CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Brylen Technologies, Inc.
275 Orange Avenue #A
Goleta, CA 93117

Fulfills the requirements of

ISO/IEC 17025:2017

and national standards

ANSI/NCSL Z540-1-1994 (R2002)

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.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 11 July 2022
Certificate Number: ACT-1201

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)

Brylen Technologies, Inc.
275 Orange Avenue #A
Goleta, CA 93117
Barbara Tzur 805-692-9300

CALIBRATION

Valid to: **July 11, 2022** Certificate Number: **ACT-1201**

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
DC Voltage – Source[1]	Up to 330 mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V 330 V to 1.02 kV	45 µV/V + 2.4 µV 27 µV/V + 50 µV 27 µV/V + 50 µV 31 µV/V + 4.9 mV 41 µV/V + 2.5 mV	Fluke 5500A SC600 Multiproduct Calibrator
DC Voltage – Measure[1]	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV	7.8 µV/V + 0.35 µV 6.8 µV/V + 0.35 µV 6.8 µV/V + 0.65 µV 9 µV/V + 40 µV 8.8 µV/V + 1.1 mV	HP 3458A Opt 002 8.5 Digit Multimeter
DC Current – Source[1]	Up to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 2.2 A (2.2 to 11) A	91 µA/A + 68 nA 68 µA/A + 0.5 µA 69 µA/A + 5.3 µA 0.23 mA/A + 0.11 mA 0.45 mA/A + 0.62 mA	Fluke 5500A SC600 Multiproduct Calibrator
DC Current – Measure[1]	Up to 100 nA 100 nA to 1 µA (1 to 10) µA (10 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	39 µA/A + 46 pA 30 µA/A + 46 pA 27 µA/A + 0.13 nA 28 µA/A + 91 pA 28 µA/A + 5.7 nA 28 µA/A + 57 nA 45 µA/A + 0.57 µA 0.13 mA/A + 11 µA	HP 3458A Opt 002 8.5 Digit Multimeter

