CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Productivity Quality, Inc. / Advanced Inspection Services, LLC
15300 25th Ave. N., Suite 100
Plymouth, MN 55447

Fulfills the requirements of

ISO/IEC 17025:2017

In the fields of

DIMENSIONAL MEASUREMENT and **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: 15 January 2026

Certificate Number: ACT-1608

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

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DIMENSIONAL MEASUREMENT & CALIBRATION

Valid to: **January 15, 2026** Certificate Number: **ACT-1608**

DIMENSIONAL MEASUREMENT

1 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) [2]	Reference Standard, Method, and/or Equipment
Dimensional Measurement 1D	Up to 0.008 in Up to 0.03 in Up to 2 in Up to 1 in Up to 3.2 in Up to 12 in Up to 24 in	120 µin 310 µin 120 µin 116 µin 124 µin 514 µin (590 + 0.2L) µin	Measurement using Dial Indicator Dial Indicator Drop Indicator Gage Pins Micrometers Calipers Dial Height Gage
	Up to 6 in	590 µin	Depth Micrometer

2 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) [2]	Reference Standard, Method, and/or Equipment
Dimensional Measurement 2D Single FOV (XY) Step (Z) Extended Range	Small Hole Dia. 2-8µm Up to 0.22 mm Up to 0.44 mm Up to 1.1 mm Up to 2.2 mm Up to 4.4 mm Up to 1 mm Up to 11 in Up to 30 in	0.2 µm (0.1 + 1.2L) µm (0.18 + 0.3L) µm (0.5 + 0.14L) µm (0.86 + 0.25L) µm (1.7 + 0.18L) µm (0.007 + 4.3L) µm (45 + 1.3L) µin (60 + 2.1L) µin	Measurement using Sensofar S-Neox View Summit

3 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) [2]	Reference Standard, Method, and/or Equipment
Dimensional Measurement 3D [1]	8 ft spherical volume Up to 708 in	(500 + 2.7*L*) µin (1 100 + 3.2*L*) µin	Measurement using Romer Absolute CMM Leica Laser Tracker (MR) w / T-probe
Single Point Scanning	Up to 99 in	(78 + 3.6*L*) µin (120 +3.6*L*) µin	Measurement using Hexagon CMM
Aluminums Plastics	Up to 45 mm Up to 45 mm	(5 + 0.4*L*) µm (6 + 0.6*L*) µm	Measurement using EasyTom CT
Dimensional Measurement 3D Single Point Scanning Performance	Up to 67 in Up to 67 in	(12+ 0.73L) µin (38 + 0.42L) µin	Measurement using Leitz Infinity

Dimensional Measurement - Other

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) [2]	Reference Standard, Method, and/or Equipment
Form Roundness	Up to 100 µin (100 to 500) µin	4.8 µin 53 µin	Measurement using Mitutoyo RA2200 AH Roundness Tester
Cylindricity	Up to 100 µin (100 to 500) µin	39 µin 66 µin	
Surface Finish (contact) Surface Finish (non-contact)	Up to 500 µin Up to 500 µin	3.9 µin 1.2 µin	Mitutoyo CV4500 Sensofar S Neox
Contour	Up to 4 in	(112 +24*L*) µin	Mitutoyo Contracer

CALIBRATION

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conductivity Meters	84.2 µS/cm 1 418 µS /cm 10 010 µS /cm 100 300 µS /cm	0.7 µS /cm + 0.6R 6 µS /cm + 0.6R 37 µS /cm + 0.6R 370 µS /cm + 0.6R	Comparison to Conductivity Solutions
pH Meters	4 pH 7 pH 10 pH	0.017 pH + 0.6R 0.014 pH + 0.6R 0.027 pH + 0.6R	Comparison to pH Buffer Solutions
Refractometers	(1.345, 1.464) nD	0.000 55 nD + 0.6R	Comparison to Refractive Index Solutions

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage - Source	Up to 330 mV 330 mV to 3 V (3 to 33) V (30 to 330) V (100 to 1 020) V	0.78 µV + 16 µV/V 1.7 µV + 8.6 µV/V 17 µV + 9.3 µV/V 0.13 mV + 14 µV/V 1.3 mV + 14 µV/V	Comparison to Fluke 5522A
DC Voltage - Measure	Up to 200 mV 200 mV to 2 V (2 to 20) V (20 to 200) V 200 V to 1 kV	0.1 µV + 5 µV/V 0.4 µV + 3.5 µV/V 4 µV + 3.5 µV/V 40 µV + 5.5 µV/V 0.5 mV + 5.5 µV/V	Comparison to Fluke 8508A
	(1 to 60) kV	0.51 mV/V	Comparison to Fluke 8846A and Ross Eng Divider
DC Current - Source	Up to 330 µA 330 µA to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	16 nA + 0.12 mA/A 40 nA + 78 µA/A 0.21 µA + 78 µA/A 2.1 µA + 78 µA/A 32 µA + 0.16 mA/A 32 µA + 0.3 mA/A 0.4 mA + 0.39 mA/A 0.59 mA + 0.78 mA/A	Comparison to Fluke 5522A
	(20.5 to 150) A (150 to 550) A (550 to 1 000) A	0.14 A + 5.1 mA/A 0.5 A + 5.1 mA/A 0.5 A + 5.1 mA/A	Comparison to Fluke 5522A and Fluke 50 Turn Current Coil

