



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

(with satellite location and capabilities identified on the scope of accreditation)

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.

A handwritten signature in black ink, appearing to be 'J. Stine', is positioned above a horizontal line.

Jason Stine, Vice President

Expiry Date: 15 January 2028

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

Productivity Quality, Inc. / Advanced Inspection Services, LLC

15300 25th Ave, N., Suite 100
Plymouth, MN 55447

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DIMENSIONAL MEASUREMENT & CALIBRATION

ISO/IEC 17025 Accreditation Granted: **23 February 2026**

Certificate Number: **ACT-1608** Certificate Expiry Date: **15 January 2028**

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	Small Hole Dia. 2-8μm	0.2 μm	Measurement using Sensofar S-Neox
Single FOV (XY) Step (Z)	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	(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	
Extended Range	Up to 11 in Up to 30 in	(45 + 1.3L) μin (60 + 2.1L) μin	View Summit

3 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Dimensional Measurement 3D ¹ Single Point Scanning Aluminums Plastics	8 ft spherical volume Up to 708 in	(500 + 2.7L) μin (1 100 + 3.2L) μin	Measurement using Romer Absolute CMM Leica Laser Tracker (MR) w / T- probe
	Up to 99 in	(78 + 3.6L) μin (120 + 3.6L) μin	Measurement using Hexagon CMM
	Up to 45 mm Up to 45 mm	(5 + 0.4L) μm (6 + 0.6L) 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
Cylindricity	Up to 100 μin (100 to 500) μin	39 μin 66 μin	Roundness Tester
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 + 24L) μin	Mitutoyo Contracer

CALIBRATION

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conductivity Meters	84.2 μ S/cm 1 418 μ S/cm 10 010 μ S/cm 100 300 μ S/cm	0.7 μ S/cm + 0.6R 6 μ S/cm + 0.6R 37 μ S/cm + 0.6R 370 μ S/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 μ V + 16 μ V/V 1.7 μ V + 8.6 μ V/V 17 μ V + 9.3 μ V/V 0.13 mV + 14 μ V/V 1.3 mV + 14 μ V/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 μ V + 5 μ V/V 0.4 μ V + 3.5 μ V/V 4 μ V + 3.5 μ V/V 40 μ V + 5.5 μ V/V 0.5 mV + 5.5 μ V/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 μ A 330 μ A 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 μ A/A 0.21 μ A + 78 μ A/A 2.1 μ A + 78 μ A/A 32 μ A + 0.16 mA/A 32 μ A + 0.3 mA/A 0.4 mA + 0.39 mA/A 0.59 mA + 0.78 mA/A	Comparison to Fluke 5522A

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current - Source	(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
DC Current - Measure	Up to 100 nA (0.1 to 1) μ A (1 to 10) μ A	0.048 nA + 36 μ A/A 0.048 nA + 24 μ A/A 0.12 nA + 24 μ A/A	Comparison to HP3458A
	(10 to 200) μ A 200 μ A 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 μ A/A 4 nA + 12 μ A/A 40 nA + 14 μ A/A 0.8 μ A + 48 μ A/A 16 μ A + 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

