



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

CalTek Electronics Joint Stock Co.
03rd Floor Ha Nam Plaza, West Quarter, Vinh Phu Ward
Thuan An Town, Binh Duong Province, Vietnam
(and satellite location as shown on the scope)

Fulfills the requirements of

ISO/IEC 17025:2017

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: 23 June 2023

Certificate Number: AC-2478



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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CALIBRATION

Valid to: **June 23, 2023**

Certificate Number: **AC-2478**

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Level Meter ¹	1 kHz		Soundtek ST-120 Sound Level Calibrator
	94 dB 114 dB	0.46 dB 0.72 dB	
Vibration ¹	Acceleration	9.8 m/s ² , 159 Hz	PCB Calibration Exciter
	Velocity	9.8 mm/s, 159 Hz	
	Displacement	9.9 μm	

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Measure ⁵	4 pH	0.018 pH	pH solutions
	7 pH	0.021 pH	
	10 pH	0.021 pH	
Conductivity Measure ⁵	5 μS/cm	0.19 μS/cm	Conductivity Solutions
	84 μS/cm	1.4 μS/cm	
	1413 μS/cm	24 μS/cm	
	12.88 mS/cm	0.24 mS/cm	
	111.8 mS/cm	1.9 mS/cm	
Refractometers	(0 to ~53) %Brix	0.26 %Brix	Comparison to Reference Refractometer, Sucrose Solutions

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Salinity Refractometer	(0 to ~10) %Salinity	4.6 % of reading + 0.12 %Salinity	Comparison to Reference Salinity Meter, Salinity Solutions
Viscosity Meter ⁵	(500 to 5000) cP	0.8 % of reading + 58 cP	Comparison to Reference Viscosity Meter, Viscosity Solutions
Gas Detectors ⁵			
H ₂ S	0.002 5 % Concentration	0.000 21 % Concentration	Standard Gases
CO	0.01 % Concentration	0.000 36 % Concentration	
CH ₄	50 % Concentration LEL	1.7 % Concentration LEL	
O ₂	18 % Concentration of N ₂	0.65 % Concentration of N ₂	
Gas Detectors – TVOC ⁵			
I-C ₄ H ₈	0.001 % Concentration 0.01 % Concentration	0.000 093 % Concentration 0.000 74 % Concentration	Standard Gases, Reference RAE Mini RAE3000
Alcohol Meter ⁵	(0 to 100) %Volume	0.71 %Volume	Comparison to Reference Alcohol Meter, Alcohol Solutions

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure ¹	Up to 100 mV 100 mV to 1 V (1 to 10) V (1V to 100) V (100 to 1 000) V	17 μV/V + 3.3 μV 9.2 μV/V + 0.24 μV 8.9 μV/V + 6.6 μV 11 μV/V + 1.4 μV 14 μV/V + 99 μV	Agilent 3458A Opt 002 8.5 Digit Multimeter
DC Current – Measure ¹	Up to 100 μA 100 μA to 1 mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	0.2 nA/A + 0.35 μA 0.1 mA/A + 2.9 nA 0.1 mA/A + 28 nA 0.1 mA/A + 0.33 μA 0.1 mA/A + 0.33 μA	Agilent 3458A Opt 002 8.5 Digit Multimeter
DC Current – Measure ¹	(1 to 3) A (3 to 100) A (3 to 100) A	1.3 mA/A + 0.71 mA 11 mA/A + 90 mA 16 mA/A + 0.11 A	Agilent 34401A 6.5 Digit Multimeter, Current Shunt
	(100 to 400) A	16 mA/A + 0.11 A	Kyoritsu Kewsnap 2009R Clamp Meter



