8 MΩ 0.12 GΩ	Comparison to Biddle Megadek, High Resistance Decade Box
DC Resistance – Source [1] Up to 10 kV (Variable Artifact)	(100 to 200) kΩ (300 to 700) kΩ (0.8 to 1) MΩ (1 to 10) MΩ (20 to 100) MΩ (200 to 900) MΩ (1 to 9) GΩ (10 to 90) GΩ (0.1 to 1) TΩ	0.035 % of reading 0.035 % of reading 0.035 % of reading 0.035 % of reading + 1.2 μΩ/V 0.12 % of reading + 1.2 μΩ/V 0.3 % of reading + 1.2 μΩ/V 0.59 % of reading + 1.2 μΩ/V 1.2 % of reading + 2.3 μΩ/V 1.2 % of reading + 5.8 μΩ/V	Comparison to IET High Resistance Decade Substituter
DC Resistance – Source [1] (Fixed Artifact)	(0.5 to 5) kV 1 TΩ	6 GΩ	Comparison to IET Standard Resistor
DC Resistance – Source [1] (Fixed Artifact)	500 V 10 TΩ 1 kV 10 TΩ 2.5 kV 10 TΩ 5 kV 10 TΩ	86 GΩ 0.15 TΩ 0.1 TΩ 60 GΩ	Comparison to IET Standard Resistors
DC Voltage – Source [1]	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V	0.000 78 % of reading + 0.4 μV 0.000 5 % of reading + 0.7 μV 0.000 35 % of reading + 2.5 μV 0.000 35 % of reading + 4 μV 0.000 5 % of reading + 40 μV	Comparison to Fluke 5730A Multiproduct Calibrator
DC Voltage – Source [1]	(220 to 1 100) V	0.000 65 % of reading + 0.4 mV	Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure [1]	(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	0.000 8 % of reading + 0.58 µV 0.000 5 % of reading + 0.58 µV 0.000 5 % of reading + 0.58 µV 0.000 8 % of reading + 35 µV 0.001 5 % of reading + 0.12 mV 0.001 8 % of reading + 0.12 mV 0.002 1 % of reading + 0.12 mV	Comparison to Keysight 3458A, Opt. 002 8.5 Digit Multimeter
DC High Voltage – Measure [1]	(1 to 10) kV	0.039 % of reading + 0.12 V	Comparison to Vitrek 4700 Digital HV Meter
DC High Voltage – Measure [1]	(10 to 20) kV (20 to 35) kV	0.036 % of reading + 1.2 V 0.064 % of reading + 1.2 V	Comparison to Vitrek 4700 Digital HV Meter, Vitrek HVL-35 High Voltage Probe
DC High Voltage – Measure [1]	(15 to 30) kV (30 to 45) kV (45 to 70) kV	0.039 % of reading + 1.2 V 0.049 % of reading + 1.2 V 0.088 % of reading + 1.2 V	Comparison to Vitrek 4700 Digital HV Meter, Vitrek HVL-70 High Voltage Probe
DC High Voltage – Measure [1]	(25 to 100) kV	0.17 % of reading + 1.2 V	Comparison to Vitrek 4700 Digital HV Meter, Vitrek HVL-100 High Voltage Probe
AC Voltage – Source [1]	Up to 2.2 mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 o 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % of reading + 4 µV 0.009 1 % of reading + 4 µV 0.008 % of reading + 4 µV 0.025 % of reading + 4 µV 0.05 % of reading + 5 µV 0.11 % of reading + 10 µV 0.14 % of reading + 20 µV 0.27 % of reading + 20 µV	Comparison to Fluke 5730A Multiproduct Calibrator

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

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) mV		Comparison to Fluke 5730A Multiproduct Calibrator
	(10 to 20) Hz	0.024 % of reading + 4 µV	
	(20 to 40) Hz	0.009 % of reading + 4 µV	
	40 Hz to 20 kHz	0.008 % of reading + 4 µV	
	(20 o 50) kHz	0.02 % of reading + 4 µV	
	(50 to 100) kHz	0.05 % of reading + 5 µV	
	(100 to 300) kHz	0.11 % of reading + 10 µV	
	(300 to 500) kHz	0.14 % of reading + 20 µV	
	500 kHz to 1 MHz	0.27 % of reading + 20 µV	
	(22 to 220) mV		
	(10 to 20) Hz	0.024 % of reading + 12 µV	
	(20 to 40) Hz	0.009 3 % of reading + 7 µV	
	40 Hz to 20 kHz	0.005 9 % of reading + 7 µV	
	(20 o 50) kHz	0.012 % of reading + 7 µV	
	(50 to 100) kHz	0.031 % of reading + 17 µV	
	(100 to 300) kHz	0.066 % of reading + 20 µV	
	(300 to 500) kHz	0.14 % of reading + 25 µV	
	500 kHz to 1 MHz	0.27 % of reading + 45 µV	
	(0.22 to 2.2) V		
	(10 to 20) Hz	0.024 % of reading + 40 µV	
	(20 to 40) Hz	0.009 4 % of reading + 15 µV	
	40 Hz to 20 kHz	0.004 6 % of reading + 8 µV	
	(20 o 50) kHz	0.006 9 % of reading + 10 µV	
	(50 to 100) kHz	0.008 6 % of reading + 30 µV	
	(100 to 300) kHz	0.034 % of reading + 80 µV	
	(300 to 500) kHz	0.1 % of reading + 0.2 mV	
	500 kHz to 1 MHz	0.17 % of reading + 0.3 mV	
	(2.2 to 22) V		
	(10 to 20) Hz	0.024 % of reading + 0.4 mV	
	(20 to 40) Hz	0.009 3 % of reading + 0.15 mV	
	40 Hz to 20 kHz	0.004 7 % of reading + 50 µV	
	(20 o 50) kHz	0.007 1 % of reading + 0.1 mV	
	(50 to 100) kHz	0.008 4 % of reading + 0.2 mV	
	(100 to 300) kHz	0.025 % of reading + 0.6 mV	
	(300 to 500) kHz	0.1 % of reading + 2 mV	
	500 kHz to 1 MHz	0.15 % of reading + 3.2 mV	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source [1]	(22 to 220) V		Comparison to Fluke 5730A Multiproduct Calibrator
	(10 to 20) Hz	0.024 % of reading + 4 mV	
	(20 to 40) Hz	0.009 4 % of reading + 1.5 mV	
	40 Hz to 20 kHz	0.005 5 % of reading + 0.6 mV	
	(20 o 50) kHz	0.008 1 % of reading + 1 mV	
	(50 to 100) kHz	0.015 % of reading + 2.5 mV	
	(100 to 300) kHz	0.09 % of reading + 16 mV	
	(300 to 500) kHz	0.44 % of reading + 40 mV	
	500 kHz to 1 MHz	0.8 % of reading + 80 mV	
AC Voltage – Source [1]	(220 to 250) V		Comparison to Fluke 5730A Multiproduct Calibrator, Fluke 5725A Amplifier
	(15 to 50) Hz	0.03 % of reading + 11 mV	
	(220 to 750)V		
	(30 to 50) kHz	0.06 % of reading	
	(50 to 100) kHz	0.23% of reading	
	(220 to 1 100) V		
	40 Hz to 1 kHz	0.009 3 % of reading	
	(1 to 20) kHz	0.007 3 % of reading	
	(20 to 30) kHz	0.06 % of reading	
AC Voltage – Measure [1]	Up to 10 mV		Comparison to Keysight 3458A, Opt. 002 8.5 Digit Multimeter
	(1 to 40) Hz	0.04 % of reading + 3.5 µV	
	40 Hz to 1 kHz	0.03 % of reading + 1.2 µV	
	(1 to 20) kHz	0.04 % of reading + 1.2 µV	
	(20 to 50) kHz	0.15 % of reading + 1.2 µV	
	(50 to 100) kHz	0.59 % of reading + 1.2 µV	
	(100 to 300) kHz	4.6 % of reading + 2.3 µV	
	300 kHz to 1 MHz	1.5 % of reading + 5.8 µV	
	(1 to 4) MHz	8.1 % of reading + 8.1 µV	
	(10 to 100) mV		
	(1 to 40) Hz	0.013 % of reading + 4.6 µV	
	40 Hz to 1 kHz	0.009 7 % of reading + 2.3 µV	
	(1 to 20) kHz	0.017 % of reading + 2.3 µV	
	(20 to 50) kHz	0.038 % of reading + 2.3 µV	
	(50 to 100) kHz	0.093 % of reading + 2.3 µV	
	(100 to 300) kHz	0.36 % of reading + 12 µV	
	300 kHz to 1 MHz	1.2 % of reading + 12 µV	
	(1 to 2) MHz	1.8 % of reading + 12 µV	
	(2 to 4) MHz	4.7 % of reading + 81 µV	
	(4 to 8) MHz	4.7 % of reading + 92 µV	
	(8 to 10) MHz	17 % of reading + 0.12 mV	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