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage - Source	(1 to 33) mV		Comparison to Fluke 5522A
	(10 to 45) Hz	4.7 μ V + 0.62 mV/V	
	45 Hz to 10 kHz	4.7 μ V + 0.12 mV/V	
	(10 to 20) kHz	4.7 μ V + 0.16 mV/V	
	(20 to 50) kHz	4.7 μ V + 0.78 mV/V	
	(50 to 100) kHz	9.4 μ V + 2.8 mV/V	
	(100 to 500) kHz	39 μ V + 6.2 mV/V	
	(33 to 330) mV		
	(10 to 45) Hz	6.3 μ V + 0.24 mV/V	
	45 Hz to 10 kHz	6.3 μ V + 0.12 mV/V	
	(10 to 20) kHz	6.3 μ V + 0.13 mV/V	
	(20 to 50) kHz	6.3 μ V + 0.28 mV/V	
	(50 to 100) kHz	25 μ V + 0.62 mV/V	
	(100 to 500) kHz	55 μ V + 1.6 mV/V	
	330 mV to 3.3 V		
	(10 to 45) Hz	40 μ V + 0.24 mV/V	
	45 Hz to 10 kHz	47 μ V + 0.12 mV/V	
	(10 to 20) kHz	47 μ V + 0.15 mV/V	
(20 to 50) kHz	40 μ V + 0.24 mV/V		
(50 to 100) kHz	97 μ V + 0.55 mV/V		
(100 to 500) kHz	0.47 mV + 1.9 mV/V		
(3.3 to 33) V			
(10 to 45) Hz	0.51 mV + 0.24 mV/V		
45 Hz to 10 kHz	0.47 mV + 0.12 mV/V		
(10 to 20) kHz	0.47 mV + 0.19 mV/V		
(20 to 50) kHz	0.47 mV + 0.28 mV/V		
(50 to 100) kHz	1.3 mV + 0.7 mV/V		
AC Voltage - Source	(33 to 330) V		Comparison to Fluke 5522A
	45 Hz to 1 kHz	1.7 mV + 0.15 mV/V	
	(1 to 10) kHz	4.7 mV + 0.16 mV/V	
	(10 to 20) kHz	4.7 mV + 0.2 mV/V	
	(20 to 50) kHz	4.7 mV + 0.24 mV/V	
	(50 to 100) kHz	39 mV + 1.6 mV/V	
	(330 to 1 020) V		
	45 Hz to 1 kHz	9.7 mV + 0.24 mV/V	
	(1 to 5) kHz	9.7 mV + 0.2 mV/V	
	(5 to 10) kHz	9.7 mV + 0.24 mV/V	



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
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 μ V + 0.36 mV/V 1.3 μ V + 0.24 mV/V 1.3 μ V + 0.36 mV/V 1.3 μ V + 1.2 mV/V 1.3 μ V + 6 mV/V 2.4 μ V + 48 mV/V 4.8 + 83 μ V/V 2.4 μ V + 83 μ V/V 2.4 μ V + 0.17 mV/V 2.4 μ V + 0.36 mV/V 2.4 μ V + 0.95 mV/V 12 μ V + 3.6 mV/V 12 μ V + 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 μ V + 0.17 mV/V 4 μ V + 0.14 mV/V 4 μ V + 0.12 mV/V 2 μ V + 0.11 mV/V 4 μ V + 0.14 mV/V 8 μ V + 0.64 mV/V 20 μ V + 0.77 mV/V 0.12 mV + 0.15 mV/V 20 μ V + 0.12 mV/V 20 μ V + 90 μ V/V 20 μ V + 75 μ V/V 20 μ V + 0.11 mV/V 40 μ V + 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