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current - Measure	Up to 100 nA (0.1 to 1) µA (1 to 10) µA	0.048 nA + 36 µA/A 0.048 nA + 24 µA/A 0.12 nA + 24 µA/A	Comparison to HP3458A
	(10 to 200) µA 200 µA to 2 mA (2 mA to 20) mA (20 to 200) mA 200 mA to 2 A (2 to 20) A	0.4 nA + 12 µA/A 4 nA + 12 µA/A 40 nA + 14 µA/A 0.8 µA + 48 µA/A 16 µA + 0.19 mA/A 0.4 mA + 0.4 mA/A	Comparison to Fluke 8508A
	(20 to 100) A (100 to 600) A	0.9 mA/A 1.0 mA/A	Comparison to Fluke 8508A with 100A Murata, and 600A Empro Shunts
AC Voltage - Source	(1 to 33) mV (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz (33 to 330) mV (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz 330 mV to 3.3 V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz (3.3 to 33) V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	 4.7 µV + 0.62 mV/V 4.7 µV + 0.12 mV/V 4.7 µV + 0.16 mV/V 4.7 µV + 0.78 mV/V 9.4 µV + 2.8 mV/V 39 µV + 6.2 mV/V 6.3 µV + 0.24 mV/V 6.3 µV + 0.12 mV/V 6.3 µV + 0.13 mV/V 6.3µV + 0.28 mV/V 25 µV + 0.62 mV/V 55 µV + 1.6 mV/V 40 µV + 0.24 mV/V 47 µV + 0.12 mV/V 47 µV + 0.15 mV/V 40 µV + 0.24 mV/V 97 µV + 0.55 mV/V 0.47 mV + 1.9 mV/V 0.51 mV + 0.24 mV/V 0.47 mV + 0.12 mV/V 0.47 mV + 0.19 mV/V 0.47 mV + 0.28 mV/V 1.3 mV + 0.7 mV/V	Comparison to Fluke 5522A

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage - Source	(33 to 330) V 45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (330 to 1 020) V 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	 1.7 mV + 0.15 mV/V 4.7 mV + 0.16 mV/V 4.7 mV + 0.2 mV/V 4.7 mV + 0.24 mV/V 39 mV + 1.6 mV/V 9.7 mV + 0.24 mV/V 9.7 mV + 0.2 mV/V 9.7 mV + 0.24 mV/V	Comparison to Fluke 5522A
AC Voltage – Measure	Up to 10 mV (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (10 to 100) mV (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	 3.6 µV + 0.36 mV/V 1.3 µV + 0.24 mV/V 1.3 µV + 0.36 mV/V 1.3 µV + 1.2 mV/V 1.3 µV + 6 mV/V 2.4 µV + 48 mV/V 4.8 + 83 µV/V 2.4 µV + 83 µV/V 2.4 µV + 0.17 mV/V 2.4 µV + 0.36 mV/V 2.4 µV + 0.95 mV/V 12 µV + 3.6 mV/V 12 µV + 12 mV/V	Comparison to HP3458A
	Up to 200 mV (1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz 200 mV to 2 V (1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	 14 µV + 0.17 mV/V 4 µV + 0.14 mV/V 4 µV + 0.12 mV/V 2 µV + 0.11 mV/V 4 µV + 0.14 mV/V 8 µV + 0.64 mV/V 20 µV + 0.77 mV/V 0.12 mV + 0.15 mV/V 20 µV + 0.12 mV/V 20 µV + 90 µV/V 20 µV + 75 µV/V 20 µV + 0.11 mV/V 40 µV + 0.22 mV/V 0.2 mV + 0.57 mV/V 2 mV + 3 mV/V 20 mV + 10 mV/V	Comparison to Fluke 8508A