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source ¹	Up to 329.999 9 mV (0.33 to 3.299 999) V (3.3 to 32.999 99) V (33 to 329.999 9) V (330 to 1 020) V	70 nV/mV + 3.6 μV 59 nV/V + 66 μV 59 nV/V + 61 μV 65 μV/V + 0.59 mV 64 μV/V + 2.1 mV	Fluke 5502A Multiproduct Calibrator
DC Current – Source ¹	Up to 329.999 μA (0.33 to 3.299 99) mA (3.3 to 32.999 9) mA (33 to 329.999) mA (0.33 to 1.099 99) mA (1.1 to 2.999 99) A (3 to 10.999 9) A (11 to 20.5) A	0.17 nA/μA + 24 nA 0.12 μA/mA + 79 nA 0.12 μA/mA + 0.54 μA 0.14 μA/mA + 5.5 μA 0.45 mA/A + 82 μA 0.43 μA/A + 0.1 mA 0.69 mA/A + 0.89 mA 1.2 mA/A + 1.2 mA	Fluke 5502A Multiproduct Calibrator
DC Current Clamp-on Meters ¹	(20.5 to 1 000) A	16 mA/A + 0.95 A	Fluke 5502A Multiproduct Calibrator, Current Coil
AC Voltage – Measure ¹	Up to 100 mV 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (0.1 to 1) V 40 to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.21 μV/mV + 1.6 μV 0.25 μV/mV + 1.9 μV 0.46 μV/mV + 2 μV 1.4 μV/mV + 1.6 μV 0.13 mV/V + 21 μV 0.18 mV/V + 22 μV 0.36 mV/V + 23 μV 0.97 mV/V + 22 μV	Agilent 3458A Opt 002 8.5 Digit Multimeter
AC Voltage – Measure ¹	(1 to 10) V (0.04 to 1) kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (10 to 100) V (0.04 to 1) kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 750) V 50 Hz to 1 kHz	0.13 mV/V + 0.21 mV 0.19 mV/V + 0.22 mV 0.36 mV/V + 0.23 mV 0.97 mV/V + 0.22 mV 0.25 mV/V + 2.2 mV 0.25 mV/V + 2.2 mV 0.5 mV/V + 2 mV 1.4 mV/V + 2.3 mV 0.47 mV/V + 17 mV	Agilent 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	(1 to 32.999) 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	1.7 μ V/mV + 23 μ V 1.2 μ V/mV + 23 μ V 1.7 μ V/mV + 23 μ V 2.3 μ V/mV + 23 μ V 4 μ V/mV + 38 μ V 11 μ V/mV + 71 μ V	Fluke 5502A Multiproduct Calibrator
	(33 to 329.999) 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 (0.33 to 3.299 99) 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 32.999 9) V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.58 μ V/mV + 23 μ V 0.36 μ V/mV + 19 μ V 0.81 μ V/mV + 23 μ V 1.2 μ V/mV + 47 μ V 2.6 μ V/mV + 0.2 mV 5.8 μ V/mV + 0.39 mV 0.58 mV/V + 71 μ V 0.35 mV/V + 72 μ V 0.81 mV/V + 0.69 mV 1.2 mV/V + 0.7 mV 2.7 mV/V + 0.24 mV 5.8 mV/V + 1.2 mV 0.58 mV/V + 0.94 mV 0.35 mV/V + 0.72 mV 0.81 mV/V + 0.8 mV 1.2 mV/V + 0.84 mV 2.7 mV/V + 2.4 mV	
AC Voltage – Source ¹	(33 to 329.999) V (10 to 45) Hz 45 Hz 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	0.58 mV/V + 3.7 mV 0.92 mV/V + 11 mV 1 mV/V + 12 mV 1.4 mV/V + 14 mV 2.7 mV/V + 0.11 V 0.58 mV/V + 23 mV 0.92 mV/V + 25 mV 1 mV/V + 26 mV	Fluke 5502A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(29 to 329.99) μ A (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (0.33 to 3.299 99) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (3.3 to 32.99 99) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	2.3 nA/ μ A + 0.12 μ A 1.7 nA/ μ A + 0.12 μ A 1.4 nA/ μ A + 0.12 μ A 2.3 nA/ μ A + 0.21 μ A 9.3 nA/ μ A + 0.23 μ A 7.7 nA/ μ A + 0.77 μ A 2.3 μ A/mA + 0.21 μ A 1.4 μ A/mA + 0.2 μ A 1.1 μ A/mA + 0.2 μ A 2.3 μ A/mA + 0.26 μ A 5.8 μ A/mA + 0.37 μ A 11 μ A/mA + 0.75 μ A 2.9 μ A/mA + 3.4 μ A 0.69 μ A/mA + 20 μ A 0.81 μ A/mA + 1.6 μ A 0.92 μ A/mA + 2.7 μ A 2.3 μ A/mA + 3.6 μ A 4.6 μ A/mA + 4.8 μ A	Fluke 5502A Multiproduct Calibrator
AC Current – Source ¹	(33 to 329.999) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	2 μ A/mA + 35 μ A 1 μ A/mA + 30 μ A 0.46 μ A/mA + 25 μ A 1.2 μ A/mA + 59 μ A 2.3 μ A/mA + 0.12 mA 4.6 μ A/mA + 0.23 mA	Fluke 5502A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(0.33 to 1.099 99) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	2.1 mA/A + 0.12 mA 0.46 mA/A + 30 μA 6.9 mA/A + 1.2 mA 28 mA/A + 5.8 mA	Fluke 5502A Multiproduct Calibrator
	(1 to 2.999 99) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	2 mA/A + 0.13 mA 0.69 mA/A + 0.16 mA 7 mA/A + 1.2 mA 28 mA/A + 5.9 mA	
	(3 to 10.999 9) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	0.69 mA/A + 2.4 mA 1.2 mA/A + 2.4 mA 34 mA/A + 2.4 mA	
	(11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	1.4 mA/A + 5.8 mA 1.4 mA/A + 5.9 mA 34.6 mA/A + 5.8 mA	
AC Current Clamp-on Meters ¹	(20.5 to 1 000) A 50 Hz	9.1 mA/A + 0.49 A	Fluke 5502A Multiproduct Calibrator, Current Coil
AC Current – Measure ¹	Up to 100 μA (45 to 100) Hz 100 Hz to 5 kHz	0.82 nA/μA + 34 nA 0.82 nA/μA + 34 nA	Agilent 3458A Opt 002 8.5 Digit Multimeter
	(0.1 to 1) mA (45 to 100) Hz 100 Hz to 5 kHz	0.88 μA/mA + 0.22 μA 0.88 μA/mA + 0.22 μA	
	(1 to 10) mA (45 to 100) Hz 100 Hz to 5 kHz	0.88 μA/mA + 2.2 μA 0.4 μA/mA + 2.2 μA	
	(10 to 100) mA (45 to 100) Hz 100 Hz to 5 kHz	0.83 μA/mA + 22 μA 0.55 μA/mA + 22 μA	
AC Current – Measure ¹	(0.1 to 1) A (45 to 100) Hz 100 Hz to 5 kHz	1.1 mA/A + 0.22 mA 1.3 mA/A + 0.22 mA	Agilent 3458A Opt 002 8.5 Digit Multimeter
	(1 to 3) A (1 to 50) Hz 50 Hz to 1 kHz	1.9 mA/A + 2 mA 1.9 mA/A + 2 mA	Agilent 34401A 6.5 Digit Multimeter
	(3 to 400) A 50 Hz	15.3 mA/A + 0.59 A	Kyoritsu Kewsnap 2009R Current Clamp Meter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes ¹ Amplitude – DC Signal into 50 Ω Load into 1 MΩ Load	Up to 2.2 V Up to 33 V	3.7 mV/V + 4.8 mV 2.6 mV/V + 10 mV	Fluke 5520A/SC300 Multiproduct Calibrator with 300 MHz Scope Option
Amplitude – Square Wave into 50 Ω Load into 1 MΩ Load	1.8 mVp-p to 2.2 Vp-p 10 Hz to 10 kHz 1.8 mVp-p to 105 Vp-p 10 Hz to 10 kHz	1.7 mV/V + 3.9 mV 1.9 mV + 2.8 mV/V + 1.9 mV	
Amplitude – Leveled Sine Wave into 50 Ω Load	5 mV to 5.5 V 50 kHz 50 kHz to 100 MHz (100 to 300) MHz	25 mV/V + 5.7 mV 45 mV/V + 3.8 mV 51 mV/V + 5 mV	
Time Marker	2 μs to 5 s 2 ns to 1 μs	0.85 ms + 6.3 ms/s 1.2 ns	
Wave Generator (Square, Sine, Triangle Wave) into 50 Ω Load	1.8 mVp-p to 2.2 Vp-p 10 Hz to 100 kHz	39 mV/V + 0.38 mV	
into 1 MΩ Load	1.8 mVp-p to 55 Vp-p 10 Hz to 100 kHz	39 mV/V + 1.7 mV	
DC Resistance – Source ¹ (Variable Artifact) (LCR Meters)	(10 to 100) mΩ (0.1 to 1) Ω (1 to 10) Ω (10 to 100) Ω (100 to 1 000) Ω (1 to 10) kΩ (10 to 40) kΩ	0.15 mΩ/Ω + 1.8 mΩ 0.11 mΩ/Ω + 1.8 mΩ 0.11 mΩ/Ω + 4.2 mΩ 47 μΩ/Ω + 26 nΩ 0.11 mΩ/Ω + 60 mΩ 86 mΩ/kΩ + 1 Ω 60 mΩ/kΩ + 5.8 Ω	General Radio 1433-M Decade Resistor
Capacitance – Source ¹ (Variable Artifact) (LCR Meters – 1 kHz)	(10 to 100) pF (100 to 1 000) pF (1 to 10) nF (10 to 100) nF (0.1 to 1) μF	55 fF/pF + 5.8 pF 5.7 fF/pF + 5.9 pF 5.6 fF/pF + 8.2 pF 5.8 nF/μF + 5.8 nF 5.8 nF/μF + 5.8 nF	General Radio 1412-BC Decade Capacitor