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		Comparison to Keysight 3458A, Opt. 002 8.5 Digit Multimeter
	(1 to 40) Hz	0.008 8 % of reading + 46 µV	
	40 Hz to 1 kHz	0.008 3 % of reading + 23 µV	
	(1 to 20) kHz	0.017 % of reading + 23 µV	
	(20 to 50) kHz	0.036 % of reading + 23 µV	
	(50 to 100) kHz	0.093 % of reading + 23 µV	
	(100 to 300) kHz	0.35 % of reading + 0.12 mV	
	300 kHz to 1 MHz	1.2 % of reading + 0.12 mV	
	(1 to 2) MHz	1.8 % of reading + 0.12 mV	
	(2 to 4) MHz	4.6 % of reading + 0.81 mV	
	(4 to 8) MHz	4.6 % of reading + 0.92 mV	
	(8 to 10) MHz	17 % of reading + 1.2 mV	
	(1 to 10) V		
	(1 to 40) Hz	0.009 5 % of reading + 0.46 mV	
	40 Hz to 1 kHz	0.023 % of reading + 0.23 mV	
	(1 to 20) kHz	0.017 % of reading + 0.23 mV	
	(20 to 50) kHz	0.036 % of reading + 0.23 mV	
	(50 to 100) kHz	0.093 % of reading + 0.23 mV	
	(100 to 300) kHz	0.35 % of reading + 1.2 mV	
	300 kHz to 1 MHz	1.2 % of reading + 1.2 mV	
	(1 to 2) MHz	1.8 % of reading + 1.2 mV	
	(2 to 4) MHz	4.6 % of reading + 8.1 mV	
	(4 to 8) MHz	4.6 % of reading + 9.2 mV	
	(8 to 10) MHz	17 % of reading + 12 mV	
	(10 to 100) V		
	(1 to 40) Hz	0.024 % of reading + 4.6 mV	
	40 Hz to 1 kHz	0.024 % of reading + 2.3 mV	
	(1 to 20) kHz	0.024 % of reading + 2.3 mV	
	(20 to 50) kHz	0.041 % of reading + 2.3 mV	
	(50 to 100) kHz	0.14 % of reading + 2.3 mV	
	(100 to 300) kHz	0.46 % of reading + 12 mV	
	300 kHz to 1 MHz	1.7 % of reading + 12 mV	
	(100 to 700) V		
	(1 to 40) Hz	0.048 % of reading + 46 mV	
	40 Hz to 1 kHz	0.048 % of reading + 23 mV	
	(1 to 20) kHz	0.071 % of reading + 23 mV	
	(20 to 50) kHz	0.19 % of reading + 23 mV	
	(50 to 100) kHz	0.35 % of reading + 23 mV	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure [1]	Up to 1 mV 100 kHz to 1 MHz (1 to 3) MHz (3 to 10) MHz (10 to 20) MHz (1 to 3) mV 100 kHz to 1 MHz (1 to 3) MHz (3 to 10) MHz (10 to 20) MHz (3 to 100) mV 100 kHz to 1 MHz (1 to 3) MHz (3 to 10) MHz (10 to 20) MHz (20 to 30) MHz	 2 % of reading + 2.4 µV 3.8 % of reading + 2.4 µV 10 % of reading + 2.4 µV 25 % of reading + 2.4 µV 1 % of reading + 2 µV 3.8 % of reading + 2 µV 11 % of reading + 2 µV 25 % of reading + 2 µV 0.98 % of reading + 3 µV 1.9 % of reading + 3 µV 3.2 % of reading + 3 µV 7.6 % of reading + 3 µV 16 % of reading + 3 µV	Comparison to Rohde & Schwarz URE3 RMS Voltmeter
AC High Voltage – Measure [1]	(0.7 to 10) kV 60 Hz	0.15 % of reading + 0.21 V	Comparison to Vitrek 4700 Digital HV Meter
AC High Voltage – Measure [1]	(10 to 20) kV 60 Hz (20 to 35) kV 60 Hz	0.07 % of reading + 1.2 V 0.08 % of reading + 1.2 V	Comparison to Vitrek 4700 Digital HV Meter, Vitrek HVP-35 High Voltage Probe
AC High Voltage – Measure [1]	(12.5 to 25) kV 60 Hz (25 to 37.5) kV 60 Hz (37.5 to 50) kV 60 Hz	0.094 % of reading + 1.3 V 0.096 % of reading + 1.3 V 0.1 % of reading + 1.3 V	Comparison to Vitrek 4700 Digital HV Meter, Vitrek HVL-70 High Voltage Probe
AC High Voltage – Measure [1]	25 kV to 75 kV 60 Hz	0.17 % of reading + 1.4 V	Comparison to Vitrek 4700 Digital HV Meter, Vitrek HVL-100 High Voltage Probe