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	(2 to 20) V (1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (20 to 200) V (1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (200 to 1 000) V (1 to 10) Hz (10 to 40) Hz 40 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	1.2 mV + 0.15 mV/V 0.2 mV + 0.12 mV/V 0.2 mV + 90 µV/V 0.2 mV + 75 µV/V 0.2 mV + 0.11 mV/V 0.4 mV + 0.22 mV/V 2 mV + 0.57 mV/V 20 mV + 3 mV/V 0.2 V + 10 mV/V 12 mV + 0.15 mV/V 2 mV + 0.12 mV/V 2 mV + 90 µV/V 2 mV + 75 µV/V 2 mV + 0.11 mV/V 4 mV + 0.22 mV/V 20 mV + 0.57 mV/V 0.2 V + 3 mV/V 2 V + 10 mV/V 70 mV + 0.15 mV/V 20 mV + 0.12 mV/V 20 mV + 0.12 mV/V 40 mV + 0.23 mV/V 0.2 V + 0.58 mV/V	Comparison to Fluke 8508A
AC Voltage - Measure	(1 to 60) kV 60 Hz	2.8 mV/V	Comparison to Fluke 8846A and Ross Eng Divider

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current - Source	(29 to 330) µA		Comparison to Fluke 5522A
	(10 to 20) Hz	78 nA + 1.6 mA/A	
	(20 to 45) Hz	78 nA + 1.2 mA/A	
	45 Hz to 1 kHz	78 nA + 0.97 mA/A	
	(1 to 5) kHz	0.12 µA + 2.4 mA/A	
	(5 to 10) kHz	0.16 µA + 6.2 mA/A	
	(10 to 30) kHz	0.31 µA + 13 mA/A	
	330 µA to 3.3 mA		
	(10 to 20) Hz	0.12 µA + 1.6 mA/A	
	(20 to 45) Hz	0.12 µA + 0.97 mA/A	
	45 Hz to 1 kHz	0.12 µA + 0.78 mA/A	
	(1 to 5) kHz	0.16 µA + 1.6 mA/A	
	(5 to 10) kHz	0.24 µA + 3.9 mA/A	
	(10 to 30) kHz	0.47 µA + 7.8 mA/A	
	(3.3 to 33) mA		
	(10 to 20) Hz	1.6 µA + 1.4 mA/A	
	(20 to 45) Hz	1.6 µA + 0.7 mA/A	
	45 Hz to 1 kHz	1.6 µA + 0.31 mA/A	
	(1 to 5) kHz	1.6 µA + 0.62 mA/A	
	(5 to 10) kHz	1.6 µA + 1.6 mA/A	
	(10 to 30) kHz	1.6 µA + 3.1 mA/A	
	(33 to 330) mA		
	(10 to 20) Hz	16 µA + 1.4 mA/A	
	(20 to 45) Hz	16 µA + 0.7 mA/A	
	45 Hz to 1 kHz	16 µA + 0.31 mA/A	
	(1 to 5) kHz	39 µA + 0.78 mA/A	
	(5 to 10) kHz	78 µA + 1.6 mA/A	
	(10 to 30) kHz	0.16 mA + 3.1 mA/A	
	(330 mA to 1.1) A		
	(10 to 45) Hz	78 µA + 1.4 mA/A	
	45 Hz to 1 kHz	78 µA + 0.39 mA/A	
	(1 to 5) kHz	0.78 mA + 4.7 mA/A	
	(5 to 10) kHz	3.9 mA + 20 mA/A	
	(1.1 to 3) A		
	(10 to 45) Hz	78 µA + 1.4 mA/A	
	45 Hz to 1 kHz	78 µA + 0.47 mA/A	
	(1 to 5) kHz	78 µA + 4.7 mA/A	
	(5 to 10) kHz	3.9 mA + 20 mA/A	
	(3 to 11) A		
	(45 to 100) Hz	1.6 mA + 0.47 mA/A	
	100 Hz to 1 kHz	1.6 mA + 0.78 mA/A	
	(1 to 5) kHz	1.6 mA + 24 mA/A	
	(11 to 20.5) A		
	(45 to 100) Hz	3.9 mA + 0.93 mA/A	
	100 Hz to 1 kHz	3.9 mA + 1.2 mA/A	
	(1 to 5) kHz	3.9 mA + 24 mA/A	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current - Source	(20.5 to 150) A (45 to 65) Hz (65 to 440) Hz (150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	 0.25 A + 5.7 mA/A 0.25 A + 11 mA/A 0.9 A + 5.7 mA/A 0.9 A + 11 mA/A	Comparison to Fluke 5522A and Fluke 50 Turn Current Coil
AC Current - Measure	Up to 200 µA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz 200 µA to 2 mA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz (2 to 20) mA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz 20 to 200) mA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz 200 mA to 2 A 10 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (2 to 20) A 10 Hz to 2 kHz (2 to 10) kHz	 20 nA + 0.5 mA/A 20 nA + 0.5 mA/A 20 nA + 0.71 mA/A 20 nA + 4 mA/A 0.2 µA + 0.31 mA/A 0.2 µA + 0.3 mA/A 0.2 µA + 0.71 mA/A 0.2 µA + 4 mA/A 2 µA + 0.31 mA/A 2 µA + 0.3 mA/A 2 µA + 0.71 mA/A 2 µA + 4 mA/A 20 µA + 0.31 mA/A 20 µA + 0.29 mA/A 20 µA + 0.63 mA/A 0.2 mA + 0.62 mA/A 0.2 mA + 0.74 mA/A 0.2 mA + 3 mA/A 2 mA + 0.82 mA/A 2 mA + 2.5 mA/A	Comparison to Fluke 8508A
AC Current - Measure	(20 to 50) A 60 Hz	21 mA/A	Comparison to Fluke 8508A and CTF-5RL
DC Power - Source	33mV to 1 020 V (0.33 to 330) mA 330 mA to 3 A (3 to 20.5) A	0.18 mW/W 0.18 mW/W 0.55 mW/W	Comparison to Fluke 5522A