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Source ¹ (Variable Artifact) (LCR Meters - 1 kHz)	(1 to 10) mH (10 to 100) mH (0.1 to 1) H (1 to 10) H	9.3 μH/mH + 0.1 μH 9.3 μH/mH + 1.6 μH 9.3 μH/mH + 8.6 μH 9.3 μH/H + 80 μH	General Radio 1490-D Decade Inductor
Hipot Testers, Spark Testers, Surge Testers, Impulse Winding Testers ¹ AC Cut-off Current	50/60 Hz (29 to 500) μA (500 to 5 000) μA (5 to 50) mA (50 to 100) mA	7 nA/μA + 0.28 μA 7 nA/μA + 0.62 μA 7 μA/mA + 23 μA 7 μA/mA + 62 μA	Resistance Box, Fluke 287 Digital Multimeter
DC Cut-off Current	Up to 500 μA (500 to 5 000) μA (5 to 50) mA (50 to 100) mA	0.91 nA/μA + 0.23 μA 0.82 nA/μA + 0.76 μA 0.6 μA/mA + 13 μA 1.6 μA/mA + 43 μA	
AC High Voltage	50 Hz Up to 25 kV	57 V/kV + 21 V	Fluke 287 DMM, High Voltage Probe
Ground Bond Tester ¹	Up to 500 mΩ	10 mΩ	General Resistance RDS41-A Decade Resistor
Withstanding/Insulation Testers ¹ DC Voltage	Up to 2 kV (2 to 10) kV (10 to 35) kV	23 V 0.12 kV 6.8 V/kV + 0.17 kV	Time Electronics 5069 Insulation Tester Calibrator, Fluke 287 DMM, High Voltage Probe
DC Current	Up to 2 mA (2 to 20) mA	24 μA 0.23 mA	
Resistance	(0.1 to 5) MΩ (10 to 100) MΩ (10 to 1 000) MΩ (1 to 10) GΩ (10 to 100) GΩ	8.4 kΩ/MΩ + 19 kΩ 12 kΩ/MΩ + 1.1 kΩ 12 kΩ/MΩ + 9.1 kΩ 15 MΩ/GΩ + 1.7 MΩ 58 MΩ/GΩ + 12 MΩ	
Resistance – Source ¹ (Simulated)	Up to 10.999 Ω (11 to 32.999) Ω (33 to 109.999) Ω (110 to 329.999) Ω (0.33 to 1.099 99) kΩ (1.1 to 3.299 99) kΩ	0.11 mΩ/Ω + 1.9 mΩ 0.13 mΩ/Ω + 2 mΩ 0.1 mΩ/Ω + 1.8 mΩ 0.1 mΩ/Ω + 2.4 mΩ 0.1 Ω/kΩ + 25 mΩ 0.1 Ω/kΩ + 24 mΩ	Fluke 5502A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source ¹ (Simulated)	(3.3 to 11) kΩ (11 to 32.999 9) kΩ (33 to 109.999) kΩ (110 to 329.999) kΩ 330 kΩ to 1.099 99 MΩ (1.1 to 3.299 99) MΩ (3.3 to 10.999 9) MΩ (11 to 32.999 9) MΩ (33 to 109.999) MΩ (110 to 329.999) MΩ (330 to 1 100) MΩ	0.1 Ω/kΩ + 74 mΩ 0.1 Ω/kΩ + 0.24 Ω 0.13 Ω/kΩ + 0.44 Ω 0.14 Ω/kΩ + 2.4 Ω 0.17 kΩ/MΩ + 5.5 Ω 0.17 kΩ/MΩ + 35 Ω 0.69 kΩ/MΩ + 61 Ω 1.2 kΩ/MΩ + 2.9 kΩ 5.8 kΩ/MΩ + 3.4 kΩ 5.8 kΩ/MΩ + 0.12 MΩ 17 kΩ/MΩ + 0.57 MΩ	Fluke 5502A Multiproduct Calibrator
Resistance – 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	54 μΩ/Ω + 97 μΩ 14 μΩ/Ω + 0.64 mΩ 14 mΩ/kΩ + 0.87 mΩ 13 mΩ/kΩ + 10 mΩ 11 mΩ/kΩ + 0.26 Ω 34 Ω/MΩ + 2.8 Ω 70 Ω/MΩ + 100 Ω 0.59 kΩ/MΩ + 1.1 kΩ	Agilent 3458A Opt 002 8.5 Digit Multimeter
Capacitance (Simulated) ¹ 10 Hz to 10 kHz 10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 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 (10 to 50) Hz (10 to 20) Hz DC to 6 Hz DC to 2 Hz DC to 0.6 Hz DC to 0.2 Hz	(220 to 399.9) pF 400 pF to 1.099 9 nF (1.1 to 3.299 9) nF (3.3 to 10.999) nF (11 to 32.999) nF (33 to 109.99) nF (110 to 329.99) nF (0.33 to 1.099 9) μF (1.1 to 3.299 9) μF (3.3 to 10.999) μF (11 to 32.999) μF (33 to 109.99) μF (110 to 329.99) μF 330 μF to 1.099 9 mF (1.1 to 3.299 9) mF (3.3 to 10.999) mF (11 to 32.999) mF (33 to 110) mF	5.8 fF/pF + 12 pF 5.7 pF/nF + 12 pF 5.8 pF/nF + 12 pF 2.9 pF/nF + 12 pF 2.9 pF/nF + 12 pF 2.9 pF/nF + 0.12 nF 3 pF/nF + 0.35 nF 3 nF/μF + 1.1 nF 3 nF/μF + 3.4 nF 3 nF/μF + 11 nF 4.7 nF/μF + 35 nF 5.4 nF/μF + 0.11 μF 5.2 nF/μF + 0.36 μF 5.2 μF/mF + 1.2 μF 5.2 μF/mF + 3.5 μF 5.2 μF/mF + 12 μF 8.4 μF/mF + 41 μF 13 μF/mF + 0.12 mF	Fluke 5502A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure ¹	Type B		Fluke 5502A Multiproduct Calibrator
	(600 to 800) °C	0.59 °C	
	(800 to 1 000) °C	0.48 °C	
	(1 000 to 1 550) °C	0.44 °C	
	(1 550 to 1 820) °C	0.47 °C	
	Type E		
	(-250 to -100) °C	0.8 °C	
	(-100 to -25) °C	0.46 °C	
	(-25 to 350) °C	0.48 °C	
	(350 to 650) °C	0.57 °C	
	(650 to 1000) °C	0.5 °C	
	Type J		
	(-210 to -100) °C	0.43 °C	
	(-100 to -30) °C	0.32 °C	
	(-30 to 150) °C	0.34 °C	
	(150 to 760) °C	0.36 °C	
	(760 to 1200) °C	0.39 °C	
	Type K		
	(-200 to -100) °C	0.48 °C	
	(-100 to -25) °C	0.34 °C	
	(-25 to 120) °C	0.29 °C	
(120 to 1000) °C	0.4 °C		
(1000 to 1372) °C	0.53 °C		
Type R			
(0 to 250) °C	0.72 °C		
(250 to 400) °C	0.56 °C		
(400 to 1 000) °C	0.47 °C		
(1 000 to 1 767) °C	0.6 °C		
Type T			
(-250 to -150) °C	0.82 °C		
(-150 to 0) °C	0.4 °C		
(0 to 120) °C	0.3 °C		
(120 to 400) °C	0.32 °C		

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Source ¹ 100 kHz to 50 MHz	(-70 to 0) dBm (0 to 13) dBm	1.3 dB 1.3 dB	Hewlett Packard 8648C Signal Generator
50 MHz to 2.5 GHz	(-70 to -25.9) dBm (-25.9 to 0) dBm (0 to 13) dBm	1.3 dB 1.2 dB 1.2 dB	
(2.5 to 3.2) GHz	(-70 to -25.9) dBm (-25.9 to 0) dBm (0 to 13) dBm	1.8 dB 1.8 dB 1.8 dB	
RF Power – Measure ¹ 10 MHz to 18 GHz	(-70 to 20) dBm	1.3 dB	Agilent E4418B Power Meter, HP 9300A Power Meter

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gauge Blocks	(0.01 to 100) mm (100 to 250) mm	2.5 nm/mm + 0.2 μm 11 nm/mm + 0.12 μm	LMM 600 Universal Length Measuring Machine, Grade 0 Gauge Blocks
Calipers ¹	Up to 600 mm	7.8 nm/mm + 5.7 μm	Gauge Blocks
Micrometers ¹	Up to 25.4 mm (25.4 to 300) mm	6 nm/mm + 0.2 μm 15.8 nm/mm + 0.8 μm	Optical Flat, Gauge Blocks
Height Gauges ¹	Up to 600 mm	13.1 nm/mm + 0.12 μm	Gauge Blocks
Depth Gauges ¹	Up to 500 mm	26.5 nm/mm + 5.5 μm	Gauge Blocks
Cylindrical Ring Gauges	(3 to 100) mm	2.6 nm/mm + 5.3 μm	LMM 600 Universal Length Measuring Machine
Bore Gauges	Up to 100 mm	11 nm/mm + 0.45 μm	LMM 600 Universal Length Measuring Machine
Thickness Gauges – Measure Mode ¹	Up to 100 mm	5.8 nm/mm + 1.2 μm	Gauge Blocks