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	(2 to 20) V		Comparison to Fluke 8508A
	(1 to 10) Hz	1.2 mV + 0.15 mV/V	
	(10 to 40) Hz	0.2 mV + 0.12 mV/V	
	(40 to 100) Hz	0.2 mV + 90 μV/V	
	100 Hz to 2 kHz	0.2 mV + 75 μV/V	
	(2 to 10) kHz	0.2 mV + 0.11 mV/V	
	(10 to 30) kHz	0.4 mV + 0.22 mV/V	
	(30 to 100) kHz	2 mV + 0.57 mV/V	
	(100 to 300) kHz	20 mV + 3 mV/V	
	300 kHz to 1 MHz	0.2 V + 10 mV/V	
	(20 to 200) V		
	(1 to 10) Hz	12 mV + 0.15 mV/V	
	(10 to 40) Hz	2 mV + 0.12 mV/V	
	(40 to 100) Hz	2 mV + 90 μV/V	
	100 Hz to 2 kHz	2 mV + 75 μV/V	
	(2 to 10) kHz	2 mV + 0.11 mV/V	
	(10 to 30) kHz	4 mV + 0.22 mV/V	
	(30 to 100) kHz	20 mV + 0.57 mV/V	
(100 to 300) kHz	0.2 V + 3 mV/V		
300 kHz to 1 MHz	2 V + 10 mV/V		
(200 to 1 000) V			
(1 to 10) Hz	70 mV + 0.15 mV/V		
(10 to 40) Hz	20 mV + 0.12 mV/V		
40 Hz to 10 kHz	20 mV + 0.12 mV/V		
(10 to 30) kHz	40 mV + 0.23 mV/V		
(30 to 100) kHz	0.2 V + 0.58 mV/V		
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) μ A		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 μ A + 2.4 mA/A	
	(5 to 10) kHz	0.16 μ A + 6.2 mA/A	
	(10 to 30) kHz	0.31 μ A + 13 mA/A	
	330 μ A to 3.3 mA		
	(10 to 20) Hz	0.12 μ A + 1.6 mA/A	
	(20 to 45) Hz	0.12 μ A + 0.97 mA/A	
	45 Hz to 1 kHz	0.12 μ A + 0.78 mA/A	
	(1 to 5) kHz	0.16 μ A + 1.6 mA/A	
	(5 to 10) kHz	0.24 μ A + 3.9 mA/A	
	(10 to 30) kHz	0.47 μ A + 7.8 mA/A	
	(3.3 to 33) mA		
	(10 to 20) Hz	1.6 μ A + 1.4 mA/A	
	(20 to 45) Hz	1.6 μ A + 0.7 mA/A	
	45 Hz to 1 kHz	1.6 μ A + 0.31 mA/A	
	(1 to 5) kHz	1.6 μ A + 0.62 mA/A	
	(5 to 10) kHz	1.6 μ A + 1.6 mA/A	
	(10 to 30) kHz	1.6 μ A + 3.1 mA/A	
	(33 to 330) mA		
	(10 to 20) Hz	16 μ A + 1.4 mA/A	
	(20 to 45) Hz	16 μ A + 0.7 mA/A	
	45 Hz to 1 kHz	16 μ A + 0.31 mA/A	
	(1 to 5) kHz	39 μ A + 0.78 mA/A	
	(5 to 10) kHz	78 μ A + 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 μ A + 1.4 mA/A	
	45 Hz to 1 kHz	78 μ A + 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 μ A + 1.4 mA/A		
45 Hz to 1 kHz	78 μ A + 0.47 mA/A		
(1 to 5) kHz	78 μ A + 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 μ A (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz 200 μ A 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 μ A + 0.31 mA/A 0.2 μ A + 0.3 mA/A 0.2 μ A + 0.71 mA/A 0.2 μ A + 4 mA/A 2 μ A + 0.31 mA/A 2 μ A + 0.3 mA/A 2 μ A + 0.71 mA/A 2 μ A + 4 mA/A 20 μ A + 0.31 mA/A 20 μ A + 0.29 mA/A 20 μ A + 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



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance - Measure	Up to 2 Ω (2 to 20) Ω (20 to 200) Ω (0.2 to 2) kΩ (2 to 20) kΩ (20 to 200) kΩ (0.2 to 2) MΩ (2 to 20) MΩ (20 to 200) MΩ (0.2 to 2)GΩ	4 μΩ + 17 μΩ/Ω 14 μΩ + 9.5 μΩ/Ω 50 μΩ + 8 μΩ/Ω 0.5 mΩ + 8 μΩ/Ω 5 mΩ + 8 μΩ/Ω 50 mΩ + 8 μΩ/Ω 5.9 Ω + 9 μΩ/Ω 0.12 kΩ + 20 μΩ/Ω 10 kΩ + 0.12 mΩ/Ω 1 MΩ + 1.6 mΩ/Ω	Comparison to Fluke 8508A
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



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Electrical – DC/Low Frequency