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power - Source	(33 to 330) mV		Comparison to Fluke 5522A
	(3.3 to 9) mA	1.1 mW/W	
	(9 to 33) mA	0.78 mW/W	
	(33 to 90) mA	1.1 mW/W	
	(90 to 330) mA	0.78 mW/W	
	(330 to 900) mA	1.1 mW/W	
	900 mA to 2.2 A	0.86 mW/W	
	(2.2 to 4.5) A	1.1 mW/W	
	(4.5 to 20.5) A	0.86 mW/W	
	330mV to 1 020 V		
	(3.3 to 9) mA	0.93 mW/W	
	(9 to 33) mA	0.62 mW/W	
	(33 to 90) mA	0.93 mW/W	
	(90 to 330) mA	0.62 mW/W	
	(330 to 900) mA	0.86 mW/W	
	900 mA to 2.2 A	0.7 mW/W	
	(2.2 to 4.5) A	0.93 mW/W	
	(4.5 to 20.5) A	0.78 mW/W	
Resistance - Source	(0 to 11) Ω	0.78 mΩ + 31 µΩ/Ω	Comparison to Fluke 5522A
	(11 to 33) Ω	1.2 mΩ + 24 µΩ/Ω	
	(33 to 110) Ω	1.1 mΩ + 22 µΩ/Ω	
	(110 to 330) Ω	1.6 mΩ + 22 µΩ/Ω	
	330 Ω to 1.1 kΩ	1.7 mΩ + 22 µΩ/Ω	
	(1.1 to 3.3) kΩ	16 mΩ + 22 µΩ/Ω	
	(3.3 to 11) kΩ	17 mΩ + 22 µΩ/Ω	
	(11 to 33) kΩ	0.16 Ω + 22 µΩ/Ω	
	(33 to 110) kΩ	0.17 Ω + 22 µΩ/Ω	
	(110 to 330) kΩ	1.6 Ω + 25 µΩ/Ω	
	330 kΩ to 1.1 MΩ	1.7 Ω + 25 µΩ/Ω	
	(1.1 to 3.3) MΩ	24 Ω + 47 µΩ/Ω	
	(3.3 to 11) MΩ	40 Ω + 0.11 mΩ/Ω	
	(11 to 33) MΩ	2 kΩ + 0.2 mΩ/Ω	
	(33 to 110) MΩ	2.4 kΩ + 0.39 mΩ/Ω	
	(110 to 330) MΩ	78 kΩ + 2.4 mΩ/Ω	
	(330 to 1 100)MΩ	390 kΩ + 12 mΩ/Ω	
Resistance - Measure	Up to 500 mΩ	0.9 mΩ/Ω	Comparison to Fluke 5522A and 8508A
Resistance - Measure	Up to 2 Ω	4 µΩ + 17 µΩ/Ω	Comparison to Fluke 8508A
	(2 to 20) Ω	14 µΩ + 9.5 µΩ/Ω	
	(20 to 200) Ω	50 µΩ + 8 µΩ/Ω	
	(0.2 to 2) kΩ	0.5 mΩ + 8 µΩ/Ω	
	(2 to 20) kΩ	5 mΩ + 8 µΩ/Ω	
	(20 to 200) kΩ	50 mΩ + 8 µΩ/Ω	
	(0.2 to 2) MΩ	5.9 Ω + 9 µΩ/Ω	
	(2 to 20) MΩ	0.12 kΩ + 20 µΩ/Ω	
	(20 to 200) MΩ	10 kΩ + 0.12 mΩ/Ω	
	(0.2 to 2)GΩ	1 MΩ + 1.6 mΩ/Ω	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance - Source	(220 to 400) pF 10 Hz to 10kHz 400 pF to 1.1 nF 10 Hz to 10 kHz (1.1 to 3.3) nF 10 Hz to 3 kHz (3.3 to 11) nF 10 Hz to 1 kHz (11 to 33) nF 10 Hz to 1 kHz (33 to 110) nF 10 Hz to 1 kHz (110 to 330) nF 10 Hz to 1 kHz 330 nF to 1.1 µF (10 to 60)0 Hz (1.1 to 3.3) µF (10 to 300) Hz (3.3 to 11) µF (10 to 150) Hz (11 to 33) µF (10 to 120) Hz (33 to 110) µF (10 to 8)0 Hz (110 to 330) µF (0 to 50) Hz (330 to 1.1) mF (0 to 20) Hz (1.1 to 3.3) mF (0 to 6) Hz (3.3 to 11) mF (0 to 2) Hz (11 to 33) mF (0 to 0.6) Hz (33 to 110) mF (0 to 0.2)Hz	7.8 pF + 3.9 mF/F 7.8 pF + 3.9 mF/F 7.8 pF + 3.9 mF/F 7.8 pF + 2 mF/F 7.8 pF + 2 mF/F 7.8 pF + 2 mF/F 24 pF + 2 mF/F 0.78 nF + 2 mF/F 2.4 nF + 2 mF/F 7.8 nF + 2 mF/F 24 nF + 3.1 mF/F 78 nF + 3.5 mF/F 0.24 µF + 3.5 mF/F 0.78 µF + 3.5 mF/F 2.4 µF + 3.5 mF/F 7.8 µF + 3.5 mF/F 24 µF + 5.9 mF/F 78 µF + 8.6 mF/F	Comparison to Fluke 5522A
Capacitance - Measure	Up to 1 nF (1 to 10) nF (10 to 100) nF 100 nF to 1 µF (1 to 10) µF (10 to 100) µF 100 µF to 1 mF (1 to 10) mF (10 to 100) mF	30 pF + 20 mF/F 62 pF + 10 mF/F 0.62 nF + 10 mF/F 8.5 nF + 10 mF/F 62 nF + 10 mF/F 0.76 µF + 10 mF/F 9.5 µF + 10 mF/F 76 µF + 10 mF/F 1.3 mF + 10 mF/F	Comparison to Fluke 8846A