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source [1,2] (Simulation)	220 pF to 399.99 pF 0.4 nF to 1.0999 nF 1.1 nF to 3.2999 nF 3.3 nF to 10.9999 nF 11 nF to 32.9999 nF 33 nF to 109.99 nF 110 nF to 329.999 nF 0.33 µF to 1.0999 µF 1.1 µF to 3.29999 µF 3.3 µF to 10.9999 µF 11 µF to 32.9999 µF 33 µF to 109.999 µF 110 µF to 329.999 µF 0.33 mF to 1.099999 mF 1.1 mF to 3.29999 mF 3.3 mF to 10.9999 mF 11 mF to 32.9999 mF 33 mF to 110 mF	0.45 % of reading + 7.8 pF 0.4 % of reading + 7.8 pF 0.4 % of reading + 0.0078 nF 0.22 % of reading + 0.0078 nF 0.22 % of reading + 0.078 nF 0.22 % of reading + 0.078 nF 0.22 % of reading + 0.23 nF 0.21 % of reading + 0.78 nF 0.22 % of reading + 2.3 nF 0.21 % of reading + 7.8 nF 0.32 % of reading + 23 nF 0.38 % of reading + 0.078 µF 0.35 % of reading + 0.23 µF 0.35 % of reading + 0.78 µF 0.35 % of reading + 2.3 µF 0.35 % of reading + 7.8 µF 0.58 % of reading + 23 µF 0.85 % of reading + 78 µF	Comparison to Fluke 5522A Multifunction Calibrator
Capacitance – Source [1,2] (Fixed Artifacts)	100 Hz to 1 kHz (0.1 to 0.7) nF (0.7 to 600) nF 600 nF to 1.4 µF	 0.1 % of reading + 0.54 pF 0.16 % of reading + 0.1 pF 0.045 % of reading + 0.5 nF	Comparison to Arco SS32 Precision Standard Capacitor Set
Capacitance – Source [1,2] (Variable Artifact)	1 kHz 100 pF to 1 nF (1.1 to 10.1) nF (10.1 to 100.1) nF 100.1 nF to 1.1111 µF	 0.61 fF/pF + 1.3 fF 0.17 pF/nF + 12 pF 0.57 pF/nF + 4.6 pF 0.61 pF/nF + 2.1 pF	Comparison to GenRad 1423A Decade Capacitor
Capacitance – Measure [2]	0.1 pF 100 kHz 1 MHz 1 pF 10 kHz 100 kHz 1 MHz 10 pF 1 kHz 10 kHz 100 kHz 1 MHz	 1.4 % of reading 1.8 % of reading 1.4 % of reading 0.37 % of reading 0.44 % of reading 1.4 % of reading 0.28 % of reading 0.28 % of reading 0.3 % of reading	Comparison to Agilent E4980AL LCR Meter

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure [2]	100 pF		Comparison to Agilent E4980AL Comparison to LCR Meter
	100 Hz	2.1 % of reading	
	1 kHz	0.23 % of reading	
	10 kHz	0.18 % of reading	
	100 kHz	0.21 % of reading	
	1 MHz	0.23 % 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	
	10 nF		
	20 Hz	0.31 % of reading	
	100 Hz	0.12 % of reading	
	1 kHz	0.1 % of reading	
	10 kHz	0.1 % of reading	
	100 kHz	0.1 % of reading	
	1 MHz	0.25 % of reading	
	100 nF		
	20 Hz	0.16 % of reading	
	100 Hz	0.1 % of reading	
	1 kHz	0.1 % of reading	
	10 kHz	0.1 % of reading	
	100 kHz	0.18 % of reading	
	1 MHz	0.33 % of reading	
	1 µF		
	20 Hz	0.15 % of reading	
	100 Hz	0.1 % of reading	
	1 kHz	0.1 % of reading	
	10 kHz	0.18 % of reading	
	100 kHz	0.25 % of reading	
	1 MHz	0.79 % of reading	
	10 µF		
	20 Hz	0.15 % of reading	
	100 Hz	0.01 % of reading	
	1 kHz	0.16 % of reading	
	10 kHz	0.28 % of reading	
	100 kHz	0.73 % of reading	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure [2]	100 µF		Comparison to Agilent E4980AL Comparison to LCR Meter
	20 Hz	0.16 % of reading	
	100 Hz	0.17 % of reading	
	1 kHz	0.29 % of reading	
	10 kHz	0.8 % of reading	
Impedance – Measure [1,2] (AC Resistance)	0.1 Ω		Comparison to Agilent E4980AL LCR Meter
	1 kHz	2 % of reading	
	10 kHz	1.2 % of reading	
	100 kHz	1.1 % of reading	
	1 MHz	1.2 % of reading	
	1 Ω		
	20 Hz	0.67 % of reading	
	100 Hz	0.45 % of reading	
	1 kHz	0.36 % of reading	
	10 kHz	0.33 % of reading	
	100 kHz	0.31 % of reading	
	1 MHz	0.38 % of reading	
	10 Ω		
	20 Hz	0.29 % of reading	
	100 Hz	0.2 % of reading	
	1 kHz	0.17 % of reading	
	10 kHz	0.18 % of reading	
	100 kHz	0.18 % of reading	
	1 MHz	0.31 % of reading	
	100 Ω		
	20 Hz	0.16 % of reading	
	100 Hz	0.1 % of reading	
	1 kHz	0.1 % of reading	
	10 kHz	0.12 % of reading	
	100 kHz	0.12 % of reading	
	1 MHz	0.2 % of reading	
	1 kΩ		
	20 Hz	0.15 % of reading	
	100 Hz	0.1 % 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	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Impedance – Measure [1,2] (AC Resistance)	10 kΩ		Comparison to Agilent E4980AL LCR Meter
	20 Hz	0.15 % of reading	
	100 Hz	0.1 % of reading	
	1 kHz	0.1 % of reading	
	10 kHz	0.1 % of reading	
	100 kHz	0.1 % of reading	
	1 MHz	0.29 % of reading	
	100 kΩ		
	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	
Inductance – Source [1,2] (Fixed Artifact)	100 mH		Comparison to Standard Inductor
	1 kHz	0.14 mH	
Inductance – Measure [2]	1 µH		Comparison to Agilent E4980AL LCR Meter
	10 kHz	1.6 % of reading	
	100 kHz	0.36 % of reading	
	1 MHz	0.27 % of reading	
	10 µH		
	10 kHz	0.37 % of reading	
	100 kHz	0.2 % of reading	
	1 MHz	0.2 % of reading	
	100 µH		
	1 kHz	0.41 % of reading	
	10 kHz	0.2 % of reading	
	100 kHz	0.12 % of reading	
	1 MHz	0.14 % of reading	
	1 mH		
	100 Hz	0.56 % of reading	
	1 kHz	0.19 % of reading	
	10 kHz	0.12 % of reading	
	100 kHz	0.1 % of reading	
	1 MHz	0.23 % of reading	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure [1,2]	10 mH		Comparison to Agilent E4980AL LCR Meter
	20 Hz	0.86 % of reading	
	100 Hz	0.22 % of reading	
	1 kHz	0.1 % of reading	
	10 kHz	0.1 % of reading	
	100 kHz	0.11 % of reading	
	1 MHz	0.35 % of reading	
	100 mH		
	20 Hz	0.28 % of reading	
	100 Hz	0.11 % of reading	
	1 kHz	0.1 % of reading	
	10 kHz	0.1 % of reading	
	100 kHz	0.21 % of reading	
	1 MHz	0.88 % of reading	
	10 H		
	20 Hz	0.15 % of reading	
	100 Hz	0.1 % of reading	
	1 kHz	0.11 % of reading	
	10 kHz	0.21 % of reading	
	100 kHz	0.69 % of reading	
	100 H		
	20 Hz	0.15 % of reading	
	100 Hz	0.11 % of reading	
	1 kHz	0.15 % of reading	
	10 kHz	0.62 % of reading	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Current Harmonics – Source [1,3]	Carrier Range to 0.25 A Harmonic: Up to 75 mA (16 to 850) Hz 850 Hz to 6.5 kHz Carrier Range to 0.5 A Harmonic: Up to 0.15 A (16 to 850) Hz 850 Hz to 6.5 kHz Carrier Range to 1 A Harmonic: Up to 0.3 A (16 to 850) Hz 850 Hz to 6.5 kHz Carrier Range to 2 A Harmonic: Up to 0.6 A (16 to 850) Hz 850 Hz to 6.5 kHz Carrier Range to 5 A Harmonic: Up to 1.5 A (16 to 850) Hz 850 Hz to 6.5 kHz Carrier Range to 10 A Harmonic: Up to 3 A (16 to 850) Hz 850 Hz to 6.5 kHz Carrier Range to 20 A Harmonic: Up to 6 A (16 to 850) Hz 850 Hz to 6.5 kHz Carrier Range to 23 V Harmonic: Up to 6.9 V (16 to 850) Hz 850 Hz to 6.5 kHz	 61 µA/A + 21 µA 0.46 mA/A + 22 µA 70 µA/A + 21 µA 0.46 mA/A + 23 µA 70 µA/A + 29 µA 0.46 mA/A + 29 µA 70 µA/A + 0.1 mA 0.46 mA/A + 0.1 mA 70 µA/A + 0.1 mA 0.46 A/A + 0.1 mA 74 µA/A + 0.29 mA 0.46 mA/A + 0.29 mA 75 µA/A + 0.45 mA 0.46 mA/A + 0.45 mA 58 µV/V + 1 mV 0.52 mV/V + 1 mV	Comparison to Fluke 6105A Electrical Power Quality Calibrator