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Ring Gauges	(3 to 100) mm	25.6 nm/mm + 5.3 μm	LMM 600 Universal Length Measuring Machine
Thread Plug Gauges	(1 to 100) mm	5 nm/mm + 2 μm	LMM 600 Universal Length Measuring Machine
Coordinate Measuring Machines ¹ (CMM)	X-axis: Up to 600 mm Y-axis: Up to 600 mm Z-axis: Up to 500 mm	15 nm/mm + 0.42 μm 15 nm/mm + 0.34 μm 15 nm/mm + 0.6 μm	Grade 0 Gauge Blocks, Grade 0 Long Gauge Blocks
Measuring Microscopes, Vision Systems ¹	X-Y Axis: Up to 300 mm	12 nm/mm + 0.94 μm	Grade 0 Gauge Blocks, Grade 0 Long Gauge Blocks
Profile Projectors ¹	X-Y Axis: Up to 300 mm	13 nm/mm + 0.68 μm	Grade 0 Gauge Blocks, Grade 0 Long Gauge Blocks
Contour Measuring Machine	X-axis: Up to 100 mm Z-axis: Up to 25.4 mm	11 nm/mm + 1.4 μm 2 μm	Gauge Block Set, Master Ball
Laser Micrometers	Up to 10 mm	90 nm/mm + 4.5 μm	Pin Gauge Set
Coating Thickness Meters ¹	(25 to 1 500) μm	2.9 μm	Coating Thickness Standards
Thickness Gauges, Feeler Gauges, Thickness Films	Up to 5 mm	1.4 nm/mm + 0.58 μm	LMM 600 Universal Length Measuring Machine
Dial Indicators, Dial Indicators ¹	Up to 100 mm	9.5 nm/mm + 1.1 μm	Gauge Blocks
Dial Test Indicators ¹	Up to 1 mm	0.55 μm	LMM 600 Universal Length Measuring Machine
Surface Roughness Testers ^{1,5} (Ra Mode)	16.1 μin 119.5 μin	6.1 μin 6.1 μin	GAR Precision Reference Standard
Measuring Tapes, Rulers	Up to 2 000 mm	0.1 mm/mm + 0.29 mm	Gauge Blocks
Levels	Up to 30°	0.042°	Comparison to INSIZE ISE-2DT Digital Level
Cylindrical Plug Gauges, Pin Gauges	Up to 100 mm	9.9 nm/mm + 0.5 μm	LMM 600 Universal Length Measuring Machine
Holtest/Borematic	(8 to 70) mm	0.11 μm/mm + 4.6 μm	Setting Ring Set
Sieves	(0 to 5) mm (5 to 125) mm	5.5 nm/mm + 4.7 μm 0.11 μm/mm + 32 μm	Microscope Digital Caliper



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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Surface Plates ¹ Local Area Flatness Only (Repeat Readings)	(12 x 12) to (72 x 144) in	57 µin	Mahr Repeat-o-Meter
Fabric Inspection/Fabric Spreading Machine ¹ Length	(0.2 to 1 000) m	0.5 % of reading + 0.22 m	Comparison to PH-200LC-SEG Digital Tachometer

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Driver, Torque Wrenches, Torque Indicators, Torque Gauges ¹	(0.1 to 3) N·m (1 to 10) N·m (5 to 50) N·m (22 to 220) N·m (70 to 650) N·m	0.8 % of reading + 0.026 cN·m 0.7 % of reading + 0.006 N·m 1.2 % of reading + 0.007 N·m 1.2 % of reading + 0.07 N·m 0.18 % of reading + 1.8 N·m	Mountz LTT-2100 Torque Analyzer; CTM 0018, CTM 0019 and BMX500F Transducers
Mass Determination	1 mg to 20 g (20 to 200) g (500 to 5 000) g (5 to 20) kg	3.8 µg/g + 52 µg 1.9 µg/g + 0.15 mg 13.9 µg/g + 3.6 mg 56.3 mg/kg + 0.46 g	Shimadzu Balance, OIML Class E2, F1, M1 Weight Sets per OIML R 111-1 (2004), ABBA Method.
Scales and Balances ^{1,3}	1 mg to 200 g (200 to 500) g (500 to 1 000) g (1 to 6.5) kg (6.5 to 450) kg	5 µg/g + 15 µg 1.6 µg/g + 0.11 mg 1.6 µg/g + 1 mg 7.3 µg/g + 8.8 g 183 mg/kg + 0.52 g	OIML Class E2, Class M1, Class M2, Class F1 weights and OIML R 76-1 (2006) utilized in the calibration of the weighing system.
Platform Scales ^{1,3}	(450 to 2 000) kg	224 mg/kg + 71 g	OIML Class E2, Class M1, Class M2, Class F1 weights and OIML R 76-1 (2006) utilized in the calibration of the weighing system.
Crane Scales ¹ (Force)	Up to 200 kgf Up to 4 500 kgf	0.47 % of reading 0.47 % of reading	VLC 110 Load Cell
Pneumatic Gauge Pressure ¹	(-7 to 7) kPa (-0.8 to 20) bar Up to 1 000 bar	5.6 Pa 7 mbar 0.58 bar	Fluke 718-1G Pressure Calibrator, Fluke 718-100G Pressure Calibrator,
Hydraulic Gauge Pressure ¹	Up to 7 kPa Up to 20 bar Up to 1 000 bar	5.6 Pa 7 mbar 0.58 bar	Fluke 718-300G Pressure Calibrator, Wika CPG1500 Master Pressure Gauge

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness Testing Machines ¹	30 HRC 50 HRC	0.89 HRC 0.91 HRC	Indirect verification using Yamamoto Scientific Standard Blocks
Vickers Hardness Testing Machines ¹	297 HV	4.9 HV	
Force Testing Machines, Compression and Tension Force Gages ¹	(20 to 200) kgf (200 to 4 500) kgf	0.47 % of reading 0.47 % of reading	VLC 110 Load Cell
Force Testing Machines, Compression and Tension Force Gages ¹	Up to 20 kgf	10 gf	OIML Class F1, Class M1, Class M2 Weight Sets
Needle Detector ¹	(0.8 to 5) mm	59 µm	Test Card
Durometers ¹ A, B, O, C, D, DO scales (Force Verification Only)	Up to 100 Duro	0.27 Duro	Shimadzu UX6200H Electronic Balance
Burette	(1 to 100) ml	1.1 nl/ml + 0.49 µl	Analytical Scales: Shimadzu AUX 220, Shimadzu UX 620H, Shimadzu UX 6200H; Jadever JWN-30k Weight Set
Pipettes, Micropipettes ¹	1 µl to 100 ml	4.3 ml/l + 0.8 µl	
Volumetric Flasks	1 ml to 20 l	69 ml/l + 1.3 ml	
Volumetric Flow	(0.3 to 30) lpm	1.4 % of reading + 0.004 lpm	Defender 520-H Primary Air Flow Calibrator
Liquid Flow	(5 to 200) m ³ /h	4.3 % of reading + 0.38 m ³ /h	PCE-TDS 100 Ultrasonic Flow Meter
Particle Counter	(0.3 to 10) µm	10 % of reading	Comparison to Reference Particle Counter
Air Velocity	(2.5 to 30) m/s	2.4 % of reading + 0.031 m/s	Omega WTM-1000 Wind Tunnel, Omega HHF91 Digital Anemometer

Photometry and Radiometry

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Light Meters	(100 to 1 100) Lux (1 100 to 15 000) Lux	4.8 % of reading + 1 Lux 4.9 % of reading + 11 Lux	Comparison to Konica Minolta CL-200A Chroma Meter
Light Box Correlated Color Temperature	(2 500 to 6 500) K	1.5 % of reading + 85 K	Konica Minolta CL-200A Chroma Meter

Photometry and Radiometry

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gloss Meters ² 60°	37 GU 97 GU	2.1 GU 2.1 GU	Reference Gloss Tiles

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Source ¹	(-25 to 0) °C (0 to 155) °C (120 to 650) °C	0.3 % of reading + 0.16 °C 0.3 % of reading + 0.22 °C 0.2 % of reading + 0.16 °C	Temperature Calibrators: MAGMAN 650H, PRESYS T-25N
Dry Ovens, Vacuum Ovens, Environmental Chambers, Furnaces, Autoclaves, Incubators ¹ Temperature	(-25 to 650) °C	0.4 % of reading + 2.5 °C	Agilent 34970A Datalogger, Type K Thermocouple
Dry Ovens, Vacuum Ovens, Environmental Chambers, Furnaces, Autoclaves, Incubators ¹ Temperature Pressure	(20 to 140) °C Up to 5 bar	0.23 °C 31 mbar	Omega OM-CP-PRTEMP140-LVL High Temp/Pressure Datalogger, Type K Thermocouple
Relative Humidity – Source/Measure ³	(10 to 97) %RH	0.8 % of reading + 2.1 %RH	Vaisala HMM100 Humidity Module, Agilent 34970A Datalogger
Temperature – Measure ¹	(-70 to 0) °C (0 to 450) °C	0.04 °C 0.006 % of reading + 0.05 °C	AccuMac PRT, Agilent 3458A 8.5 Digit Multimeter
Infrared Thermometers ¹	(50 to 400) °C	1.9 °C	Omega BB703 Blackbody Source (Flat Plate) $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Stopwatches, Timers ¹	10 ms to 3 600 s	42 ms	Agilent 53131A Counter; NIST SP 960-12 Method 6A
Frequency – Source ¹	9 kHz to 3.2 GHz	3.5 Hz/MHz + 19 Hz	Hewlett Packard 8648C Signal Generator
Frequency – Measure ¹	(30 to 500) Hz 500 Hz to 225 MHz 225 MHz to 3 GHz	17 µHz 0.33 mHz/MHz + 0.1 Hz 0.17 mHz/MHz + 1.8 Hz	Agilent 53131A Counter
Non-contact Tachometers ^{1,2}	(6 to 100 000) rpm	0.004 % of reading + 0.2 rpm	LED, Fluke 5502A Multiproduct Calibrator
Speed Measurement ^{1,2} Non-contact	(6 to 100 000) rpm	0.008 % of reading + 1.5 rpm	Comparison to PH-200LC-SEG Digital Tachometer
Surface Speed	(1 to 400) m/min	0.5 % of reading + 0.21 m/min	