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple – Source	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 Type J (-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1 200) °C Type K (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1 000) °C (1 000 to 1 372) °C Type L (-200 to -100) °C (-100 to 800) °C (800 to 900) °C	 0.35 °C 0.27 °C 0.24 °C 0.26 °C 0.24 °C 0.21 °C 0.24 °C 0.39 °C 0.66 °C 0.39 °C 0.13 °C 0.11 °C 0.13 °C 0.17 °C 0.21 °C 0.13 °C 0.11 °C 0.14 °C 0.18 °C 0.26 °C 0.14 °C 0.13 °C 0.21 °C 0.31 °C 0.29 °C 0.21 °C 0.14 °C	Comparison to Fluke 5522A

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple – Source	Type N (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1 300) °C Type R (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type S (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C Type U (-200 to 0) °C (0 to 600)°C	 0.31 °C 0.18 °C 0.15 °C 0.14 °C 0.21 °C 0.45 °C 0.28 °C 0.26 °C 0.31 °C 0.37 °C 0.28 °C 0.29 °C 0.36 °C 0.49 °C 0.19 °C 0.13 °C 0.11 °C 0.44 °C 0.21 °C	Comparison to Fluke 5522A
Electrical Simulation of RTDs – Source	Pt 385 100 Ω (-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C Pt 3926 100 Ω (-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C Pt 3916 100 Ω (-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	 0.043 °C 0.057 °C 0.072 °C 0.08 °C 0.095 °C 0.18 °C 0.043 °C 0.057 °C 0.072 °C 0.08 °C 0.095 °C 0.2 °C 0.036 °C 0.043 °C 0.05 °C 0.057 °C 0.065 °C 0.072 °C 0.08 °C 0.18 °C	Comparison to Fluke 5522A