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Voltage Harmonics – Source [1,3]	Carrier Range to 45 V Harmonic: Up to 13.5 V (16 to 850) Hz 850 Hz to 6.5 kHz	 67 µV/V + 2 mV 0.52 mV/V + 2 mV	Comparison to Fluke 6105A Electrical Power Quality Calibrator
	Carrier Range to 90 V Harmonic: Up to 27 V (16 to 850) Hz 850 Hz to 6.5 kHz	 69 µV/V + 2 mV 0.52 mV/V + 2 mV	
	Carrier Range to 180 V Harmonic: Up to 54 V (16 to 850) Hz 850 Hz to 6.5 kHz	 69 µV/V + 6 mV 0.52 mV/V + 6 mV	
	Carrier Range to 360 V Harmonic: Up to 108 V (16 to 850) Hz 850 Hz to 6.5 kHz	 69 µV/V + 13 mV 0.52 V/V + 13 mV	
	Carrier Range to 650 V Harmonic: Up to 195 V (16 to 850) Hz 850 Hz to 6.5 kHz	 70 µV/V + 22 mV 0.52 mV/V + 22 mV	
	Carrier Range to 1 008 V Harmonic: Up to 302 V (16 to 850) Hz 850 Hz to 6.5 kHz	 70 µV/V + 33 mV 0.52 mV/V + 33 mV	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Power – Source [1]			
(0.33 to 330) mA	11 µW to 1.1 mW	0.024 % of reading	
	1.1 mW to 0.11 W	0.027 % of reading	
	(0.11 to 110) W	0.024 % of reading	
	(110 to 330) W	0.018 % of reading	
(0.33 to 3) A	11 µW to 110 mW	0.044 % of reading	Comparison to Fluke 5520A Multiproduct Calibrator
	(0.11 to 990) W	0.053 % of reading	
	(0.99 to 3) kW	0.009 6 % of reading	
(3 to 20.5) A	99 mW to 0.99 W	0.088 % of reading	
	0.99 W to 6.8 kW	0.07 % of reading	
	(6.8 to 20.5) kW	0.04 % of reading	
AC Power – Source [1,4] PF = 1			
(3.3 to 9) mA	(10 to 65) Hz		
	(0.11 mW to 3) mW	0.13 % of reading	
	3 mW to 9 W	0.077 % of reading	
(9 to 33) mA	(10 to 65) W		
	(0.3 to 10) mW	0.089 % of reading	
	10 mW to 33 W	0.077 % of reading	
(33 to 90) mA	(10 to 65) Hz		
	(1 to 30) mW	0.071 % of reading	
	30 mW to 90 W	0.057 % of reading	
(90 to 330) mA	(10 to 65) Hz		Comparison to Fluke 5520A Multiproduct Calibrator
	(3 to 100) mW	0.089 % of reading	
	100 mW to 300 W	0.078 % of reading	
(0.33 to 0.9) A	(10 to 65) Hz		
	(11 to 300) mW	0.071 % of reading	
	(0.3 to 900) W	0.081 % of reading	
(0.9 to 2.2) A	(10 to 65) Hz		
	(30 to 720) mW	0.089 % of reading	
	0.72 W to 2 kW	0.079 % of reading	
(2.2 to 4.5) A	(10 to 65) Hz		
	80 mW to 1.4 W	0.088 % of reading	
	1.4 W to 4.5 kW	0.18 % of reading	
(4.5 to 20.5) A	(10 to 65) Hz		
	150 mW to 20 kW	0.17 % of reading	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
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 90)° (10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	 0.11° 0.2° 0.39° 1.9° 3.9° 7.8°	Comparison to Fluke 5520A Multiproduct Calibrator
Total Harmonic Distortion	5 Hz to 500 kHz 500 kHz to 1 MHz	18 % of reading + 0.13 %T HD 29 % of reading + 0.7 % THD	Comparison to Kron-Hite 6900B Distortion Analyzer
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 0.21 °C 0.17 °C 0.19 °C 0.22 °C 0.24 °C 0.30 °C 0.33 °C 1.6 °C 0.24 °C 0.12 °C 0.095 °C 0.08 °C 0.076 °C 0.064 °C 0.074 °C	Comparison to Ectron 1140A Thermocouple Calibrator/Simulator

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

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	0.087 °C	
	(1 000 to 1 372) °C	0.096 °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	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

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 0.095 °C 0.08 °C	Comparison to Ectron 1140A Thermocouple Calibrator/Simulator
Oscilloscopes [1,8] Amplitude – DC into 50 Ω load into 1 MΩ load Amplitude – Square Wave Rate: 10 Hz to 10 kHz into 50 Ω load into 1 MΩ load Time Markers 100 mVp-p to 1 Vp-p into 50 Ω load Square Wave Sine Wave Pulse Triangle Wave	 (-5 to 5) V (-200 to 200) V 40 µVp-p to 1 mVp-p 1 mVp-p to 5 Vp-p 40 µVp-p to 1 mVp-p 1 mVp-p to 200 Vp-p 9.009 1 ns to 83 µs 83 µs to 55s 450.5 ps to 9.009 ns 900.91 ns to 83 µs 83 µs to 55s 900.91 ns to 83 µs 83 µs to 55s	 0.023 % of reading + 19 µV 0.023 % of reading + 19 µV 0.78 % of reading + 7.8 µV 0.078 % of reading + 7.8 µV 0.78 % of reading + 7.8 µV 0.078 % of reading + 7.8 µV 0.19 µs/s 2.3 µs/s 0.19 µs/s 0.19 µs/s 2.3 µs/s 0.19 µs/s 2.3 µs/s	Comparison to Fluke 9500B Oscilloscope Calibrator, Fluke 9500B/3200 Oscilloscope Calibrator, Fluke 9530 3.2 GHz Active Head, Fluke 9550 Active Head w/ 25 ps Capability