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Voltage – Source[1]	Up to 33 mV		Fluke 5500A SC600 Multiproduct Calibrator
	(10 to 45) Hz	2.6 mV/V + 16 µV	
	45 Hz to 10 kHz	1.1 mV/V + 16 µV	
	(10 to 20) kHz	1.5 mV/V + 16 µV	
	(20 to 50) kHz	1.9 mV/V + 16 µV	
	(50 to 100) kHz	2.7 mV/V + 26 µV	
	(100 to 500) kHz	4.6 mV/V + 46 µV	
	(33 to 330) mV		
	(10 to 45) Hz	1.9 mV/V + 38 µV	
	45 Hz to 10 kHz	0.38 mV/V + 16 µV	
	(10 to 20) kHz	0.76 mV/V + 16 µV	
	(20 to 50) kHz	1.2 mV/V + 31 µV	
	(50 to 100) kHz	1.8 mV/V + 129 µV	
	(100 to 500) kHz	5.3 mV/V + 0.25 mV	
	330 mV to 3.3 V		
	(10 to 45) Hz	1.1 mV/V + 0.2 mV	
	45 Hz to 10 kHz	0.22 mV/V + 60 µV	
	(10 to 20) kHz	0.61 mV/V + 53 µV	
	(20 to 50) kHz	1.1 mV/V + 0.23 mV	
	(50 to 100) kHz	1.8 mV/V + 1.3 mV	
	(100 to 500) kHz	3.8 mV/V + 2.5 mV	
	(3.3 to 33) V		
	(10 to 45) Hz	1.1 mV/V + 1.9 mV	
	45 Hz to 10 kHz	0.3 mV/V + 0.64 mV	
	(10 to 20) kHz	6.1 µV/V + 2.1 mV	
	(20 to 50) kHz	1.4 mV/V + 3.8 mV	
	(50 to 100) kHz	1.8 mV/V + 13 mV	
	(33 to 330) V		
	45 Hz to 1 kHz	0.38 mV/V + 6.1 mV	
	(1 to 10) kHz	0.61 mV/V + 12 µV	
	(10 to 20) kHz	0.68 mV/V + 26 µV	
	330 V to 1.02 kV		
	45 Hz to 1 kHz	0.38 mV/V + 61 mV	
	(1 to 5) kHz	1.5 mV/V + 76 mV	
	(5 to 10) kHz	1.5 mV/V + 0.38 V	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Voltage – Measure[1]	Up to 10 mV		HP 3458A Opt 002 8.5 Digit Multimeter
	(1 to 40) Hz	340 µV/V + 2 µV	
	40 Hz to 1 kHz	0.23 mV/V + 0.23 µV	
	(1 to 20) kHz	0.34 mV/V + 1 µV	
	(20 to 50) kHz	1.1 mV/V + 1 µV	
	(50 to 100) kHz	5.7 mV/V + 1 µV	
	(100 to 300) kHz	45 mV/V + 2 µV	
	300 kHz to 1 MHz	14 mV/V + 6 µV	
	(1 to 4) MHz	73 mV/V + 8 µV	
	(4 to 8) MHz	0.23 V/V + 9 µV	
	(10 to 100 mV)		
	(1 to 40) Hz	82 µV/V + 4.5 µV	
	40 Hz to 1 kHz	82 µV/V + 2.3 µV	
	(1 to 20) kHz	0.16 mV/V + 2.3 µV	
	(20 to 50) kHz	0.34 mV/V + 2.3 µV	
	(50 to 100) kHz	0.91 mV/V + 2.3 µV	
	(100 to 300) kHz	0.34 mV/V + 11 µV	
	300 kHz to 1 MHz	11 mV/V + 11 µV	
	(1 to 4) MHz	45 mV/V + 79 µV	
	(4 to 8) MHz	45 mV/V + 91 µV	
	(8 to 10) MHz	0.17 V/V + 0.11 mV	
	100 mV to 1 V		
	(1 to 40) Hz	82 µV/V + 45 µV	
	40 Hz to 1 kHz	82 µV/V + 23 µV	
	(1 to 20) kHz	0.16 mV/V + 23 µV	
	(20 to 50) kHz	0.34 mV/V + 23 µV	
	(50 to 100) kHz	0.9 mV/V + 23 µV	
	(100 to 300) kHz	0.34 mV/V + 0.11 mV	
	300 kHz to 1 MHz	11 mV/V + 0.11 mV	
	(1 to 4) MHz	46 mV/V + 0.79 mV	
	(4 to 8) MHz	45 mV/V + 0.9 mV	
	(8 to 10) MHz	0.17 V/V + 1.1 mV	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Voltage – Measure[1]	(1 to 10) V		HP 3458A Opt 002 8.5 Digit Multimeter
	(1 to 40) Hz	82 µV/V + 0.45 mV	
	40 Hz to 1 kHz	82 µV/V + 0.23 mV	
	(1 to 20) kHz	0.16 mV/V + 0.23 mV	
	(20 to 50) kHz	0.34 mV/V + 0.23 mV	
	(50 to 100) kHz	0.9 mV/V + 0.23 mV	
	(100 to 300) kHz	0.34 mV/V + 1.1 mV	
	300 kHz to 1 MHz	11 mV/V + 1.1 mV	
	(1 to 4) MHz	45 mV/V + 7.9 mV	
	(4 to 8) MHz	45 mV/V + 9.1 mV	
	(8 to 10) MHz	0.11 V/V + 11 mV	
	(10 to 100) V		
	(1 to 40) Hz	0.23 mV/V + 4.5 mV	
	40 Hz to 1 kHz	0.23 mV/V + 2.3 mV	
	(1 to 20) kHz	0.23 mV/V + 2.3 mV	
	(20 to 50) kHz	0.4 mV/V + 2.3 mV	
	(50 to 100) kHz	1.4 mV/V + 2.3 mV	
	(100 to 300) kHz	4.5 mV/V + 11 mV	
	300 kHz to 1 MHz	17 mV/V + 11 mV	
	100 to 1 kV		
	(1 to 40) Hz	0.46 mV/V + 45 mV	
	40 Hz to 1 kHz	0.46 mV/V + 23 mV	
	(1 to 20) kHz	0.68 mV/V + 23 mV	
	(20 to 50) kHz	1.4 mV/V + 23 mV	
	(50 to 100) kHz	3.4 mV/V + 23 mV	
AC Current – Source[1]	(30 to 330) µA		Fluke 5500A SC600 Multiproduct Calibrator
	(10 to 20) Hz	1.9 mA/A + 0.13 µA	
	(20 to 45) Hz	0.92 mA/A + 0.13 µA	
	45 Hz to 1 kHz	0.94 mA/A + 0.2 µA	
	(1 to 5) kHz	3 mA/A + 0.13 µA	
	(5 to 10) kHz	9.5 mA/A + 0.12 µA	
	330 µA to 3.3 mA		
	(10 to 20) Hz	1.5 mA/A + 0.23 µA	
	(20 to 45) Hz	0.76 mA/A + 0.23 µA	
	45 Hz to 1 kHz	0.76 mA/A + 0.23 µA	
	(1 to 5) kHz	1.5 mA/A + 0.23 µA	
	(5 to 10) kHz	4.6 mA/A + 0.23 µA	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Current - Source[1]	(3.3 to 33) mA		Fluke 5500A SC600 Multiproduct Calibrator
	(10 to 20) Hz	1.5 mA/A + 2.3 µA	
	(20 to 45) Hz	0.76 mA/A + 2.3 µA	
	45 Hz to 1 kHz	0.68 mA/A + 2.3 µA	
	(1 to 5) kHz	1.5 mA/A + 2.3 µA	
	(5 to 10) kHz	4.6 mA/A + 2.3 µA	
	(33 to 330) mA		
	(10 to 20) Hz	1.5 mA/A + 23 µA	
	(20 to 45) Hz	0.76 mA/A + 23 µA	
	45 Hz to 1 kHz	0.68 mA/A + 23 µA	
	(1 to 5) kHz	1.5 mA/A + 23 µA	
	(5 to 10) kHz	4.6 mA/A + 23 µA	
	330 mA to 2.2 A		
	(10 to 45) Hz	1.5 mA/A + 0.23 mA	
	45 Hz to 1 kHz	0.76 mA/A + 0.23 mA	
	(1 to 5) kHz	5.7 mA/A + 0.23 mA	
	(2.2 to 11) A		
	(45 to 65) Hz	0.45 mA/A + 1.6 mA	
	65 Hz to 500 Hz	0.76 mA/A + 1.6 mA	
	500 Hz to 1 kHz	2.5 mA/A + 1.6 mA	
AC Current – Measure[1]	(5 to 100) µA		HP 3458A Opt 002 8.5 Digit Multimeter
	(10 to 20) Hz	4.5 mA/A + 34 nA	
	(20 to 45) Hz	1.7 mA/A + 23 nA	
	(45 to 100) Hz	684 µA/A + 34 nA	
	100 Hz to 1 kHz	676 µA/A + 35 nA	
	100 µA to 1 mA		
	(10 to 20) Hz	4.5 mA/A + 0.23 µA	
	(20 to 45) Hz	1.7 mA/A + 0.23 µA	
	(45 to 100) Hz	0.68 mA/A + 0.23 µA	
	100 Hz to 5 kHz	0.34 mA/A + 0.24 µA	
	(5 to 20) kHz	0.68 mA/A + 0.23 µA	
	(20 to 50) kHz	4.5 mA/A + 0.45 mA	
	(50 to 100) kHz	6.3 mA/A + 8 µA	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Current – Measure[1]	(1 to 10) mA		HP 3458A Opt 002 8.5 Digit Multimeter
	(10 to 20) Hz	4.5 mA/A + 2.3 µA	
	(20 to 45) Hz	1.7mA/A + 2.3 µA	
	(45 to 100) Hz	0.68 mA /A + 2.3 µA	
	100 Hz to 5 kHz	0.33 mA /A + 2.5 µA	
	(5 to 20) kHz	0.68 mA /A + 2.3 µA	
	(20 to 50) kHz	4.5 mA/A + 4.5 µA	
	(50 to 100) kHz	6.3 mA/A + 80 µA	
	(10 to 100) mA		
	(10 to 20) Hz	4.5 mA/A + 23 µA	
	(20 to 45) Hz	1.7 mA/A + 23 µA	
	(45 to 100) Hz	0.68 mA/A + 23 µA	
	100 Hz to 5 kHz	0.33 mA/A + 25 µA	
	(5 to 20) kHz	0.68 mA/A + 2.3 µA	
	(20 to 50) kHz	4.5 mA/A + 45 µA	
	(50 to 100) kHz	6.2 mA/A + 0.17 mA	
	100 mA to 1 A		
	(10 to 20) Hz	4.5 mA/A + 0.23 mA	
	(20 to 45) Hz	1.8 mA/A + 0.23 mA	
	(45 to 100) Hz	0.91 mA/A + 0.23 mA	