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Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Level Meter ¹	1 kHz 94 dB 114 dB	0.46 dB 0.72 dB	Soundtek ST-120 Sound Level Calibrator
Vibration ¹ Acceleration	9.8 m/s ² , 159 Hz	4.3 % of reading	PCB Calibration Exciter
Velocity	9.8 mm/s, 159 Hz	4.3 % of reading	
Displacement	9.9 µm	4.3 % of reading	

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Measure	4 pH 7 pH 10 pH	0.018 pH 0.021 pH 0.021 pH	pH solutions
Conductivity Measure	84 µS/cm 1413 µS/cm 12.88 mS/cm 111.8 mS/cm	1.5 µS/cm 24 µS/cm 0.24 mS/cm 1.9 mS/cm	Conductivity Solutions
Refractometers	(0 to ~53) %Brix	0.26 %Brix	Comparison to Reference Refractometer, Sucrose Solutions
Salinity Refractometer	(0 to ~10) %Salinity	4.6 % of reading + 0.12 %Salinity	Comparison to Reference Salinity Meter, Salinity Solutions

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure ¹	Up to 100 mV 100 mV to 1 V (1 to 10) V (1V to 100) V (100 to 1 000) V	17 µV/V + 3.3 µV 9.2 µV/V + 0.24 µV 8.9 µV/V + 6.6 µV 11 µV/V + 1.4 µV 14 µV/V + 99 µV	Agilent 3458A Opt 002 8.5 Digit Multimeter
DC Current – Measure ¹	Up to 100 µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	0.2 nA/A + 0.35 µA 0.1 mA/A + 2.9 nA 0.1 mA/A + 28 nA 0.1 mA/A + 0.33 µA 0.1 mA/A + 0.33 µA	Agilent 3458A Opt 002 8.5 Digit Multimeter
DC Current – Measure ¹	(1 to 3) A (3 to 100) A (3 to 100) A	1.3 mA/A + 0.71 mA 11 mA/A + 90 mA 16 mA/A + 0.11 A	Agilent 34401A 6.5 Digit Multimeter, Current Shunt
	(100 to 400) A	16 mA/A + 0.11 A	Kyoritsu Kewsnap 2009R Clamp Meter
DC Voltage – Source ¹	Up to 329.999 9 mV (0.33 to 3.299 999) V (3.3 to 32.999 99) V (33 to 329.999 9) V (330 to 1 020) V	70 nV/mV + 3.6 µV 59 nV/V + 66 µV 59 nV/V + 61 µV 65 µV/V + 0.59 mV 64 µV/V + 2.1 mV	Fluke 5502A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source ¹	Up to 329.999 μ A (0.33 to 3.299 99) mA (3.3 to 32.999 9) mA (33 to 329.999) mA (0.33 to 1.099 99) mA (1.1 to 2.999 99) A (3 to 10.999 9) A (11 to 20.5) A	0.17 nA/ μ A + 24 nA 0.12 μ A/mA + 79 nA 0.12 μ A/mA + 0.54 μ A 0.14 μ A/mA + 5.5 μ A 0.45 mA/A + 82 μ A 0.43 μ A/A + 0.1 mA 0.69 mA/A + 0.89 mA 1.2 mA/A + 1.2 mA	Fluke 5502A Multiproduct Calibrator
DC Current Clamp-on Meters ¹	(20.5 to 1 000) A	16 mA/A + 0.95 A	Fluke 5502A Multiproduct Calibrator, Current Coil
AC Voltage – Measure ¹	Up to 100 mV 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (0.1 to 1) V 40 to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (1 to 10) V (0.04 to 1) kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.21 μ V/mV + 1.6 μ V 0.25 μ V/mV + 1.9 μ V 0.46 μ V/mV + 2 μ V 1.4 μ V/mV + 1.6 μ V 0.13 mV/V + 21 μ V 0.18 mV/V + 22 μ V 0.36 mV/V + 23 μ V 0.97 mV/V + 22 μ V 0.13 mV/V + 0.21 mV 0.19 mV/V + 0.22 mV 0.36 mV/V + 0.23 mV 0.97 mV/V + 0.22 mV	Agilent 3458A Opt 002 8.5 Digit Multimeter
AC Voltage – Measure ¹	(10 to 100) V (0.04 to 1) kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 750) V 50 Hz to 1 kHz	0.25 mV/V + 2.2 mV 0.25 mV/V + 2.2 mV 0.5 mV/V + 2 mV 1.4 mV/V + 2.3 mV 0.47 mV/V + 17 mV	Agilent 3458A Opt 002 8.5 Digit Multimeter