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes [1,8]			
Rise Time			
into 50 Ω load			
Rate: 10 Hz to 2 MHz	5 mVp-p to 3 Vp-p		
	500 ps (nominal)	290 ps	
	150 ps (nominal)	31 ps	
Rate: 10 Hz to 1 MHz	425 mVp-p to 575 mVp-p		Comparison to Fluke 9500B Oscilloscope Calibrator, Fluke 9500B/3200 Oscilloscope Calibrator, Fluke 9530 3.2 GHz Active Head, Fluke 9550 Active Head w/ 25 ps Capability
	25 ps (nominal)		
		6.8 ps	
Leveled Sine Wave			
50 kHz Reference			
into 50 Ω load	50 kHz to 10 MHz	1.2 % of reading	
Input Impedance Measure	(10 to 40) Ω	0.39 % of reading	
	(40 to 90) Ω	0.083 % of reading	
	(90 to 150) Ω	0.39 % of reading	
	(50 to 800) kΩ	0.39 % of reading	
	(0.8 to 1.2) MΩ	0.083 % of reading	
	(1.2 to 12) MΩ	0.39 % of reading	
Input Capacitance Measure	(1 to 35) pF	1.6 % of reading + 0.19 pF	
	(35 to 95) pF	2.3 % of reading + 0.19 pF	
Rise Time – Source [1,8]			Comparison to Tektronix PG509 Pulse Generator
(45 to 55) kHz	25 Vp-p		
	(300 to 400) ps	64 ps	
Rise Time – Measure [1]	≥ 350 ps	28 ps	Comparison to Agilent DSO6102 Oscilloscope
Bandwidth Flatness Measure [1]			Comparison to Fluke 9500B/3200 Oscilloscope Calibrator, Fluke 9530 3.2 GHz Active Head
into VSWR (1.2:1)	5 mVp-p to 5 Vp-p		
(wrt Reference Frequency)	100 Hz to 300 MHz	1.6 % of reading	
	(300 to 550) MHz	1.9 % of reading	
	5 mVp-p to 3 Vp-p		
	550 MHz to 1.1 GHz	2.7 % of reading	
	(1.1 to 2.5) GHz	3.1 % of reading	
	5 mVp-p to 2 Vp-p		
	(2.5 to 3.2) GHz	3.1 % of reading	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Harmonic Distortion – Measure (dBc) into VSWR ≤ 1.3:1	(-80 to 0) dB 9 kHz to 3 GHz (3 to 6.8) GHz (6.8 to 13.2) GHz	 0.02 dB/dB + 1.1 dB 0.02 dB/dB + 3.1 dB 0.02 dB/dB + 3.7 dB	Comparison to Agilent E4405B Opt. 1DS, 1DR, 1D5 Spectrum Analyzer
Frequency Response to RF Source	100 kHz to 4.2 GHz (-30 to -20) dB (-20 to -10) dB (-10 to 0) dB (0 to 10) dB (10 to 20) dB	 1.9 % of reading 1.9 % of reading 1.9 % of reading 1.9 % of reading 1.9 % of reading	Comparison to Agilent 438A Power Meter, Agilent 8482A Power Sensor

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Angle Measuring Devices (Protractors, Inclinometers, Squares, Angle Gages, etc.)	0.005 6″ to 5° (5 to 20) ° (20 to 35) ° (35 to 45) ° (45 to 60) ° (60 to 75) ° (75 to 85) ° 90°	3.2″ 6.1″ 11″ 15″ 25″ 54″ 166″ 15″	Comparison to 5 in Sine Bar, Gage Blocks Master Square
Micrometers, Calipers [1,5] (Outside, Inside, Depth)	Up to 1 in (1 to 9) in (9 to 15) in (15 to 40) in	(40 + 1*L*) µin (40 + 2*L*) µin (20 + 3.5*L*) µin (16 + 4*L*) µin	Comparison to Gage Blocks
Anvil Flatness [1]	Up to 1 in	4.2 µin	Comparison to Optical Flats
Anvil Parallelism [1]	Up to 1 in	7.2 µin	Comparison to Optical Parallels
Bore Gages [5]	(0.125 to 1) in (1 to 6) in	33 µin (26 + 7*L*) µin	Comparison to Characterized Cylindrical Rings
Indicators [1,5] (Dial, Digital, Test)	Up to 1 in (1 to 6) in	(10 + 2*L*) µin (5 + 5*L*) µin	Comparison to Gage Blocks, Surface Plates

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Test Indicators	Up to 0.05 in	5.7 µin	Comparison to Universal Length Measuring Machine
Single Axis Length – Outside [5]	Up to 1 in (1 to 7) in (7 to 12) in (12 to 24) in (24 to 48) in	(6 + 1*L*) µin (4 + 3.5*L*) µin (4*L*) µin (53 + 3*L*) µin (8.2 + 1.67*L*) µin	Comparison to Universal Length Measuring Machine P&W U304393 Digital & Laser Measuring Machine
Single Axis Length – Inside [5]	(0.04 to 1) in (1 to 2.5) in (2.5 to 10) in (10 to 12) in	(9 + 1*L*) µin (9 + 3*L*) µin (14 + 3*L*) µin (25 + 3L) µin	Comparison to Universal Length Measuring Machine
Chamfer/Countersink Gages [1,5]	Up to 0.825 in (0.825 to 1.51) in (1.51 to 2.51) in	58 µin (72 + 12*L*) µin (80 + 23*L*) µin	Comparison to Characterized Cylindrical Ring Gages
Height Gages [1,5]	Up to 4 in (4 to 24) in	(26 + 0.5*L*) µin (16 + 3*L*) µin	Comparison to Gage Blocks, Grade AA Surface Plate
Height Standards, Height Masters, Risers [5]	Up to 12 in	(28 + 3.2*L*) µin	Comparison to Gage Amplifier, Probe, Grade AA Surface Plate
Squareness	Up to 18 in	9 µin/in	Comparison to Master Square, Gage Amplifier, Probe, Grade AA Surface Plate
Parallelism Physical Size Up to (3 x 12) in (3 x 12) in to (3 x 18) in (6 x 18) in to (6 x 30) in	 Up to 0.05 in Up to 0.05 in Up to 0.05 in	 47 µin 52 µin 42 µin	Comparison to Gage Amplifier, Probe, Grade AA Surface Plate
Straightness Physical Size Up to 12 in (12 to 18) in (18 to 30) in	 Up to 0.05 in Up to 0.05 in Up to 0.05 in	 35 µin 42 µin 46 µin	Comparison to Gage Amplifier, Probe, Grade AA Surface Plate