	100 Hz to 5 kHz	0.11 mA/A + 0.25 mA	
	(5 to 20) kHz	3.4 mA/A + 0.23 mA	
	(20 to 50) kHz	11 mA/A + 0.45 mA	
Resistance – Source[1]	Up to 11 Ω	69 µΩ/Ω + 8 mΩ	Fluke 5500A SC600 Multiproduct Calibrator
	(11 to 33) Ω	84 µΩ/Ω + 13 mΩ	
	(33 to 110) Ω	64 uΩ/Ω + 13 mΩ	
	(110 to 330) Ω	67 µΩ/Ω + 12 mΩ	
	330 Ω to 1.1 kΩ	58 µΩ/Ω + 70 mΩ	
	(1.1 to 3.3) kΩ	65 µΩ/Ω + 63 mΩ	
	(3.3 to 11) kΩ	58 µΩ/Ω + 0.7Ω	
	(11 to 33) kΩ	65 µΩ/Ω + 0.62 Ω	
	(33 to 110) kΩ	80 µΩ/Ω + 6.8 Ω	
	(110 to 330) kΩ	81 µΩ/Ω + 6 Ω	
	330 kΩ to 1.1 MΩ	0.1 mΩ/Ω + 64 Ω	
	(1.1 to 3.3) MΩ	50 µΩ/Ω + 538 Ω	
	(3.3 to 11) MΩ	0.42 mΩ/Ω + 1 kΩ	
	(11 to 33) MΩ	0.7 mΩ/Ω + 3 kΩ	
	(33 to 110) MΩ	3.8 mΩ/Ω + 5.3 kΩ	
	(110 to 330) MΩ	3.8 mΩ/Ω + 12.6 kΩ	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Resistance – Source[1] (Fixed)	500 µΩ 2 mΩ 5 mΩ 10 mΩ	5.7 µΩ 23 µΩ 57 µΩ 0.1 mΩ	Simpson Current Shunts
Resistance – Measure[1]	Up to 10 Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 k Ω to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 M Ω to 1 GΩ	18 µΩ/Ω + 79 µΩ 17 µΩ/Ω + 0.58 mΩ 15 µΩ/Ω + 0.68 mΩ 15 µΩ/Ω + 2.1 mΩ 15 µΩ/Ω + 30 mΩ 20 µΩ/Ω + 2.4 Ω 59 µΩ/Ω + 130 Ω 0.6 mΩ/Ω + 1.6 kΩ 5.6 mΩ/Ω + 54 kΩ	HP 3458A Opt 002 8.5 Digit Multimeter
Capacitance – Source[1] 10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (0 to 50) Hz (0 to 20) Hz (0 to 6) Hz (0 to 2) Hz (0 to 0.6) Hz (0 to 0.2) Hz	 (330 to 500) pF 500 pF to 1.1 nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF 330 nF to 1.1 µF (1.1 to 3.3) µF (3.3 to 11) µF (11 to 33) µF (33 to 110) µF (110 to 330) µF 330 µF to 1.1 mF	 3.8 mF/F + 7.6 pF 3.8 mF/F + 7.6 pF 3.8 mF/F + 7.6 pF 3.8 mF/F + 8.6 pF 1.9 mF/F + 76 pF 1.8 mF/F + 90 pF 1.9 mF/F + 0.2 nF 1.9 mF/F + 0.8 nF 2.7 mF/F + 2.3 nF 2.6 mF/F + 8.8 nF 3.0 mF/F + 23 nF 3.8 mF/F + 86 nF 5.3 mF/F + 0.2 µF 7.3 mF/F + 0.3 µF	Fluke 5500A SC600 Multiproduct Calibrator
Inductance-Source[1]	0 to 999.999 mH	23 mH/H + 90 nH	IET LC-400L-SC Decade Inductor
Electrical Simulation of Thermocouple Indicators[1]	Type B (600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °C	 0.33 °C 0.26 °C 0.23 °C 0.25 °C	Fluke 5500A SC600 Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Electrical Simulation of Thermocouple Indicators[1]	Type C		Fluke 5500A SC600 Multiproduct Calibrator
	(0 to 15) °C	0.23 °C	
	(150 to 650) °C	0.2 °C	
	(650 to 1 000) °C	0.24 °C	
	(1 000 to 1 800) °C	0.38 °C	
	(1 800 to 2 316) °C	0.64 °C	
	Type E		
	(-250 to -100) °C	0.38 °C	
	(-100 to -25) °C	0.12 °C	
	(-25 to 350) °C	0.11 °C	
	(350 to 650) °C	0.12 °C	
	(650 to 1 000) °C	0.16 °C	
	Type J		
	(-210 to -100) °C	0.21 °C	
	(-100 to -30) °C	0.12 °C	
	(-30 to 150) °C	0.11 °C	
	(150 to 760) °C	0.13 °C	
	(760 to 1 200) °C	0.18 °C	
	Type K		
	(200 to -100) °C	0.25 °C	
	(-100 to -25) °C	0.14 °C	
	(-25 to 120) °C	0.12 °C	
	(120 to 1 000 °C	0.2 °C	
	(1 000 to 1 372) °C	0.3°C	
	Type L		
	(200 to -100) °C	0.28 °C	
	(-100 to 800) °C	0.2 °C	
	(800 to 900) °C	0.13 °C	
	Type N		
	(-200 to -100) °C	0.3 °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	0.43 °C	
	(250 to 400) °C	0.27 °C	
	(400 to 1 000) °C	0.25 °C	
	(1 000 to 1 767) °C	0.3°C	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Electrical Simulation of Thermocouple Indicators[1]	Type S		Fluke 5500A SC600 Multiproduct Calibrator
	(0 to 250) °C	0.36 °C	
	(250 to 1 000) °C	0.27 °C	
	(1 000 to 1 400) °C	0.28 °C	
	(1 400 to 1 767) °C	0.35 °C	
	Type T		
	(-250 to -150) °C	0.48 °C	
	(-150 to 0) °C	0.18 °C	
	(0 to 120) °C	0.12 °C	
	(120 to 400) °C	0.11 °C	
	Type U		
	(-200 to 0) °C	0.43 °C	
	(0 to 600) °C	0.21 °C	
Electrical Simulation of RTD Indicators[1]	Pt 395 (100 Ω)		Fluke 5500A SC600 Multiproduct Calibrator
	(-200 to 0) °C	0.04 °C	
	(0 to 100) °C	0.04 °C	
	(100 to 300) °C	0.05 °C	
	(300 to 400) °C	0.68 °C	
	(400 to 630) °C	0.08 °C	
	(630 to 800) °C	0.09 °C	
	Pt 3926 (100 Ω)		
	(-200 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	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Electrical Simulation of RTD Indicators[1]	Pt 385 (200 Ω)		Fluke 5500A SC600 Multiproduct Calibrator
	(-200 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	
	Pt 385 (500 Ω)		
	(-200 to -80) °C	0.03 °C	
	(-80 to 100) °C	0.04 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 400) °C	0.06 °C	
	(400 to 600) °C	0.07 °C	
	(600 to 630) °C	0.08 °C	
	Pt 385 (1 000 Ω)		
	(-200 to 0) °C	0.02 °C	
	(0 to 100) °C	0.02 °C	
	(100 to 260) °C	0.03 °C	
	(260 to 300) °C	0.04 °C	
	(300 to 600) °C	0.05 °C	
	(600 to 630) °C	0.05 °C	
	Ni 120 (120 Ω)		
	(-80 to 100) °C	0.06 °C	
	(100 to 260) °C	0.11 °C	
	Cu 427 (10 Ω)		
	(-100 to 260) °C	0.23 °C	
Oscilloscopes[1,2]			Fluke 5500A SC600 Multiproduct Calibrator
Amplitude DC Signal			
into 50 Ω load	± (1 to 25) mV	1.9 mV/V + 30 µV	
	± (25 to 110) mV	1.9 mV/V + 31 µV	
	± 110 mV to ± 2.2 V	1.9 mV/V + 44 µV	
	± (2.2 to 25) V	1.9 mV/V + 0.13 mV	
into 1 MΩ load	(-130 to 130) V	0.38 mV/V + 30 µV	
Amplitude Square Wave			
50 Ω load	±1 mV to ±6.6 V p-p		
	10 Hz to 1 kHz	1.9 mV/V + 25 µV	
1 MΩ load	±1 mV to ±130 V p-p		
	10 Hz to 1 kHz	0.76 mV/V + 0.6 mV	
	(1 to 10) kHz	1.9 mV/V + 0.4 mV	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Oscilloscopes[1,2]			Fluke 5500A SC600 Multiproduct Calibrator
Rise Time	< 300 ps	+0 ps/-100 ps	
Leveled Sine Wave (Relative to 50 kHz)	5 mVp-p to 5.5 Vp-p		
	50 kHz to 100 MHz	11 mV/V + 0.8 mV	
	(100 to 300) MHz	15 mV/V + 0.7 mV	
	(300 to 600) MHz	30 mV/V + 0.7 mV	
Time Marker into 50 Ω Load	50 ms to 5 s	(25 + 1 000*T*) µs/s	
	2 ns to 20 ms	2.5 µs	
Rise Time into 50 Ω Load	≤350 ps	+0/-100 ps	
	5 mV to 2.5 V	15 mV/V + 0.15 mV	
Wave Generator – Amplitude (square, sine, & triangle wave)			
into 50 Ω	10 Hz to 10 kHz		
	1.8 mV to 2.5 V p-p	23 mV/V + 76 µV	
into 1 MΩ	10 Hz to 10 kHz		
	1.8 mV to 55 V p-p	23 mV/V + 76 µV	

