



CERTIFICATE OF ACCREDITATION

ANSI National Accreditation Board
11617 Coldwater Road, Fort Wayne, IN 46845 USA

This is to certify that

Techmaster Electronics J.S.C.
169/1/5 Luong Dinh Cua Street, Binh An Ward, District 2
Ho Chi Minh City, Vietnam
(and satellite location as shown on the scope)

has been assessed by ANAB and meets the requirements of international standard

ISO/IEC 17025:2017

and national standard

ANSI/NCSL Z540-1-1994 (R2002)

while demonstrating technical competence in the field of

CALIBRATION

Refer to the accompanying Scope of Accreditation for information regarding the types of activities to which this accreditation applies

AC-1868
Certificate Number


ANAB Approval

Certificate Valid Through: 10/29/2020
Version No. 007 Issued: 02/24/2020



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).



ANSI National Accreditation Board

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017 AND ANSI/NCSL Z540-1-1994 (R2002)

TECHMASTER ELECTRONICS J.S.C

169/1/5 Luong Dinh Cua Street, Binh An Ward, District 2,
Ho Chi Minh City, Vietnam (Primary Laboratory).
Website: www.techmaster.com.vn

Authorized Leadership for Techmaster in Vietnam

Tri Nguyen, Vietnam General Director; Email: tri.nguyen@techmaster.com.vn
Tien Nguyen, Vietnam Quality Manager; Email: tien.nguyen@techmaster.com.vn
Nghiep Le, Vietnam Technical Manager; Email: nghiep.le@techmaster.com.vn

CALIBRATION

Valid to: **October 29, 2020**

Certificate Number: **AC-1868**

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Level Meters ¹	94 dB, 1 kHz 114 dB, 1 kHz	0.39 dB	Sound Calibrator
Vibration Meters ¹ Acceleration, Velocity	Up to 50 g Up to 1 000 Hz, (1 to 2) kHz	1.9 % of reading + 0.25g 2.6 % of reading + 0.25g	Vibration Calibration System, VMI International AB-CA200

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH meters ¹	4.00 pH 7.00 pH 10.00 pH	0.013 pH 0.013 pH 0.015 pH	Control Company Solutions
Conductivity meters ¹	1 µS/cm 10 µS/cm 84 µS/cm 1 413 µS/cm	0.83 µS/cm 0.93 µS/cm 1.4 µS/cm 9.2 µS/cm	
Refractometers	(0, 15, 40) °Brix (1 to 20) % Salinity	0.22 Brix 0.18 % Refraction	Brix Reference Solutions Analytical Balance

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Viscosity Meters ¹	1 000 mPa.s (cP) Up to 200 000 mPa.s (cP)	0.95 % of reading 2.1% of reading	Paragon Scientific Solutions Cannon Solutions
Gas Detectors ¹	H ₂ S 25 ppm Concentration CO 50 ppm Concentration 100 ppm Concentration CH ₄ 50% Concentration LEL O ₂ 12% Concentration in N ₂ 18% Concentration in N ₂ NH ₃ 50 ppm Concentration	2 ppm Concentration 2.6 ppm Concentration 3.4 ppm Concentration 3 % of reading 1.4 % of reading 2.7 % of reading 3 % of reading	Standard Gases
Total Volatile Organic Compounds (TVOC) ¹	Up to 100 ppm Concentration	0.8 ppm Concentration	Standard Gas
Turbidity Meter ¹	(0 to 500) NTU (0 to 1 000) NTU	0.1 NTU + 0.01 NTU / NTU 0.2 NTU + 0.001 NTU / NTU	Turbidity Calibration Standards Solution
Alcohol meter ¹	(0 to 100) % Vol / Vol	0.24 % Vol / Vol	Reference Alcohol meter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage - Source ¹	Up to 220 mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V 220 V to 1.1 kV	8.1 μ V/V + 0.8 μ V 7.1 μ V/V + 1 μ V 8.1 μ V/V + 3.5 μ V 7.1 μ V/V + 6.5 μ V 8.1 μ V/V + 80 μ V 11 μ V/V + 0.5 μ V	Fluke 5700 A w Opt 03 Multiproduct Calibrator
DC Voltage - Measure ¹	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1 000) V	11 μ V/V + 1.2 μ V 9.5 μ V/V + 1.2 μ V 9.5 μ V + 2.6 μ V 12 μ V/V + 36 μ V 118 μ V/V + 12 μ V/V	Agilent 3458A w Opt 002 Multimeter
DC Voltage - Measure ¹	(1 to 10) kV	0.06 2kV	Kikusui Digital High Voltage Meter