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness			Comparison to
Physical Size			
Up to 4 in Diameter	Up to 250 µin	4.4 µin	Optical Flat
Up to (3 x 12) in	Up to 0.05 in	49 µin	Gage Amplifier, Probe, Grade AA Surface Plate
(3 x 12) in to (3 x 18) in	Up to 0.05 in	54 µin	
(6 x 18) in to (6 x 30) in	Up to 0.05 in	54 µin	
Up to (3 x 12) in	Up to 1 in	138 µin	Multi-axis Vision System
Optical Comparator [1,5]			Comparison to
Length	(0 to 6) in	(185 + 13*L*) µin	Calibration Grids
Squareness	(0.04 to 1) in	(213 + 1*L*) µin	Calibration Grids
Magnification	10X to 50X	(295 + 20*L*) µin	Magnification Checker
Length Measuring Equipment [5]			Comparison to
Linear Displacement	Up to 12 ft	(1 + 2.1*L*) µin	Laser Interferometer
Optical Reference Plane	Up to 6 in (6 to 12) in	51 µin 74 µin	Comparison to Glass Scale, Calibration Grid
Thread Wires	(2 to 120) TPI (0.008 33 to 0.5) in	12 µin	Direct Measure using Measuring Machine
Cylindrical Plug Gages [5]			Direct Measure using
Outside Diameter	Up to 1 in (1 to 7) in	12 µin (9 + 3*L*) µin	Universal Length Measuring Machine
Pin Gages			Non-contact Measure using
Outside Diameter	(0.003 to 1) in	30 µin	Laser Micrometer
Cylindrical Rings [5]			Comparison to
Inside Diameter	(0.04 to 0.5) in (0.50 to 4) in (4 to 8.5) in (8.5 to 14) in	7.2 µin (7.2 + 3*L*) µin (4 + 3.6*L*) µin (11 + 3.6*L*) µin	Universal Length Measuring Machine, Master Ring Gages (Non-commercial Cal)
Cylindrical Rings [5]			Comparison to
Inside Diameter	(0.04 to 1) in (1 to 2.5) in (2.5 to 10) in (10 to 14) in	(9 + 1*L*) µin (9 + 3*L*) µin (14 + 3*L*) µin (25 + 3L) µin	Universal Length Measuring Machine, Working Reference Rings

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Laser Micrometers [1,5]	Up to 0.1 in (0.1 to 0.4) in (0.4 to 1) in	13 µin 8 µin (12 + 5*L*) µin	Comparison to Characterized Master Pin Gages
Measuring Tapes, Rulers [5]	Up to 1 ft (1 to 3) ft (3 to 1 000) ft	(760 + 0.5*L*) µin (740 + 2*L*) µin (23*L*) µin	Direct Measure using Vision System
Laser Distance Meters	Up to 1 m	0.31 mm	Direct Measure using Vision System
Surface Plates [1,4] Overall Flatness Local Area Flatness (Repeat Readings)	 (17 to 168) in*DL* Up to 0.001 in	 (24 + √*DL*) µin 31 µin	In accordance with ASME B89.3.7 using Electronic Level System Repeat-o-Meter w/ Supramess
Thread Plug Gages [5] 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 µin 80 µin 83 µin 13 µin (10 + 3*L*) µin	Comparison to Universal Length Measuring Machine, Master Thread Wires
Step Height	Up to 1 in	32 µin	Comparison to Gage Amplifier, Probe, Gage Blocks
Tapered Thread Plug Pitch Diameter Standoff	 Up to 3 in Up to 1 in	 90 µin 31 µin	Comparison to Universal Length Measuring Machine, Master Thread Wires Gage Amplifier, Probe
Tapered Thread Ring Gage	Up to 3 in	90 µin	Comparison to Master Plug
Thread Ring Gage Inner Pitch Diameter	 Up to 1 in (1 to 4) in (4 to 7) in	 79 µin 80 µin 83 µin	Comparison to Master Plug

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Wire Crimpers/Dies [1]			Comparison to
Die Diameter	(0.011 to 0.0605) in	0.000 64 in	Pin Gage Set (500 µin Step)
	(0.061 to 0.625) in	0.001 2 in	Pin Gage Set (0.001 in Step)
Crimp Height	(0.001 to 0.8) in	180 µin	Crimp Height Micrometer

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Air Velocity			Comparison to
Pitot Tube, Constant Temperature Anemometers	(0.3 to 2) m/s	0.76 % of reading + 0.02 m/s	Laser Doppler Velocimeter, Westenberg Westi-box Wind Tunnel System
	(2 to 30) m/s	0.6 % of reading	
	(0.3 to 2) m/s	0.06 m/s	Westenberg Westi-box Wind Tunnel System
	(2 to 60) m/s	1.4 % of reading	
Air Velocity			Comparison to
Vane Anemometers	(0.3 to 2) m/s	0.87 % of reading + 0.04 m/s	Laser Doppler Velocimeter, Westenberg Westi-box Wind Tunnel System
	(2 to 30) m/s	0.95 % of reading	
	(30 to 60) m/s	2.4 % of reading	
Shore Hardness Test Blocks			Comparison to
Type A	(15 to 95) duro	1.8 duro	Type A Digital Durometer
Type D	(15 to 95) duro	1.6 duro	Type D Digital Durometer
Durometers			Direct Verification per
(Type A, B, C, D, E, DO, O)			ASTM D2240 using
Indenter Dimensions			
Length	Up to 1 in	84 µin	Multi-axis Vision System
Angle	Up to 40°	0.006°	
Radius	50 µin to 1 in	120 µin	
Spring Force	Up to 60 duro	0.73 duro	Duro Calibrator
	(60 to 100) duro	0.94 duro	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Balances and Scales [1,6] (SI)	Up to 500 mg (0.5 to 5) g (5 to 20) g 20 g to 1 kg (1 to 5) kg (5 to 10) kg (10 to 25) kg (25 to 36) kg	6 µg 20 µg 50 µg 0.000 19 % of reading 0.000 26 % of reading 0.000 16 % of reading 0.000 14 % of reading 0.000 12 % of reading	Characterized with ASTM E617 Class 1 weights and internal calibration procedure utilized for the calibration of the weighing system.
Balances and Scales [1,6] (SI)	Up to 500 mg (0.5 to 5) g (5 to 20) g 20 g to 10 kg (10 to 25) kg (25 to 35) kg	12 µg 40 µg 90 µg 0.000 31 % of reading 0.000 3 % of reading 0.000 25 % of reading	ASTM E617 Class 1 weights and internal calibration procedure utilized for the calibration of the weighing system.
Balances and Scales [1,6] (SI)	Up to 3 mg (3 to 10) mg (10 to 50) mg (50 to 100) mg (100 to 300) mg	30 µg 40 µg 50 µg 60 µg 70 µg	ASTM E617 Class 3 weights and internal calibration procedure utilized for the calibration of the weighing system.
Balances and Scales [1,6] (SI)	(300 to 500) mg (0.5 to 3) g (3 to 5) g (5 to 10) g (10 to 30) g (30 to 50) g (50 to 100) g	0.1 mg 0.15 mg 0.2 mg 0.3 mg 0.5 mg 0.7 mg 1.2 mg	ASTM E617 Class 3 weights and internal calibration procedure utilized for the calibration of the weighing system.
Balances and Scales [1,6] (Avoirdupois)	Up to 0.5 lb (0.5 to 2) lb (2 to 10) lb (10 to 1 150) lb	0.024 % of reading 0.018 % of reading 0.013 % of reading 0.012 % of reading	NIST Class F weights and internal calibration procedure utilized for the calibration of the weighing system.
Mass Determination	Up 1.2 kg	0.002 8 mg/g + 6.8 mg	Direct Measure using Mettler Toledo XS1203S Precision Balance
Force (Tension and Compression)	Up to 400 lbf	0.012 % of reading	Comparison to Deadweight