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Angle Plates	Up to 6 in	63 µin	Cylindrical Square, Granite Cube, Mu-Checker, Surface Plate
Angle Blocks	(0 to 99) °	5 ”	Rotary Table, Autocollimator, Reflecting Cube
Caliper Checker[2]	Up to 8 in	(57 + 2*L*) µin	Mu-Checker, Height Master, Surface Plate

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Calipers[1] Length Depth Inside Diameter	 Up to 8 in (8 to 12) in (12 to 20) in (20 to 40) in (40 to 72) in 1 in only 1.617 67 in only	 294 µin 289 µin 299 µin 594 µin 647 µin 285 µin 290 µin	Caliper Checker, Gage Blocks
Chamfer Gauges[1]	Up to 2 in	639 µin	Ring Gauges
Depth Micrometers[1,2]	Up to 12 in	(53 + 2*L*) µin	Gage Blocks, Surface Plate
Dial Caliper Gages[2]	Up to 6 in	(244 + 32*L*) µin	P&W Supermicrometer, Ring Gages
Feeler Gages[1]	Up to 0.01 in	35 µin	P&W Supermicrometer, Gage Blocks, Micrometer
Gage Blocks[2]	Up to 0.05 in (0.05 to 0.7) in (0.7 to 1) in (1 to 4) in	4.6 µin 3.4 µin 3.5 µin (2.6 + 0.9*L*) µin	Gage Block Comparator, Grade 1 Gage Blocks
	Up to 15.0 mm (15.0 to 100.0) mm	(0.12 + 0.000 1*L*) µm (0.08 + 0.001 4*L*) µm	
Long Gage Blocks[2]	(4 to 20) in	2*L* µin	Mu-Checker, Grade 1 Gage Blocks
Height Gages[1,2]	Up to 24 in	(297 + 0.8*L*) µin	Gage Blocks, Surface Plate, Test Indicator
Height Master[2]	Up to 18 in	(38 + 2*L*) µin	Mu-checker, Surface Plate, Gage Blocks
Indicators[1,2] (Drop and Test)	Up to 4 in (4 to 10) in	(43 + 13*L*) µin (255 + 11*L*) µin	Micrometer Head, Gage Blocks, Surface Plate, P&W Supermicrometer
Inside Micrometers[2]	Up to 4 in (4 to 24) in	71 µin (69 + 3*L*) µin	P&W Lab Master, Gage Blocks, Riser Block, Sine Plate, Height Master