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTDs – Source	Pt 385 200 Ω (-200 to -80) °C (-80 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 600) °C (600 to 630) °C Pt 385 500 Ω (-200 to -80) °C (-80 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C Pt 385 1000 Ω (-200 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 600) °C (600 to 630) °C PtNi 385 120 Ω (-80 to 0) °C (0 to 100) °C (100 to 260) °C Cu 427 10 Ω (-100 to 260) °C	 0.31 °C 0.036 °C 0.043 °C 0.095 °C 0.11 °C 0.13 °C 0.036 °C 0.043 °C 0.05 °C 0.065 °C 0.065 °C 0.072 °C 0.087 °C 0.029 °C 0.036 °C 0.043 °C 0.05 °C 0.057 °C 0.18 °C 0.065 °C 0.065 °C 0.11 °C 0.24 °C	Comparison to Fluke 5522A
Oscilloscope Leveled Sine Wave – Source Amplitude Frequency	5 mV to 5.5 V 50 kHz (Reference) 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz 5 mV to 3.5 V (600 to 1 100) MHz 50 kHz to 600) MHz (600 to 1100) MHz	 0.24 mV + 16 mV/V 0.24 mV + 28 mV/V 0.24 mV + 31 mV/V 0.24 mV + 47 mV/V 0.24 mV + 55 mV/V 5.8 kHz + 2 µHz/Hz 58 kHz + 2 µHz/Hz	Comparison to Fluke 5522A SC1100

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscope Voltage – Source			Comparison to Fluke 5522A SC1100
DC Signal 50 Ω	(1 to 25) mV (25 to 110) mV 110 mV to 2.2 V (2.2 to 6.6) V	31 µV + 2 mV/V 32 µV + 2 mV/V 66 µV + 2 mV/V 0.58 mV + 2 mV/V	
DC Signal 1 MΩ	(1 to 25) mV (25 to 110) mV 110 mV to 2.2 V (2.2 to 11) V (11 to 130) V	31 µV + 0.39 mV/V 32 µV + 0.39 mV/V 66 µV + 0.39 mV/V 0.58 mV + 0.39 mV/V 5.8 mV + 0.39 mV/V	
Square Wave 50 Ω	(1 to 25) mV (25 to 110) mV 110 mV to 2.2 V (2.2 to 6.6) V	31 µV + 2 mV/V 32 µV + 2 mV/V 66 µV + 2 mV/V 0.58 mV + 2 mV/V	
Square Wave 1 MΩ	(1 to 25) mV (25 to 110) mV 110 mV to 2.2 V (2.2 to 11) V (11 to 130) V	31 µV + 0.78 mV/V 32 µV + 0.78 mV/V 66 µV + 0.78 mV/V 0.58 mV + 0.78 mV/V 5.8 mV + 0.78 mV/V	
Square Wave Frequency	(10 to 100) Hz 100 Hz to 1 kHz (1 to 10) kHz	5.8 mHz + 2 µHz/Hz 58 mHz + 2 µHz/Hz 0.58 Hz + 2 µHz/Hz	
Oscilloscope Pulse Generator – Source Pulse Width	(4 to 10) nS (10 to 500) nS	1.8 nS + 39 mS/S 1.9 nS + 39 mS/S	
Pulse Period	200 nS to 1 uS (1 to 10) uS (10 to 100) uS 100 uS to 1 mS (1 to 10) mS (10 to 20) mS	58 pS + 2 uS/S 0.58 nS + 2 uS/S 5.8 nS + 2 uS/S 58 nS + 2 uS/S 0.58 uS + 2 uS/S 5.8 uS + 2 uS/S	
Oscilloscope Wave Generator – Source Amplitude p-p	(1.8 to 100) mV (0.1 to 1) V (1 to 8) V (8 to 55) V	97 µV + 24 mV/V 0.59 mV + 24 mV/V 5.8 mV + 24 mV/V 58 mV + 24 mV/V	
Frequency	10 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz	13 mHz + 20 µHz/Hz 59 mHz + 20 µHz/Hz 5.8 Hz + 20 µHz/Hz	

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) [2]	Reference Standard, Method, and/or Equipment
Micrometers- O.D., Blade, Point, Spline, Tube, Disc, Depth, Indicating, Interchangeable, Bench and Pitch [1]	Up to 48 in Flatness Parallelism	$(42 + 0.44L)$ µin 11 µin 16 µin	Comparison to Gage Blocks w/ Optical Flats, and Parallels
Calipers [1]	Up to 72 in	$(408 + 0.08L)$ µin	Comparison to Gage Blocks
Indicator Gages [1]	Up to 6 in	$(14 + 0.21L)$ µin	Comparison to Gage Blocks
Electronic Indicator Gages/ LVDT [1]	Up to 4 in	$(9 + 0.23L)$ µin	Comparison to Gage Blocks
Height Gages [1]	Up to 48 in	$(31 + 0.53L)$ µin	Comparison to Gage Blocks
Height Masters [1]	Up to 24 in	$(28 + 0.67L)$ µin	Comparison to Gage Blocks
Step Gages	Up to 48 in	$(28 + 0.67L)$ µin	Comparison to Gage Blocks
Length – 1D [1]	Up to 40 in	$(6.6 + 1.2L)$ µin	Measurement using Universal Measuring Machine
Long Gage Blocks	4 to 20 in	$(3.4 + 1.2L)$ µin	Measurement using Universal Measuring Machine
Steel Rule	Up to 72 in	2 880 µin $(66 + 0.5L)$ µin	Comparison to Gage Block Video Measuring Machine
Tapes [1]	Up to 25 ft	$(3\,600 + 0.1L)$ µin $(133 + 0.6L)$ µin	Comparison to Master Tape Video Measuring Machine
Plug Gages [1]	Up to 40 in	$(6.6 + 1.2D)$ µin	Measurement using Universal Measuring Machine
Spherical Diameters [1]	Up to 8 in	$(7.1 + 0.87D)$ µin	Measurement using Universal Measuring Machine
Thread Wires	Up to 0.6 in	$(7.6 + 0.38D)$ µin	Measurement using Universal Measuring Machine