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pneumatic Absolute Pressure Devices	Up to 14.7 psia (14.7 to 39.7) psia (39.7 to 514.7) psia	0.002 5 psi 0.000 7 % of reading + 0.002 3 psi 0.006 5 % of reading	Comparison to Ruska 7250xi Pressure Controller/Calibrator
Pneumatic Absolute Pressure Devices	Up to 30 psia (30 to 1 000) psia	0.002 4 psi 0.007 % of reading + 0.000 48 psi	Comparison to DHI PPC4 Pressure Controller
Hydraulic Absolute Pressure Devices	(500 to 1 600) psia (> 1 600 to 16 000) psia	0.011 % of reading + 0.07 psi 0.015 % of reading + 0.01 psi	Comparison to Fluke P3125-3 Deadweight Tester, Barometer
Pneumatic Gauge Pressure Devices [1]	(0 to 25) psig (25 to 500) psig	0.001 4% of reading + 0.001 3 psi 0.006 7 % of reading	Comparison to Ruska 7250xi Pressure Controller/Calibrator
Pneumatic Gauge Pressure Devices [1]	(500 to 1 000) psig	0.006 2 % of reading + 0.000 1 psi	Comparison to DHI PPC4 Pressure Controller
Pneumatic Vacuum Devices [1]	(-14.7 to 0) psig	0.000 64 % of reading + 0.001 3 psi	Comparison to Ruska 7250xi Pressure Controller/Calibrator
Pneumatic Compound Devices [1]	(-60 to -6) inH_2O (-6 to 6) inH_2O (6 to 60) inH_2O (-14.7 to -7.5) psi (-7.5 to 7.5) psi (7.5 to 30) psi	0.007 % of reading + 0.000 005 inH_2O 0.002 1 % of reading + 0.000 3 inH_2O 0.007 % of reading + 0.000 005 inH_2O 0.006 5 % of reading 0.001 5 % of reading + 0.000 38 psi 0.006 5 % of reading	Comparison to Ruska 7252i Pressure Controller/Calibrator
Hydraulic Gauge Pressure Devices [1]	(500 to 1 600) psig (> 1 600 to 16 000) psig	0.1 psi 0.006 1 % of reading	Comparison to Fluke P3125-3 Deadweight Tester
Torque Tools [1]	(1 to 10) lbf·in 9 lbf·in to 800 lbf·ft	0.37 % of reading + 0.028 lbf·in 1 % of reading	Comparison to Torque Calibration System
Pneumatic Torque Tools	0.2 lbf·in to 18 lbf·in 18 lbf·in to 70 lbf·in 8 lbf·in to 130 lbf·in	0.55 lbf·in 1.1 lbf·in 0.89 lbf·in	Comparison to Imada Torque Tester

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Transducers	2.5 ozf·in to 12.5 lbf·in (12 to 150) lbf·in (12.5 to 250) lbf·ft (250 to 2 000) lbf·ft	0.085 % of reading 0.052 % of reading 0.048 % of reading 0.053 % of reading	Comparison to Master Weights, Butterfly Wheels, 40 in Torque Arm
Torque Angle (Fixed Points)	45° and 225° 90° and 180° 135° and 225° 180° and 360°	0.67° 0.67° 0.67° 0.67°	Comparison to Torque Angle Fixture

Thermodynamics

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity – Source	(15.56 to 25) °F 0 %RH	0.003 %RH	Comparison to Thunder Scientific 3900 Humidity Generator, Liquid Nitrogen (N_2), Vaisala DMT-152 Dew Point Transmitter
Humidity – Source	(-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 2500 Humidity Generator
Humidity – Measure [1]	(-20 to 15) °C Up to 95 %RH (15 to 25) °C (10 to 90) %RH (90 to 95) %RH (25 to 40) °C Up to 95 %RH	 0.008 4 % of reading + 1.2 %RH 1.3 %RH 1.9 %RH 0.008 4 % of reading + 1.2 %RH	Direct Measure using Vaisala MI70/HMP76B Temperature/Humidity Indicator/Probe

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Thermodynamics

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dew/Frost Point – Source [1]	(-85 to -80) °C (-80 to -70) °C (-70 to -60) °C (-60 to -50) °C (-50 to -40) °C (-40 to -10) °C	1.2 °C 0.61 °C 0.4 °C 0.36 °C 0.25 °C 0.15 °C	Comparison to Thunder Scientific 3900 Humidity Generator
Dew/Frost Point – Source [1]	(-10 to 20) °C (20 to 30) °C (30 to 40) °C (40 to 65) °C	0.13 °C 0.15 °C 0.16 °C 0.17 °C	Comparison to Thunder Scientific 2500 Humidity Generator
Temperature – Source [1] (Temperature Measuring Devices)	(-75 to -70) ºC (-70 to 100) ºC (100 to 200) ºC (200 to 400) ºC (400 to 600) °C	0.039 ºC 0.039 °C 0.051 °C 0.074 °C 0.092 °C	Comparison to AccuMac AM1760 SPRT, Black Stack, Hart Bath or Metrology Well
Temperature – Source [1] (Temperature Measuring Devices)	(600 to 800) °C (800 to 1 000) °C (1 000 to 1 200) °C	1.2 °C 1.5 °C 3.6 °C	Comparison to Fluke 5649 Type R Thermocouple Probe, HP 3458 8.5 Digit Multimeter, Furnace
Temperature – Measure [1]	(-195 to 0) °C (0 to 420) °C (420 to 660) °C	0.015 °C 0.03 °C 0.039 °C	Direct Measure using AccuMac AM1760 SPRT, Black Stack
Temperature – Measure [1]	(600 to 800) °C (800 to 1 000) °C (1 000 to 1 450) °C	0.55 °C 0.76 °C 2.9 °C	Comparison to Fluke 5649 Type R Thermocouple Probe, HP 3458 8.5 Digit Multimeter

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Thermodynamics

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Infrared Temperature – Source (Infrared Temperature Measuring Instruments)	(-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 (500 to 600) °C (600 to 700) °C (700 to 800) °C (800 to 900) °C (900 to 1 000) °C	0.44 °C 0.44 °C 0.48 °C 0.59 °C 0.64 °C 1.1 °C 1.8 °C 4.4 °C 4.7 °C 5.1 °C 5.4 °C 5.8 °C	Comparison to Blackbody Source (Flat Plate) λ = (8 to 14) µm, ε = (0.9 to 1)
Surface Probe Measuring Equipment	(20 to 100) °C	0.68 °C	Comparison to Fluke 3125 Surface Probe Calibrator
Surface Probe Measuring Equipment	(100 to 300) °C	1.2 °C	Comparison to Pyromation RAT185 RTD, Fluke 1502 Thermometer Readout
Centrifuge Chamber [1] Temperature	(-40 to 100) °C	1.2 °C	Comparison to Altek 422 Thermocouple Calibrator, Type T Thermocouple Probe