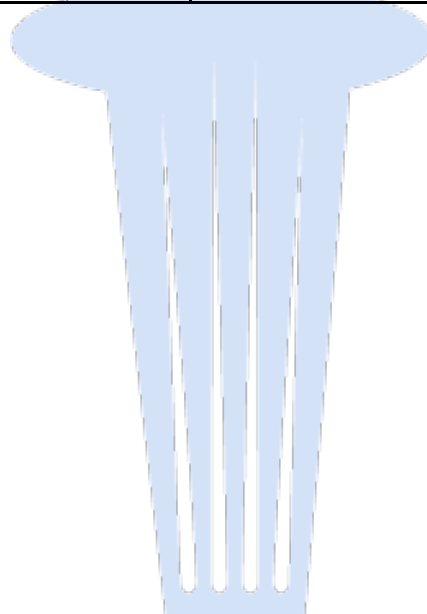
Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance - Measure	Up to 1 nF (1 to 10) nF (10 to 100) nF 100 nF to 1 μF (1 to 10) μF (10 to 100) μF 100 μF to 1 mF (1 to 10) mF (10 to 100) mF	30 pF + 20 mF/F 62 pF + 10 mF/F 0.62 nF + 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 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		Comparison to Fluke 5522A
	(-200 to -100) °C	0.31 °C	
	(-100 to -25) °C	0.18 °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	0.45 °C	
	(250 to 1 000) °C	0.28 °C	
	(1 000 to 1 400) °C	0.26 °C	
	(1 400 to 1 767) °C	0.31 °C	
	Type S		
	(0 to 250) °C	0.37 °C	
	(250 to 1 000) °C	0.28 °C	
	(1 000 to 1 400) °C	0.29 °C	
(1 400 to 1 767) °C	0.36 °C		
Type T			
(-250 to -150) °C	0.49 °C		
(-150 to 0) °C	0.19 °C		
(0 to 120) °C	0.13 °C		
(120 to 400) °C	0.11 °C		
Type U			
(-200 to 0) °C	0.44 °C		
(0 to 600) °C	0.21 °C		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTDs – Source	Pt 385 100 Ω		Comparison to Fluke 5522A
	(-200 to 0) °C	0.043 °C	
	(0 to 100) °C	0.057 °C	
	(100 to 300) °C	0.072 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 630) °C	0.095 °C	
	(630 to 800) °C	0.18 °C	
	Pt 3926 100 Ω		
	(-200 to 0) °C	0.043 °C	
	(0 to 100) °C	0.057 °C	
	(100 to 300) °C	0.072 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 630) °C	0.095 °C	
	Pt 3916 100 Ω		
	(-200 to -190) °C	0.2 °C	
	(-190 to -80) °C	0.036 °C	
	(-80 to 0) °C	0.043 °C	
	(0 to 100) °C	0.05 °C	
(100 to 260) °C	0.057 °C		
(260 to 300) °C	0.065 °C		
(300 to 400) °C	0.072 °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 RTDs – Source	Pt 385 200 Ω		Comparison to Fluke 5522A
	(-200 to -80) °C	0.31 °C	
	(-80 to 100) °C	0.036 °C	
	(100 to 260) °C	0.043 °C	
	(260 to 300) °C	0.095 °C	
	(300 to 600) °C	0.11 °C	
	(600 to 630) °C	0.13 °C	
	Pt 385 500 Ω		
	(-200 to -80) °C	0.036 °C	
	(-80 to 100) °C	0.043 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.065 °C	
	(300 to 400) °C	0.065 °C	
	(400 to 600) °C	0.072 °C	
	(600 to 630) °C	0.087 °C	
	Pt 385 1000 Ω		
(-200 to 0) °C	0.029 °C		
(0 to 100) °C	0.036 °C		
(100 to 260) °C	0.043 °C		
(260 to 300) °C	0.05 °C		
(300 to 600) °C	0.057 °C		
(600 to 630) °C	0.18 °C		
PtNi 385 120 Ω			
(-80 to 0) °C	0.065 °C		
(0 to 100) °C	0.065 °C		
(100 to 260) °C	0.11 °C		
Cu 427 10 Ω			
(-100 to 260) °C	0.24 °C		
Oscilloscope Leveled Sine Wave – Source	Amplitude 5 mV to 5.5 V 50 kHz (Reference) 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	0.24 mV + 16 mV/V	Comparison to Fluke 5522A SC1100
		0.24 mV + 28 mV/V	
		0.24 mV + 31 mV/V	
		0.24 mV + 47 mV/V	
	Frequency 5 mV to 3.5 V (600 to 1 100) MHz	0.24 mV + 55 mV/V	
50 kHz to 600) MHz (600 to 1100) MHz	5.8 kHz + 2 μHz/Hz		
	58 kHz + 2 μHz/Hz		