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) [2]	Reference Standard, Method, and/or Equipment
Thread Plug / Set Plugs [1] Major Diameter Pitch Diameter	 Up to 12 in Up to 12 in	 (12 + 0.67*D*) µin (69 + 0.23*D*) µin	Measurement using Universal Measuring Machine w/ Thread Wires
Thread Rings Pitch Diameter	Up to 4 in	(70 + 0.3*D*) µin	Comparison to Thread Setting Plug
Ring Gages / Internal Diameter [1]	(0.012 to 0.5) in (0.5 to 20) in	(5.8 + 0.64*D*) µin (6.1 + 1.07*D*) µin	Measurement using Universal Measuring Machine and Ring Gage Comparator
Feeler (Thickness) Gages	Up to 0.25 in	(7.7 + 0.51*L*) µin	Measurement using Universal Measuring Machine
Gage Blocks	(0.01 to 4) in	(1.4 + 0.77*L*) µin	Comparison to Master Gage Blocks w/ Gage Block Comparator
Optical Comparators [1]	Up to 12 in	(70+ 3.3*L*) µin	Comparison to Glass scales
Machine Tools [1] Linearity Volume	 Up to 3 200 in Up to 24 in	 (2.4 + 1.3*L*) µin 50 µin	Comparison to Laser Interferometer Ball Bar System
Video Measuring Systems [1] X/Y Axes Z Axis PF(V)2D Squareness	 Up to 30 in Up to 6 in Up to 0.2 in Up to 6 in	 35 µin (24 +0.8*L*) µin 25 µin 53 µin	Comparison to Glass grid Z step gage Reticle Z step Gage
Sensofar (Single FOV) XY Z Surface Finish InspecVision 10360-4 (XY)	 2 µm 50 µm 500 µm 100 nm 2 µm, 10 µm Up to 500 µin Table Center Table Edge	 0.031 µm 0.104 µm 0.250 µm 0.005 µm 0.050 µm 1.2 µin 14 µm 17 µm	 Glass Pitch Pattern Step Gage Surface Finish Standard ISO Disk
Horizontal Measuring Machine [1]	(0 to 8) in	(3 + 0.75*L*) µin	Comparison to Gage Blocks

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) [2]	Reference Standard, Method, and/or Equipment
Coordinate Measuring Machines (CMM) [1]			Comparison to
	Up to 26 in	(41 + 0.8*L*) µin	Step Gage
	Up to 24.41 in	14 µin	Step Gage (Koba)
Linear Displacement Accuracy	Up to 3 200 in	(2.4 + 1.3*L*) µin	Laser Interferometer
Volumetric Performance	Up to 36 in	19 µin	Ball Bar
Sphere Repeatability Probing and Scanning Form	(0.75 to 1) in	6.7 µin	Sphere
	1 to 1.18 in	(12 + 0.3*L*) µin	Sphere
Surface Finish Analyzers [1]	120 µin at 0.03 in cut-off	3.8 µin	Comparison to Master Specimens
Surface Finish Specimen	(2 to 300) µin	3.7 µin	Measurement using Surface Finish Analyzer
Surface Finish (RA)	Up to 500 µin	3.9 µin	Measurement using Mitutoyo Surface Roughness Tester
Surface Plates [1,3]			Measurement using
Overall Flatness	(0 to 140) in	(0.27+0.3*d*) µin	Renishaw Laser
Repeat Reading	(0 to 140) in	19 µin	Repeat-O-Meter
Vision (Z)			Measurement using
Two Dimensions	Up to 10 in	(64+ 4.1*L*) µin	
(Vision) (X & Y)	Up to 11 in	(45 + 1.3*L*) µin	View Summit 600
	Up to 25 in	(60 + 2.1*L*) µin	
	Small Hole Dia. 2-8µm	0.2 µm	
Two Dimensions	Up to 0.22 mm	(0.1 + 1.2*L*) µm	
(Vision)(XY – Single FOV)	Up to 0.44 mm	(0.18 + 0.3*L*) µm	
	Up to 1.1 mm	(0.5 + 0.14*L*) µm	Sensofar S-Neox
	Up to 2.2 mm	(0.86 + 0.25*L*) µm	
Step (Z)	Up to 4.4 mm	(1.7 + 0.18*L*) µm	
	Up to 1 mm	(0.005 + 4.3*L*) µm	
Three Dimensions			
Single Point	Up to 67 in	(12 + 0.73*L*) µin	
	Up to 99 in	(78 + 3.6*L*) µin	Leitz Infinity
	Up to 67 in	(38 + 0.42*L*) µin	Hexagon 122210
Scanning	Up to 99 in	(120 + 3.6 *L*) µin	
	Up to 100 µin	4.8 µin	Mitutoyo RA2200 AH
Form	(100 to 500) µin	53 µin	Roundness Tester