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Levels	All	1.2 ”	Autocollimator, Reflective Cube, Rotary Table
Outside Micrometers[1,2]	Up to 3 in (3 to 20) in	34 µin (52 + 1.9*L*) µin	Gage Blocks
Micrometer Heads[1]	Up to 2 in	18 µin	Mu-Checker, Gage Blocks
Mu Checkers[1]	Up to 150 µin	3.9 µin	Gage Blocks
Optical Comparator[1,2] Linear Measurement X-axis and Y-axis Angular Measurement Magnification	 Up to 6 in (6 to 30) in (0 to 360) º 10 X 20 X 31.25 X	 (60 + 0.6*L*) µin (13 + 8.3L) µin 34 s 11 µin 11 µin 11 µin	 Microrule, Gage Blocks, Glass Scale Angle Blocks Magnification Checker, Steel Rule
Plugs Cylindrical[2] Pin Gage	Up to 6 in	(2.5 + 4.1*L*) µin	P&W Lab Master, Gage Blocks
Protractors, Digital Protractors, Bevel Angle Blade Parallelism	(0 to 90) º (0 to 35) º Up to 0.001 in	22 ” 0.025 ° 34 µin	Rotary Table, Level Angle Blocks, Mu-Checker, Surface Plate
Threaded Plugs[2] Pitch Diameter Major Diameter Angle	 Up to 6 in Up to 6 in Up to 60 º	 (133 + 0.2*L*) µin (10 + 1.5*L*) µin 80 ”	Gage Blocks, Thread Wires, P&W Supermic, Gage Blocks, Optical Comparator