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Oscilloscope Voltage – Source			
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	Comparison to Fluke 5522A SC1100

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 + 0.67D) μin (69 + 0.23D) μin	Measurement using Universal Measuring Machine w/ Thread Wires
Thread Rings Pitch Diameter	Up to 4 in	(70 + 0.3D) μin	Comparison to Thread Setting Plug
Ring Gages / Internal Diameter ¹	(0.012 to 0.5) in (0.5 to 20) in	(5.8 + 0.64D) μin (6.1 + 1.07D) μin	Measurement using Universal Measuring Machine and Ring Gage Comparator
Feeler (Thickness) Gages	Up to 0.25 in	(7.7 + 0.51L) μin	Measurement using Universal Measuring Machine
Gage Blocks	(0.01 to 4) in	(1.4 + 0.77L) μin	Comparison to Master Gage Blocks w/ Gage Block Comparator
Optical Comparators ¹	Up to 12 in	(70 + 3.3L) μin	Comparison to Glass scales
Machine Tools ¹ Linearity Volume	Up to 3 200 in Up to 24 in	(2.4 + 1.3L) 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 + 0.8L) μin 25 μin 53 μin	Comparison to Glass grid Z step gage Reticle Z step Gage
Sensofar (Single FOV) XY	2 μm 50 μm 500 μm	0.031 μm 0.104 μm 0.250 μm	Glass Pitch Pattern
Z	100 nm 2 μm, 10 μm	0.005 μm 0.050 μm	Step Gage
Surface Finish	Up to 500 μin	1.2 μin	Surface Finish Standard
InspecVision 10360-4 (XY)	Table Center Table Edge	14 μm 17 μm	ISO Disk

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Horizontal Measuring Machine ¹	(0 to 8) in	$(3 + 0.75L) \mu\text{in}$	Comparison to Gage Blocks
Coordinate Measuring Machines (CMM) ¹	Up to 26 in Up to 24.41 in	$(41 + 0.8L) \mu\text{in}$ 14 μin	Comparison to Step Gage Step Gage (Koba)
Linear Displacement Accuracy	Up to 3 200 in	$(2.4 + 1.3L) \mu\text{in}$	Laser Interferometer
Volumetric Performance Sphere Repeatability Probing and Scanning Form	Up to 36 in	19 μin	Ball Bar
	(0.75 to 1) in	6.7 μin	Sphere
	1 to 1.18 in	$(12 + 0.3L) \mu\text{in}$	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} Overall Flatness Repeat Reading	(0 to 140) in (0 to 140) in	$(0.27+0.3d) \mu\text{in}$ 19 μin	Measurement using Renishaw Laser Repeat-O-Meter

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Vision (Z) Two Dimensions (Vision) (X & Y)	Up to 10 in Up to 11 in Up to 25 in	(64+ 4.1L) μin (45 + 1.3L) μin (60 + 2.1L) μin	Measurement using View Summit 600
Two Dimensions (Vision)(XY – Single FOV)	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	0.2 μm (0.1 + 1.2L) μm (0.18 + 0.3L) μm (0.5 + 0.14L) μm (0.86 + 0.25L) μm	Sensofar S-Neox
Step (Z)	Up to 4.4 mm Up to 1 mm	(1.7 + 0.18L) μm (0.005 + 4.3L) μm	
Three Dimensions Single Point	Up to 67 in Up to 99 in Up to 67 in Up to 99 in	(12 + 0.73L) μin (78 + 3.6L) μin (38 + 0.42L) μin (120 + 3.6 L) μin	Leitz Infinity Hexagon 122210
Scanning			
Form	Up to 100 μin (100 to 500) μin	4.8 μin 53 μin	Mitutoyo RA2200 AH 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	0.71 HRBw	Indirect Verification per ASTM E18 using Hardness Test Blocks
	Middle	0.71 HRBw	
	High	0.71 HRBw	
	HRC		
	Low	0.71 HRC	
Middle	0.71 HRC		
High	0.71 HRC		