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness Testers[1]	HRBw Low Middle High HRC Low Middle High	 0.71 HRBw 0.71 HRBw 0.71 HRBw 0.71 HRC 0.71 HRC 0.71 HRC	Indirect Verification per ASTM E18 using Hardness Test Blocks
Torque	(5 to 50) 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	0.45% of rdg 0.37% of rdg 0.29% of rdg 0.35% of rdg 0.44% of rdg 0.50% of rdg	Comparison to Torque Tester
Pressure Gages Pressure Transducers[1]	(0 to 1) inH2O (0 to 10) inH2O (0 to 10) PSI (0 to 100) PSI (-14.7 to 200) PSI	0.005 3 inH2O 0.011 inH2O 0.023 PSI 0.033 PSI 0.16 PSI	Comparison to Ashcroft ATE-2 / AM2-1
	(0 to 1 000) PSI (0 to 3 000) PSI (0 to 10 000) PSI	0.54 PSI 2.5 PSI 8.8 PSI	Comparison to Fluke 525A / 700 Series

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature - Measure	(-197 to -38) °C (-38 to 0) °C (0 to 157) °C (157 to 232) °C (232 to 420) °C (420 to 660) °C	0.03 °C 0.03 °C 0.044 °C 0.045 °C 0.054 °C 0.071 °C	Comparison to Fluke 5609 with Fluke 914X-P
	(-197 to -38) °C (-38 to 0) °C (0 to 157) °C (157 to 232) °C (232 to 420) °C (420 to 660) °C	0.029 °C 0.029 °C 0.042 °C 0.042 °C 0.046 °C 0.058 °C	Comparison to Fluke 5609 with Fluke 8508A
Temperature - Source	(-25 to -12) °C (-12 to 75) °C (75 to 150) °C	0.069 °C 0.069 °C 0.084 °C	Comparison to Fluke 9142

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature - Source	(50 to 200) °C (200 to 330) °C (330 to 540) °C (540 to 660) °C	0.092 °C 0.22 °C 0.30 °C 0.42 °C	Comparison to Fluke 9144
Infrared Temperature	31 °C 50 °C 100 °C 200 °C	1.4 °C 1.4 °C 1.6 °C 1.8 °C	Comparison to Omega IR Calibrator
Humidity – Source/Measure	(1 to 40) %RH (40 to 90) %RH (90 to 99) %RH	1.6%RH 1.7 %RH 2.3 %RH	Comparison to Vaisala MI70 with MPH77B

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Stop Watches Timers	1s to 24 Hr	36 ms	Measurement using Helmut Klien Timometer
Frequency - Measure	0.1 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 10) MHz (10 to 100) MHz (100 to 225) MHz	0.12 mHz + 9 uHz/Hz 0.12 mHz + 16 uHz/Hz 0.12 mHz + 0.11 mHz/Hz 0.12 mHz + 1.1 mHz/Hz 5.8 mHz + 2.6 mHz/Hz 5.8 mHz + 27 mHz/Hz 10 mHz + 80 mHz/Hz	Comparison to Agilent 53131A

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 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. The use of (L) represents length in inches or millimeters based on unit of measure, the use of (D) represents diameter in inches, the use of (d) represents diagonal in inches
3. The expanded uncertainty for Surface Plate Overall Flatness represents the maximum closure error acceptable for Surface Plate Calibrations.
4. The expanded uncertainties for electrical parameters do not contain a contributor for a "best existing device. Reported uncertainties will reflect the resolution of the device under test.
5. This scope is formatted as part of a single document including Certificate of Accreditation No. ACT-1608.

Jason Stine, Vice President