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(1 to 32.999) mV (10 to 45) Hz	1.7 μ V/mV + 23 μ V	Fluke 5502A Multiproduct Calibrator
	45 Hz to 10 kHz	1.2 μ V/mV + 23 μ V	
	(10 to 20) kHz	1.7 μ V/mV + 23 μ V	
	(20 to 50) kHz	2.3 μ V/mV + 23 μ V	
	(50 to 100) kHz	4 μ V/mV + 38 μ V	
	(100 to 500) kHz	11 μ V/mV + 71 μ V	
	(33 to 329.999) mV (10 to 45) Hz	0.58 μ V/mV + 23 μ V	
	45 Hz to 10 kHz	0.36 μ V/mV + 19 μ V	
	(10 to 20) kHz	0.81 μ V/mV + 23 μ V	
	(20 to 50) kHz	1.2 μ V/mV + 47 μ V	
	(50 to 100) kHz	2.6 μ V/mV + 0.2 mV	
	(100 to 500) kHz	5.8 μ V/mV + 0.39 mV	
	(0.33 to 3.299 99) V (10 to 45) Hz	0.58 mV/V + 71 μ V	
	45 Hz to 10 kHz	0.35 mV/V + 72 μ V	
	(10 to 20) kHz	0.81 mV/V + 0.69 mV	
	(20 to 50) kHz	1.2 mV/V + 0.7 mV	
	(50 to 100) kHz	2.7 mV/V + 0.24 mV	
	(100 to 500) kHz	5.8 mV/V + 1.2 mV	
	(3.3 to 32.999 9) V (10 to 45) Hz	0.58 mV/V + 0.94 mV	
	45 Hz to 10 kHz	0.35 mV/V + 0.72 mV	
	(10 to 20) kHz	0.81 mV/V + 0.8 mV	
	(20 to 50) kHz	1.2 mV/V + 0.84 mV	
	(50 to 100) kHz	2.7 mV/V + 2.4 mV	
	(33 to 329.999) V (10 to 45) Hz	0.58 mV/V + 3.7 mV	
45 Hz to 10 kHz	0.92 mV/V + 11 mV		
(10 to 20) kHz	1 mV/V + 12 mV		
(20 to 50) kHz	1.4 mV/V + 14 mV		
(50 to 100) kHz	2.7 mV/V + 0.11 V		
AC Voltage – Source ¹	(330 to 1 020) V 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.58 mV/V + 23 mV 0.92 mV/V + 25 mV 1 mV/V + 26 mV	Fluke 5502A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(29 to 329.99) μ A		Fluke 5502A Multiproduct Calibrator
	(10 to 20) Hz	2.3 nA/ μ A + 0.12 μ A	
	(20 to 45) Hz	1.7 nA/ μ A + 0.12 μ A	
	45 Hz to 1 kHz	1.4 nA/ μ A + 0.12 μ A	
	(1 to 5) kHz	2.3 nA/ μ A + 0.21 μ A	
	(5 to 10) kHz	9.3 nA/ μ A + 0.23 μ A	
	(10 to 30) kHz	7.7 nA/ μ A + 0.77 μ A	
	(0.33 to 3.299 99) mA		
	(10 to 20) Hz	2.3 μ A/mA + 0.21 μ A	
	(20 to 45) Hz	1.4 μ A/mA + 0.2 μ A	
	45 Hz to 1 kHz	1.1 μ A/mA + 0.2 μ A	
	(1 to 5) kHz	2.3 μ A/mA + 0.26 μ A	
	(5 to 10) kHz	5.8 μ A/mA + 0.37 μ A	
	(10 to 30) kHz	11 μ A/mA + 0.75 μ A	
	(3.3 to 32.99 99) mA		
	(10 to 20) Hz	2.9 μ A/mA + 3.4 μ A	
	(20 to 45) Hz	0.69 μ A/mA + 20 μ A	
	45 Hz to 1 kHz	0.81 μ A/mA + 1.6 μ A	
	(1 to 5) kHz	0.92 μ A/mA + 2.7 μ A	
	(5 to 10) kHz	2.3 μ A/mA + 3.6 μ A	
	(10 to 30) kHz	4.6 μ A/mA + 4.8 μ A	
	(33 to 329.999) mA		
	(10 to 20) Hz	2 μ A/mA + 35 μ A	
	(20 to 45) Hz	1 μ A/mA + 30 μ A	
	45 Hz to 1 kHz	0.46 μ A/mA + 25 μ A	
	(1 to 5) kHz	1.2 μ A/mA + 59 μ A	
	(5 to 10) kHz	2.3 μ A/mA + 0.12 mA	
	(10 to 30) kHz	4.6 μ A/mA + 0.23 mA	
	(0.33 to 1.099 99) A		
	(10 to 45) Hz	2.1 mA/A + 0.12 mA	
45 Hz to 1 kHz	0.46 mA/A + 30 μ A		
(1 to 5) kHz	6.9 mA/A + 1.2 mA		
(5 to 10) kHz	28 mA/A + 5.8 mA		
(1 to 2.999 99) A			
(10 to 45) Hz	2 mA/A + 0.13 mA		
45 Hz to 1 kHz	0.69 mA/A + 0.16 mA		
(1 to 5) kHz	7 mA/A + 1.2 mA		
(5 to 10) kHz	28 mA/A + 5.9 mA		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(3 to 10.999 9) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.69 mA/A + 2.4 mA 1.2 mA/A + 2.4 mA 34 mA/A + 2.4 mA 1.4 mA/A + 5.8 mA 1.4 mA/A + 5.9 mA 34.6 mA/A + 5.8 mA	Fluke 5502A Multiproduct Calibrator
AC Current Clamp-on Meters ¹	(20.5 to 1 000) A 50 Hz	9.1 mA/A + 0.49 A	Fluke 5502A Multiproduct Calibrator, Current Coil
AC Current – Measure ¹	Up to 100 μ A (45 to 100) Hz 100 Hz to 5 kHz (0.1 to 1) mA (45 to 100) Hz 100 Hz to 5 kHz (1 to 10) mA (45 to 100) Hz 100 Hz to 5 kHz (10 to 100) mA (45 to 100) Hz 100 Hz to 5 kHz	0.82 nA/ μ A + 34 nA 0.82 nA/ μ A + 34 nA 0.88 μ A/mA + 0.22 μ A 0.88 μ A/mA + 0.22 μ A 0.88 μ A/mA + 2.2 μ A 0.4 μ A/mA + 2.2 μ A 0.83 μ A/mA + 22 μ A 0.55 μ A/mA + 22 μ A	Agilent 3458A Opt 002 8.5 Digit Multimeter
AC Current – Measure ¹	(0.1 to 1) A (45 to 100) Hz 100 Hz to 5 kHz	1.1 mA/A + 0.22 mA 1.3 mA/A + 0.22 mA	Agilent 3458A Opt 002 8.5 Digit Multimeter
	(1 to 3) A (1 to 50) Hz 50 Hz to 1 kHz	1.9 mA/A + 2 mA 1.9 mA/A + 2 mA	Agilent 34401A 6.5 Digit Multimeter
	(3 to 400) A 50 Hz	15.3 mA/A + 0.59 A	Kyoritsu Kewsnap 2009R Current Clamp Meter
Oscilloscopes ¹ Amplitude – DC Signal into 50 Ω Load into 1 M Ω Load Amplitude – Square Wave into 50 Ω Load into 1 M Ω Load	Up to 2.2 V Up to 33 V 1.8 mVp-p to 2.2 Vp-p 10 Hz to 10 kHz 1.8 mVp-p to 105 Vp-p 10 Hz to 10 kHz	3.7 mV/V + 4.8 mV 2.6 mV/V + 10 mV 1.7 mV/V + 3.9 mV 1.9 mV + 2.8 mV/V + 1.9 mV	Fluke 5520A/SC300 Multiproduct Calibrator with 300 MHz Scope Option



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes ¹ Amplitude – Leveled Sine Wave into 50 Ω Load	5 mV to 5.5 V 50 kHz 50 kHz to 100 MHz (100 to 300) MHz	25 mV/V + 5.7 mV 45 mV/V + 3.8 mV 51 mV/V + 5 mV	Fluke 5520A/SC300 Multiproduct Calibrator with 300 MHz Scope Option
Time Marker	2 μs to 5 s 2 ns to 1 μs	0.85 ms + 6.3 ms/s 1.2 ns	
Wave Generator (Square, Sine, Triangle Wave) into 50 Ω Load	1.8 mVp-p to 2.2 Vp-p 10 Hz to 100 kHz	39 mV/V + 0.38 mV	
into 1 MΩ Load	1.8 mVp-p to 55 Vp-p 10 Hz to 100 kHz	39 mV/V + 1.7 mV	
DC Resistance – Source ¹ (Variable Artifact) (LCR Meters)	(10 to 100) mΩ (0.1 to 1) Ω (1 to 10) Ω (10 to 100) Ω (100 to 1 000) Ω (1 to 10) kΩ (10 to 40) kΩ	0.15 mΩ/Ω + 1.8 mΩ 0.11 mΩ/Ω + 1.8 mΩ 0.11 mΩ/Ω + 4.2 mΩ 47 μΩ/Ω + 26 nΩ 0.11 mΩ/Ω + 60 mΩ 86 mΩ/kΩ + 1 Ω 60 mΩ/kΩ + 5.8 Ω	General Radio 1433-M Decade Resistor
Capacitance – Source ¹ (Variable Artifact) (LCR Meters – 1 kHz)	(10 to 100) pF (100 to 1 000) pF (1 to 10) nF (10 to 100) nF (0.1 to 1) μF	55 fF/pF + 5.8 pF 5.7 fF/pF + 5.9 pF 5.6 fF/pF + 8.2 pF 5.8 nF/μF + 5.8 nF 5.8 nF/μF + 5.8 nF	General Radio 1412-BC Decade Capacitor
Inductance – Source ¹ (Variable Artifact) (LCR Meters - 1 kHz)	(1 to 10) mH (10 to 100) mH (0.1 to 1) H (1 to 10) H	9.3 μH/mH + 0.1 μH 9.3 μH/mH + 1.6 μH 9.3 μH/mH + 8.6 μH 9.3 μH/H + 80 μH	General Radio 1490-D Decade Inductor