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque	(5 to 50) ozf·in	0.45% of rdg	Comparison to Torque Tester
	(4 to 50) lbf·in	0.37% of rdg	
	(30 to 400) lbf·in	0.29% of rdg	
	(80 to 1 000) lbf·in	0.35% of rdg	
	(20 to 250) lbf·ft	0.44% of rdg	
Pressure Gages Pressure Transducers ¹	(60 to 600) lbf·ft	0.50% of rdg	Comparison to Ashcroft ATE-2 / AM2-1
	(0 to 1) inH ₂ O	0.005 3 inH ₂ O	
	(0 to 10) inH ₂ O	0.011 inH ₂ O	
	(0 to 10) PSI	0.023 PSI	
	(0 to 100) PSI	0.033 PSI	
	(-14.7 to 200) PSI	0.16 PSI	
	(0 to 1 000) PSI	0.54 PSI	Comparison to Fluke 525A / 700 Series
	(0 to 3 000) PSI	2.5 PSI	
	(0 to 10 000) PSI	8.8 PSI	

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
Temperature - Measure	(-197 to -38) °C	0.03 °C	Comparison to Fluke 5609 with Fluke 914X-P	
	(-38 to 0) °C	0.03 °C		
	(0 to 157) °C	0.044 °C		
	(157 to 232) °C	0.045 °C		
	(232 to 420) °C	0.054 °C		
		(420 to 660) °C	0.071 °C	Comparison to Fluke 5609 with Fluke 8508A
		(-197 to -38) °C	0.029 °C	
		(-38 to 0) °C	0.029 °C	
		(0 to 157) °C	0.042 °C	
		(157 to 232) °C	0.042 °C	
Temperature - Source	(232 to 420) °C	0.046 °C	Comparison to Fluke 9142	
	(420 to 660) °C	0.058 °C		
	(-25 to -12) °C	0.069 °C		
Temperature - Source	(-12 to 75) °C	0.069 °C	Comparison to Fluke 9144	
	(75 to 150) °C	0.084 °C		
	(50 to 200) °C	0.092 °C		
	(200 to 330) °C	0.22 °C		
Temperature - Source	(330 to 540) °C	0.30 °C		
	(540 to 660) °C	0.42 °C		

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
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

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DIMENSIONAL MEASUREMENT

1 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Dimensional Measurement 1D	Up to 24 in Up to 12 in Up to 3.2 in Up to 0.008 in Up to 0.03 in Up to 2 in Up to 1 in	(590 + 0.2L) μin 514 μin 124 μin 120 μin 310 μin 120 μin 116 μin	Dial Height Gage Calipers Micrometers Dial Indicator Dial Indicator Drop Indicator Gage Pins
	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	Small Hole Dia. 2 to 8 μm	0.2 μm	Microscope
Single FOV (XY)	Up to 0.22 mm	(0.1 + 1.2L) μm	
	Up to 0.44 mm	(0.18 + 0.3L) μm	
	Up to 1.1 mm	(0.5 + 0.14L) μm	
	Up to 2.2 mm	(0.86 + 0.25L) μm	
Step (Z)	Up to 4.4 mm	(1.7 + 0.18L) μm	
	Up to 1 mm	(0.007 + 4.3L) μm	
X, Y Z	Up to 16.5 in	(70 + 5.8L) μin	VCMM
	Up to 6 in	(160 + 3.5L) μin	

3 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Dimensional Measurement 3D ¹ Single Point Scanning	Up to 50 in	(78 + 3.6L) μin (120 + 3.6L) μin	CMM

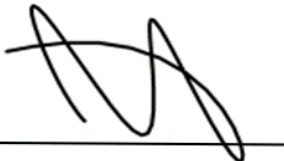
Dimensional Measurement - Other

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Surface Finish (non-contact)	Up to 500 μin	1.2 μin	Microscope

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.



Jason Stine, Vice President