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Threaded Ring Gages Pitch Diameter Minor Diameter	 Up to 4 in Up to 4 in	 304 µin 140 µin	Setting Plug Gages, Optical Comparator, Pin Gages
Radius Gauge	Up to 1 in	0.000 6 in	Optical Comparator, Radius Screen
Ring Gauge – Plain[2]	(0.25 to 1) in (1 to 11) in	(18 + 3*L*) µin 4.1*L* µin	Gage Blocks, Ring Comparator, P&W Lab Master
Rotary Tables[1] Angle Flatness/Parallelism Compound Angle	 360 ° Up to 0.1 in (15, 30, 45) °	 1.4 ” 35 µin 2.5 ”	Autocollimator, Reflecting Cube, Mu Checker, Surface Plate, Angle Blocks
Sine Plates Angle Flatness & Parallelism	 (15, 30, 45) ° (5 in and 10 in Roller Spacing only) Up to 0.001 in	 4.6 ” 35 µin	 Angle Blocks, Gauge Blocks, Mu Checker, Surface Plate Mu Checker, Surface Plate
Steel Rules[2]	Up to 78 in	(131 + 37*L*) µin	Optical Comparator
Surface Plates[1,2] Overall Flatness Repeat reading	 Up to 161 in*DL* Up to 0.001 in	 (15 + 3.2*DL*) µin 20 µin	In accordance with Fed Spec GGG-P-463 using Autocollimator Mu Checker w/ Probe
Thread Wires	(4 to 120) TPI	29 µin	Plug Gages, P&W Lab Master, Gage Blocks
Tri-Micrometers[1]	Up to 3 in	88 µin	Ring Gages
V-Anvil Micrometers[1]	Up to 1 in	84 µin	Plain Plug Gages

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Vee Block Parallelism to Adjacent Side	Up to 0.001 in	67 µin	Plug Gauge, Mu Checker, Surface Plate
Parallelism to Opposite Side	Up to 0.001 in	36 µin	Angle Block, Mu Checker, Surface Plate
Side Squareness	Up to 0.001 in	63 µin	Granite Cube, Mu Checker, Surface Plate
Surface Flatness & Parallelism	Up to 0.001 in	34 µin	Mu Checker, Surface Plate
Length – Measure[1,2]	Up to 13 in	(1.9 + 4.2*L*) µin	P&W Lab Master
	(0 to 4) in	76 µin	Micrometer Set
	Up to 4 in	(133 + 1*L*) µin	Optical Comparator
	Up to 18 in	(60 + 2.6*L*) µin	Height Master, Mu Checker, Surface Plate
	Up to 24 in	(32 + 2.3*L*) µin	Gage Blocks, Mu Checker, Surface Plate
	Up to 1 200 in	(0.007 + 0.000 2*L*) in	Steel Rule
Depth[1]	(0 to 1) in	150 µin	Drop Indicator
Flatness & Parallelism[1]	Up to 0.001 in	35 µin	Mu Checker, Surface Plate
Go - No Go Measurement[2]	Up to 1 in	(118 + 8*L*) µin	Pin Gages
Squareness	Up to (8 x 8) in	56 µin	Granite Cube, Mu Checker, Surface Plate
Angle	(0 to 360) °	0.025 ”	Optical Comparator
Radius	Up to 1 in	257 µin	

Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Velometers and Anemometers	(50 to 200) fpm (200 to 1 200) fpm	1.3 % of reading + 5.7 fpm 1.5 % of reading + 1 fpm	Standard Anemometer
Balances and Scales[1] (0.000 01 g resolution)	Up to 210 g	0.18 mg	ASTM Class 1 Weights and internal procedure BP042 utilized for the calibration of the weighing system.
Balances and Scales[1] (0.01 g resolution)	(210 to 2 000) g	7.5 mg	ASTM Class 4 Weights and internal procedure BP042 utilized for the calibration of the weighing system.
Balances and Scales[1] (0.1 g resolution)	(2 to 31) kg	59 mg	ASTM Class 6 Weights and internal procedure BP042 utilized for the calibration of the weighing system.
Balances and Scales[1,3]	Up to 300 lb	0.57 lb	ASTM Class 6 Weights and internal procedure BP042 utilized for the calibration of the weighing system.
Balances and Scales[1,3]	(300 to 400) lb	0.58 lb	ASTM Class 6 Weights and internal procedure BP042 utilized for the calibration of the weighing system.
Balances and Scales[1,3]	(400 to 2 000) lb	1.1 lb	ASTM Class 6 Weights and internal procedure BP042 utilized for the calibration of the weighing system.
Barometers	(28 to 32) in Hg	0.09 in Hg	Manometer w/ Master Barometer
Durometer Force Type A, B, E, & O Types C, D, & DO Type OO & OOO	(0 to 821) gf (0 to 4 532) gf (0 to 114) gf	0.14 gf	Class 4 Weights, Analytical Balance
Durometer Indenter Length	(0.09 to 0.11) in	133 µin	Optical Comparator

Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Dynamometer[1,2]	Up to 5 000 g	(0.02 + 0.56*R*) g	ASTM Class 1 & S Weights
	(11 to 400) lb (400 to 1 000) lb (1 000 to 10 000) lb	(0.02 + 0.56*R*) lb (0.64 + 0.43*R*) lb (3.9 to 0.28*R*) lb	ASTM Class 6 Weights Load Cell, Multimeter
Flow Meters[1]	Up to 2 slpm (2 to 20) slpm	0.9 % of reading + 0.003 slpm 0.7 % of reading + 0.044 slpm	Alicat Flow Controller
Rockwell Hardness Testers[1]	HRA HRBW HRC HRD HRE HRF	1.2 HRA 1.2 HRBW 0.7 HRC 1.2 HRD 1.3 HRE 1.3 HRF	Indirect verification per ASTM E18 using Test Blocks
Brinell Hardness Testers[1]	229 HBW 323 HBW	3.3 HBW 5.5 HBW	Indirect verification per ASTM E10 using Test Blocks
Force[1]	Up to 210 g	0.64 mg	Class 1 Weights
	(2 to 400) lbf (400 to 1 000) lbf (1 000 to 5 000) lbf (5 000 to 10 000) lbf	0.03 % of reading 0.03 % of reading + 0.3 lbf 0.03 % of reading + 0.9 lbf 0.03 % of reading + 2.7 lbf	ASTM Class 6 Weights, Load Cell, Multimeter
Mass / Weights	Up to 2 g	0.67 % of reading + 0.01 mg	Sartorius MC 210 S Balance, ASTM Class 1 & 4 Weights
Mass / Weights	(2 to 200) g	0.07 % of reading + 0.03 mg	Sartorius MC 210-03S Balance, ASTM Class 1 & 4 Weights
	(200 to 2 000) g	0.34 % of reading	Sartorius MSA31 Scale, ASTM Class 1 & 4 Weights
	(2 000 to 31 000) g	79 mg	GP-30K Scale, Class 1 & 4 Weights
Pipettes	(0.5 to 10 000) µL	0.04 % of reading + 0.03 µL	Precision Balances, Distilled Water

Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Volumetric Ware	Up to 2 000 mL	0.04 % of reading	Precision Balances, Distilled Water
Barometers	(28 to 32) in Hg	0.09 inHg	Manometer w/ Master Barometer
Pressure Gages and Transducers[1]	Up to 0.5 in H_2O	0.000 3 % of reading + 0.55 inH_2O	Manometer
	(0.072 to 7.5) psig	0.009 % of reading + 0.47 psi	Comparison to Mensor 2400 Digital Pressure Gage
	(7.5 to 60) psig	0.018 % + 0.54 psi	Dead Weight Tester
	(60 to 1 000) psig	0.045 % of reading + 0.47 psi	Dead Weight Tester
	(1 000 to 10 000) psig	0.057 % of reading + 0.22 psi	Dead Weight Tester
Vacuum Gages[1]	(-30 to 0) inHg	0.09 inHg	Comparison to Master Manometer
Torque Transducers	Up to 27.6 lbf·in (27.6 to 150) lbf·in 150 lbf·in to 60 lbf·ft (60 to 2 000) lbf·ft	0.007 % of reading + 0.004 lbf·in 0.06 % of reading + 0.000 1 lbf·in 0.3 % of reading + 0.009 lbf·ft 0.08 % of reading + 0.000 5 lbf·ft	Torque Arms and Class 6 Weights
Torque Tools[1,2]	(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	0.17 % of reading + 0.11 lbf·in 0.41 % of reading + 0.05 lbf-in 0.42 % of reading + 0.02 lbf·in 0.39 % of reading + 0.07 lbf·ft 0.29 % of reading + 0.01 lbf·ft 0.3 % of reading	CDI Torque Machine

Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Humidity[1]	(10 to 90) %RH (90 to 95) %RH	1.3 %RH 2.1 %RH	Vaisala HMI70 Temperature/Humidity Indicator w/ Accredited Salts
Temperature – Measure[1]	(-20 to 60) °C	0.25 °C	Vaisala HMI41 Temperature/Humidity Indicator

Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Temperature – Measure[1]	(-270 to -210) °C (-210 to 400) °C (400 to 1 370) °C	0.7 °C 0.62 °C 1.3 °C	Comparison to Datalogger w/ Type T Thermocouple Probe
	(-270 to 400) °C (400 to 1 370) °C	0.37 °C 1.26 °C	Comparison to Fluke 5500A Multiproduct Calibrator, w/ Type T Thermocouple Probe
Temperature – Measure[1]	(-200 to 100) °C (100 to 300) °C (300 to 500) °C (500 to 660) °C	0.046 °C 0.065 °C 0.085 °C 0.12 °C	Fluke/Hart 5628 PRT w/ HP 3458A Opt 002 8.5 Digit Multimeter
Temperature – Source[1]	(-270 to 400) °C (400 to 1 370) °C	0.57 °C 1.3 °C	Dry Well, Fluke 5500A Multiproduct Calibrator w/ Type K Thermocouple Probe
	(-25 to 100) °C (100 to 300) °C (300 to 400) °C	0.046 °C 0.065 °C 0.085 °C	Dry Well, Fluke/Hart 5628 PRT w/ HP 3458A Opt 002 8.5 Digit Multimeter
Thermocouple Wires and Probes[1]	(-25 to 400) °C	0.07 °C	Fluke/Hart 5628 PRT w/ HP 3458A Opt 002 8.5 Digit Multimeter, Reading w/ Fluke 5500A Multiproduct Calibrator
Infrared Thermometers[1]	(-20 to 660) °C	0.31 °C	Comparison to Fluke/Hart 5628 PRT w/ Keithley 2100 Multimeter, Blackbody Source $\varepsilon = 0.96$, $\lambda = (8 \text{ to } 14)$ µm
Infrared Thermometers[1]	(23 to 400) °C	0.6 % of reading + 1.1 °C	Ametek ETC-400R Blackbody Source (cavity) $\varepsilon = 0.96$, $\lambda = (8 \text{ to } 14)$ µm

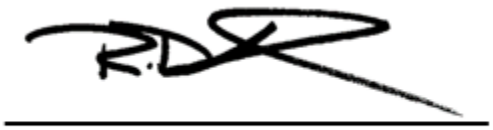
Time and Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Frequency – Source[1]	1 µHz to 50 kHz	5 µHz/Hz	HP 3325B Function Generator
	50 kHz to 600 MHz	2.5 µHz/Hz	Fluke 5500A SC 600 Multiproduct Calibrator
Frequency – Measure[1]	(1 to 40) Hz 40 Hz to 10 kHz 10 kHz to 1 MHz (1 to 20) MHz (20 to 100) MHz	500 µHz/Hz 100 µHz/Hz 3.6 µHz/Hz + 1 Hz 0.4 Hz 2.4 Hz	HP 3458A Opt 002 8.5 Digit Multimeter, HP 5334A Counter
Stopwatches and Timers[1]	Up to 24 h	0.12 s	Time Signal Receiver
Rate of Pull[1] (Tensile Testers)	Up to 24 in/min	0.14 % of reading + 0.013 in/min	Steel Rule, Stopwatch
Rotational Indicating Devices[1]	Up to 30 000 rpm	0.04 % of reading + 0.6 rpm	Comparison to Master Tachometer
Handheld Tachometers[1]	(20 to 300) rpm (300 to 3 000) rpm (3 000 to 30 000) rpm	0.009 % of reading + 0.026 rpm 0.01 % of reading + 0.14 rpm 0.01 % of reading + 1.3 rpm	Comparison to Ametek 1965 Digistrobe

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*" represents Length in inches, "*D*" refers to Diagonal length in inches, "*R*" represents the Resolution of the unit under test, "*T*" represents time in seconds, and "*DL*" represents diagonal length in inches.
3. 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.
4. This scope is formatted as part of a single document including Certificate of Accreditation No. ACT-1201.



R. Douglas Leonard Jr., VP, PILR SBU