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Hipot Testers, Spark Testers, Surge Testers, Impulse Winding Testers ¹ AC Cut-off Current	50/60 Hz (29 to 500) μ A (500 to 5 000) μ A (5 to 50) mA (50 to 100) mA	7 nA/ μ A + 0.28 μ A 7 nA/ μ A + 0.62 μ A 7 μ A/mA + 23 μ A 7 μ A/mA + 62 μ A	Resistance Box, Fluke 287 Digital Multimeter
DC Cut-off Current	Up to 500 μ A (500 to 5 000) μ A (5 to 50) mA (50 to 100) mA	0.91 nA/ μ A + 0.23 μ A 0.82 nA/ μ A + 0.76 μ A 0.6 μ A/mA + 13 μ A 1.6 μ A/mA + 36 μ A	
AC High Voltage	50 Hz Up to 25 kV	56 V/kV + 30 V	Fluke 287 DMM, High Voltage Probe
Ground Bond Tester ¹	Up to 500 m Ω	0.01 % of reading + 1.7 m Ω	General Resistance RDS41-A Decade Resistor
Withstanding/Insulation Testers ¹			
DC Voltage	Up to 2 kV (2 to 10) kV (10 to 35) kV	23 V 0.12 kV 0.18 kV	Time Electronics 5069 Insulation Tester Calibrator, Fluke 287 DMM, High Voltage Probe
DC Current	Up to 2 mA (2 to 20) mA	23 μ A 0.23 mA	
Resistance	(0.1 to 5) M Ω (10 to 100) M Ω (10 to 1 000) M Ω (1 to 10) G Ω (10 to 100) G Ω	8.4 k Ω /M Ω + 19 k Ω 12 k Ω /M Ω + 1.1 k Ω 12 k Ω /M Ω + 9.1 k Ω 15 M Ω /G Ω + 1.7 M Ω 58 M Ω /G Ω + 12 M Ω	
Resistance – Source ¹ (Simulated)	(3.3 to 11) k Ω (11 to 32.999 9) k Ω (33 to 109.999) k Ω (110 to 329.999) k Ω 330 k Ω to 1.099 99 M Ω (1.1 to 3.299 99) M Ω (3.3 to 10.999 9) M Ω (11 to 32.999 9) M Ω (33 to 109.999) M Ω (110 to 329.999) M Ω (330 to 1 100) M Ω	0.1 Ω /k Ω + 74 m Ω 0.1 Ω /k Ω + 0.24 Ω 0.13 Ω /k Ω + 0.44 Ω 0.14 Ω /k Ω + 2.4 Ω 0.17 k Ω /M Ω + 5.5 Ω 0.17 k Ω /M Ω + 35 Ω 0.69 k Ω /M Ω + 61 Ω 1.2 k Ω /M Ω + 2.9 k Ω 5.8 k Ω /M Ω + 3.4 k Ω 5.8 k Ω /M Ω + 0.12 M Ω 17 k Ω /M Ω + 0.57 M Ω	Fluke 5502A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – 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	54 μΩ/Ω + 97 μΩ 14 μΩ/Ω + 0.64 mΩ 14 mΩ/kΩ + 0.87 mΩ 13 mΩ/kΩ + 10 mΩ 11 mΩ/kΩ + 0.26 Ω 34 Ω/MΩ + 2.8 Ω 70 Ω/MΩ + 100 Ω 0.59 kΩ/MΩ + 1.1 kΩ	Agilent 3458A Opt 002 8.5 Digit Multimeter
Capacitance (Simulated) ¹ 10 Hz to 10 kHz 10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 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 (10 to 50) Hz (10 to 20) Hz DC to 6 Hz DC to 2 Hz DC to 0.6 Hz DC to 0.2 Hz	(220 to 399.9) pF 400 pF to 1.099 9 nF (1.1 to 3.299 9) nF (3.3 to 10.999) nF (11 to 32.999) nF (33 to 109.99) nF (110 to 329.99) nF (0.33 to 1.099 9) μF (1.1 to 3.299 9) μF (3.3 to 10.999) μF (11 to 32.999) μF (33 to 109.99) μF (110 to 329.99) μF 330 μF to 1.099 9 mF (1.1 to 3.299 9) mF (3.3 to 10.999) mF (11 to 32.999) mF (33 to 110) mF	5.8 fF/pF + 12 pF 5.7 pF/nF + 12 pF 5.8 pF/nF + 12 pF 2.9 pF/nF + 12 pF 2.9 pF/nF + 12 pF 2.9 pF/nF + 0.12 nF 3 pF/nF + 0.35 nF 3 nF/μF + 1.1 nF 3 nF/μF + 3.4 nF 3 nF/μF + 11 nF 4.7 nF/μF + 35 nF 5.4 nF/μF + 0.11 μF 5.2 nF/μF + 0.36 μF 5.2 μF/mF + 1.2 μF 5.2 μF/mF + 3.5 μF 5.2 μF/mF + 12 μF 8.4 μF/mF + 41 μF 13 μF/mF + 0.12 mF	Fluke 5502A Multiproduct Calibrator
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure ¹	Type B (600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °C Type E (-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.59 °C 0.48 °C 0.44 °C 0.47 °C 0.8 °C 0.46 °C 0.48 °C 0.57 °C 0.5 °C	Fluke 5502A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure ¹	Type J		Fluke 5502A Multiproduct Calibrator
	(-210 to -100) °C	0.43 °C	
	(-100 to -30) °C	0.32 °C	
	(-30 to 150) °C	0.34 °C	
	(150 to 760) °C	0.36 °C	
	(760 to 1200) °C	0.39 °C	
	Type K		
	(-200 to -100) °C	0.48 °C	
	(-100 to -25) °C	0.34 °C	
	(-25 to 120) °C	0.29 °C	
	(120 to 1000) °C	0.4 °C	
	(1000 to 1372) °C	0.53 °C	
	Type R		
	(0 to 250) °C	0.72 °C	
	(250 to 400) °C	0.56 °C	
(400 to 1 000) °C	0.47 °C		
(1 000 to 1 767) °C	0.6 °C		
Type T			
(-250 to -150) °C	0.82 °C		
(-150 to 0) °C	0.4 °C		
(0 to 120) °C	0.3 °C		
(120 to 400) °C	0.32 °C		

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
RF Power – Source ¹	100 kHz to 50 MHz	(-70 to 0) dBm	1.3 dB	Hewlett Packard 8648C Signal Generator
		(0 to 13) dBm	1.3 dB	
	50 MHz to 2.5 GHz	(-70 to -25.9) dBm	1.3 dB	
		(-25.9 to 0) dBm	1.2 dB	
		(0 to 13) dBm	1.2 dB	
	(2.5 to 3.2) GHz	(-70 to -25.9) dBm	1.8 dB	
		(-25.9 to 0) dBm	1.8 dB	
		(0 to 13) dBm	1.8 dB	
	RF Power – Measure ¹			
10 MHz to 18 GHz	(-40 to 20) dBm	1.3 dB		