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Reference	10 MHz	23 pHz/Hz	Comparison to Pendulum FTR-210R GPS Disciplined Oscillator
Period – Source	(1 to 100) s	58 ns/s	Comparison to Keysight 33250A Function/Arbitrary Waveform Generator, Pendulum FTR-210R GPS Disciplined Oscillator

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Period – Measure	(1 to 10) s (10 to 100) s	17 µs 53 µs	Comparison to HP 53132A Universal Counter, Pendulum FTR-210R GPS Disciplined Oscillator
Frequency – Source	1 Hz to 80 MHz	58 nHz/Hz	Comparison to Keysight 33250A Function/Arbitrary Waveform Generator, Pendulum FTR-210R GPS Disciplined Oscillator
Frequency – Measure	1 Hz to 1 kHz 1 kHz to 10 MHz (10 to 225) MHz	1.5 nHz/Hz + 5.5 µHz 1.3 nHz/Hz + 4 µHz 1.2 nHz/Hz	Comparison to HP 53132A Universal Counter, Pendulum FTR-210R GPS Disciplined Oscillator
AC Duty Cycle – Source [1] Square Wave: < 3.3 Vp-p Freq: 0.1 Hz to 100 kHz	(1 to 10) % Duty Cycle 10 µs to 100 s (10 to 49) % Duty Cycle 10 µs to 100 s 50 % Duty Cycle 10 µs to 100 s (51 to 90) % Duty Cycle 10 µs to 100 s (90 to 99) % Duty Cycle 10 µs to 100 s	 0.039 % 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 5522A Multiproduct Calibrator
Stopwatches/Timers	Up to 19.99 s/d	59 ms/d	Direct Measure using Vibrograf 4500 Timometer
Time – Measure [1]	Up to 24 hr	1.1 s/d + 0.2 s	Comparison to Stopwatch
Non-Contact Rate of Rotation (Including Centrifuges) [1,2]	(5 to 99.999) rpm (100 to 999.99) rpm (1 000 to 9 999.9) rpm (10 000 to 99 999) rpm (100 000 to 200 000) rpm	0.012 % of reading + 0.001 2 rpm 0.012 % of reading + 0.012 rpm 0.012 % of reading + 0.12 rpm 0.014 % of reading + 1.2 rpm 0.014 % of reading + 12 rpm	Comparison to Optical Tachometer

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

DIMENSIONAL MEASUREMENT

1 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Geometric Measurement of Fixtures, Gauges, Dies and Molds [5]			
(Length – Single Axis) Outside Dimensions	Up to 1 in	(6 + 1*L*) µin	Universal Length Measuring Machine utilized as the reference standard for 1-D Length Measurements.
	(1 to 7) in	(4 + 3.5*L*) µin	
	(7 to 12) in	(4*L*) µin	
Inside Dimensions	(0.04 to 0.125) in	11 µin	
	(0.125 to 0.25) in	11 µin	
	(0.25 to 1) in	11 µin	
	(1 to 2.5) in	17 µin	
	(2.5 to 10) in	(18 + 3*L*) µin	
	(10 to 14) in	(38 + 3*L*) µin	

2 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Geometric Measurement of Fixtures, Gauges, Dies and Molds [5]			
X-Y Axis	50 µin to 1 in	103 µin	Multi-axis Vision System utilized as the reference standard for 2-D Length Measurements.
	(1 to 2) in	109 µin	
	(2 to 3) in	115 µin	
	(3 to 4) in	122 µin	
	(4 to 5) in	128 µin	
	(5 to 6) in	136 µin	
	(6 to 7) in	142 µin	
	(7 to 8) in	149 µin	
	(8 to 9) in	157 µin	
	(9 to 10) in	164 µin	
	(10 to 11) in	172 µin	
	(11 to 12) in	180 µin	
Angles	Up to 360°		Multi-axis Vision System utilized as the reference standard for Angle Measurements.
	Up to 5 in	0.006°	
	(5 to 10) in	0.008°	
	(10 to 12) in	0.009°	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

2 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Radius	50 µin to 1 in (1 to 6) in	120 µin 150 µin	Multi-axis Vision System utilized as the reference standard for Radius Measurements.

3 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Geometric Measurement of Fixtures, Gauges, Dies and Molds [5]			Multi-axis Vision System utilized as the reference standard for 3-D Measurements.
X-axis	50 µin to 1 in	84 µin	
	(1 to 2) in	90 µin	
	(2 to 3) in	96 µin	
	(3 to 4) in	100 µin	
	(4 to 5) in	110 µin	
	(5 to 6) in	120 µin	
	(6 to 9) in	140 µin	
	(9 to 12) in	160 µin	
Y-axis	50 µin to 1 in	84 µin	
	(1 to 2) in	90 µin	
	(2 to 3) in	96 µin	
	(3 to 4) in	100 µin	
	(4 to 5) in	110 µin	
	(5 to 6) in	120 µin	
	(6 to 9) in	140 µin	
	(9 to 12) in	160 µin	
Z-axis	(0.1 to 2) in	150 µin	
	(2 to 4) in	160 µin	
	(4 to 5) in	170 µin	

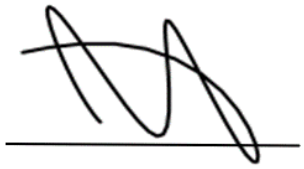
Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement 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.

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

2. As frequency deviates from the listed values, uncertainty may be higher than stated. If needed, contact the laboratory for more information regarding uncertainties at frequency and range combinations other than the ones shown.
3. Carrier range is the output amplitude capability of the fundamental wave. Up to 10 harmonics can be placed on the fundamental wave up to the amplitude of the value shown as the harmonic range. The uncertainties shown are for both the fundamental and harmonic amplitudes within the frequency range shown.
4. The uncertainties shown are for the most favorable conditions. There is an increase in uncertainty that corresponds to the laboratory's AC voltage and current uncertainties at different frequencies other than the ones shown. Power factors (PF) other than the one shown contribute to the power uncertainty. PF is related to the cosine of phase. Therefore, uncertainties track the laboratory's phase uncertainty closely at PF near one but are magnified heavily as PF approaches zero. The lab may also report reactive power, apparent power, and power factor under this accreditation. If needed, contact the laboratory for more information regarding uncertainties at frequency and power factor combinations other than the ones shown.
5. ″ = arc-second; *L* = length in inches; *DL* = diagonal length in inches; rpm = revolutions per minute.
6. 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.
7. Uncertainties are for cardinal point temperatures, measurement between cardinal temperate points are available with greater uncertainties.
8. The stated uncertainty is the laboratory's ability to source a fast rise pulse that is approximately 500 ps, 350 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.
9. Unless otherwise specified in the far-right hand column, the calibration procedure being utilized by the laboratory was written internally.



Jason Stine, Vice President

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org