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers ¹	Up to 600 mm	7.4 nm/mm + 10 μm	Gauge Blocks
Micrometers ¹	Up to 25.4 mm (25.4 to 300) mm	8.3 nm/mm + 0.22 μm 11 nm/mm + 1.5 μm	Optical Flat, Gauge Blocks
Height Gauges ¹	Up to 600 mm	15 nm/mm + 0.3 μm	Gauge Blocks
Depth Gauges ¹	Up to 500 mm	10 nm/mm + 12 μm	Gauge Blocks
Coordinate Measuring Machines ¹ (CMM)	X-axis: Up to 600 mm Y-axis: Up to 600 mm Z-axis: Up to 500 mm	15 nm/mm + 0.42 μm 15 nm/mm + 0.34 μm 15 nm/mm + 0.6 μm	Grade 0 Gauge Blocks, Grade 0 Long Gauge Blocks
Measuring Microscopes, Vision Systems ¹	X-Y Axis: Up to 300 mm	12 nm/mm + 0.94 μm	Grade 0 Gauge Blocks, Grade 0 Long Gauge Blocks
Profile Projectors ¹	X-Y Axis: Up to 300 mm	13 nm/mm + 0.68 μm	Grade 0 Gauge Blocks, Grade 0 Long Gauge Blocks
Laser Micrometers	Up to 10 mm	90 nm/mm + 4.5 μm	Pin Gauge Set
Coating Thickness Meters ¹	(25 to 1 500) μm	2.9 μm	Coating Thickness Standards
Dial Indicators, Dial Indicators ¹	Up to 100 mm	9.5 nm/mm + 1.1 μm	Gauge Blocks
Surface Roughness Testers ¹ (Ra Mode)	16.1 μin	4.2 μin	GAR Precision Reference Standard
Measuring Tapes, Rulers	Up to 2 000 mm	0.1 mm/mm + 0.29 mm	Gauge Blocks
Holtest/Borematic	(8 to 70) mm	0.11 μm/mm + 4.6 μm	Setting Ring Set
Levels	Up to 30°	0.042°	Comparison to INSIZE ISE-2DT Digital Level
Surface Plates ¹ Local Area Flatness Only (Repeat Readings)	(12 x 12) to (72 x 144) in	57 μin	Mahr Repeat-o-Meter
Fabric Inspection/Fabric Spreading Machine ¹ Length	(0.2 to 1 000) m	0.5 % of reading + 0.22 m	Comparison to PH-200LC-SEG Digital Tachometer



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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Driver, Torque Wrenches, Torque Indicators, Torque Gauges ¹	(0.1 to 3) N·m (1 to 10) N·m (5 to 50) N·m (22 to 220) N·m (70 to 650) N·m	0.8 % of reading + 0.026 cN·m 0.7 % of reading + 0.006 N·m 1.2 % of reading + 0.007 N·m 1.2 % of reading + 0.07 N·m 0.18 % of reading + 1.8 N·m	Mountz LTT-2100 Torque Analyzer; CTM 0018, CTM 0019 and BMX500F Transducers
Mass Determination	1 mg to 20 g (20 to 200) g (500 to 5 000) g (5 to 20) kg	3.8 µg/g + 52 µg 1.9 µg/g + 0.15 mg 13.9 µg/g + 3.6 mg 56.3 mg/kg + 0.46 g	Shimadzu Balance, OIML Class E2, F1, M1 Weight Sets per OIML R 111-1 (2004), ABBA Method.
Scales and Balances ^{1,3}	1 mg to 200 g (200 to 500) g (500 to 1 000) g (1 to 6.5) kg (1 to 300) kg	5 µg/g + 15 µg 1.6 µg/g + 0.11 mg 1.6 µg/g + 1 mg 7.3 µg/g + 8.8 g 28 mg/kg + 0.64 g	OIML Class E2, Class M1, Class M2, Class F1 weights and OIML R 76-1 (2006) utilized in the calibration of the weighing system.
Platform Scales ^{1,3}	(450 to 2 000) kg	224 mg/kg + 71 g	OIML Class E2, Class M1, Class M2, Class F1 weights and OIML R 76-1 (2006) utilized in the calibration of the weighing system.
Crane Scales ¹ (Force)	Up to 200 kgf Up to 4 500 kgf	0.47 % of reading 0.47 % of reading	VLC 110 Load Cell
Pneumatic Gauge Pressure ¹	(-7 to 7) kPa (-0.8 to 20) bar Up to 1 000 bar	5.6 Pa 7 mbar 0.58 bar	Fluke 718-1G Pressure Calibrator, Fluke 718-100G Pressure Calibrator,
Hydraulic Gauge Pressure ¹	Up to 7 kPa Up to 20 bar Up to 1 000 bar	5.6 Pa 7 mbar 0.58 bar	Fluke 718-300G Pressure Calibrator, Wika CPG1500 Master Pressure Gauge
Rockwell Hardness Testing Machines ¹	30 HRC 50 HRC	0.89 HRC 0.91 HRC	Indirect verification using Yamamoto Scientific Standard Blocks
Vickers Hardness Testing Machines ¹	297 HV	4.9 HV	
Force Testing Machines, Compression and Tension Force Gages ¹	(20 to 200) kgf (200 to 4 500) kgf	0.47 % of reading 0.47 % of reading	VLC 110 Load Cell
Force Testing Machines, Compression and Tension Force Gages ¹	Up to 20 kgf	10 gf	OIML Class F1, Class M1, Class M2 Weight Sets
Needle Detector ¹	(0.8 to 5) mm	59 µm	Test Card

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Durometers ¹ A, B, O, C, D, DO scales (Force Verification Only)	Up to 100 Duro	0.27 Duro	Shimadzu UX6200H Electronic Balance
Burette	(1 to 100) ml	1.1 nl/ml + 0.49 μ l	Analytical Scales: Shimadzu AUX 220, Shimadzu UX 620H, Shimadzu UX 6200H; Jadever JWN-30k Weight Set
Pipettes, Micropipettes ¹	1 μ l to 100 ml	4.3 ml/l + 0.8 μ l	Comparison with Analytical Balance
Volumetric Flasks	1 ml to 20 l	69 ml/l + 1.3 ml	Comparison with Analytical Balance
Volumetric Flow	(0.3 to 30) lpm	1.4 % of reading + 0.004 lpm	Defender 520-H Primary Air Flow Calibrator
Hydrometers	(0.7 to 1.8) g/ml	0.001 4 g/ml	Comparison to Reference Hydrometers per DLVN 293:2016; Manufacturer's Manual

Photometry and Radiometry

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gloss Meters ² 60 °	37 GU 97 GU	2.1 GU 2.1 GU	Reference Gloss Tiles

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Source ¹	(-25 to 0) °C (0 to 155) °C (120 to 650) °C	0.3 % of reading + 0.16 °C 0.3 % of reading + 0.22 °C 0.2 % of reading + 0.16 °C	Temperature Calibrators: MAGMAN 650H, PRESYS T-25N

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dry Ovens, Vacuum Ovens, Environmental Chambers, Furnaces, Autoclaves, Incubators ¹ Temperature	(-25 to 650) °C	0.4 % of reading + 2.5 °C	Agilent 34970A Datalogger, Type K Thermocouple
Pressure	(20 to 140) °C Up to 5 bar	0.23 °C 31 mbar	Omega OM-CP-PRTEMP140-LVL High Temp/Pressure Datalogger, Type K Thermocouple
Relative Humidity – Source/Measure ³	(10 to 97) %RH	0.8 % of reading + 2.1 %RH	Vaisala HMM100 Humidity Module, Agilent 34970A Datalogger
Temperature – Measure ¹	(-70 to 0) °C (0 to 450) °C	0.04 °C 0.006 % of reading + 0.05 °C	AccuMac PRT, Agilent 3458A 8.5 Digit Multimeter
Infrared Thermometers ¹	(50 to 400) °C	1.9 °C	Omega BB703 Blackbody Source (Flat Plate) $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Stopwatches, Timers ¹	10 ms to 3 600 s	42 ms	Agilent 53131A Counter; NIST SP 960-12 Method 6A
Frequency – Source ¹	9 kHz to 3.2 GHz	3.5 Hz/MHz + 19 Hz	Hewlett Packard 8648C Signal Generator
Frequency – Measure ¹	(30 to 500) Hz 500 Hz to 225 MHz 225 MHz to 3 GHz	17 µHz 0.33 mHz/MHz + 0.1 Hz 0.17 mHz/MHz + 1.8 Hz	Agilent 53131A Counter
Non-contact Tachometers ^{1,2}	(6 to 100 000) rpm	0.004 % of reading + 0.11 rpm	LED, Fluke 5502A Multiproduct Calibrator

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Speed Measurement ^{1,2} Non-contact	(6 to 100 000) rpm	0.008 % of reading + 1.5 rpm	Comparison to PH-200LC-SEG Digital Tachometer
Surface Speed	(1 to 400) m/min	0.5 % of reading + 0.21 m/min	

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. GU = Gloss Unit, rpm = revolutions per minute.
 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. The humidity is limited to the prevailing ambient conditions in the laboratory at the time of calibration.
 5. These values are approximate values. The actual certificate value will be utilized during calibration.
 6. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2478.



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