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage - Measure ¹	(10 to 40) kV	0.47 kV	High Voltage Probe
DC Current - Measure ¹	Up to 100 nA 100 nA to 1 µA (1 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	35 µA/A + 0.05 nA 24 µA/A + 0.05 nA 24 µA/A + 0.95 nA 24 µA/A + 5.9 nA 24 µA/A + 5.9 nA 41 µA/A + 0.6 nA 0.13 µA/A + 0.01 mA	Agilent 3458A w Opt 002 Multimeter
	(1 to 10) A (10 to 300) A (300 to 1 000) A (1 000 to 2 000) A	0.58 µA/A 0.14 µA/A 6.8 mA/A 4.1 A	Multimeter with Current Shunt, Clamp Meter
DC Current – Source ¹	Up to 220 µA 220 µA to 22 mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A	50 µA/A + 8 nA 50 µA/A + 8 nA 50 µA/A + 80 nA 60 µA/A + 0.8 µA 80 µA/A + 25 µA	Fluke 5700A w Opt 03 Multiproduct Calibrator
	330 µA to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 2.2 A (2.2 to 20) A	0.15 mA/A + 0.06 µA 0.11 mA/A + 0.46 µA 0.1 µA/A + 8.8 µA 0.32 µA/A + 0.12 mA 0.66 µA/A + 0.81 mA	Fluke 5520A Multiproduct Calibrator
	(20 to 1 000) A	5.4 mA/A	Multiproduct Calibrator w Fluke Coil
AC Voltage – Source ¹	Up to 2.2 mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.55 mV/V + 4.5 µV 0.21 mV/V + 4.5 µV 0.11 mV/V + 4.5 µV 0.37 mV/V + 4.5 µV 0.85 mV/V + 7 µV 1.1 mV/V + 13 µV 1.7 mV/V + 25 µV 3.4 mV/V + 25 µV	Fluke 5700A w Opt 03 Multiproduct Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(2.2 to 22) mV		Fluke 5700A w Opt 03 Multiproduct Calibrator
	(10 to 20) Hz	0.55 mV/V + 5 μV	
	(20 to 40) Hz	0.21 mV/V + 5 μV	
	40 Hz to 20 kHz	0.11 mV/V + 5 μV	
	(20 to 50) kHz	0.37 mV/V + 5 μV	
	(50 to 100) kHz	0.85 mV/V + 7 μV	
	(100 to 300) kHz	1.1 mV/V + 12 μV	
	(300 to 500) kHz	1.7 mV/V + 25 μV	
	500 kHz to 1 MHz	3.4 mV/V + 25 μV	
	(22 to 220) mV		
	(10 to 20) Hz	0.55 mV/V + 13 μV	
	(20 to 40) Hz	0.21 mV/V + 8 μV	
	40 Hz to 20 kHz	0.11 mV/V + 8 μV	
	(20 to 50) kHz	0.37 mV/V + 8 μV	
	(50 to 100) kHz	0.85 mV/V + 25 μV	
	(100 to 300) kHz	1.1 mV/V + 25 μV	
	(300 to 500) kHz	1.7 mV/V + 35 μV	
	500 kHz to 1 MHz	3.4 mV/V + 80 μV	
	220 mV to 2.2 V		
	(10 to 20) Hz	0.5 mV/V + 80 μV	
	(20 to 40) Hz	0.16 mV/V + 25 μV	
	40 Hz to 20 kHz	80 μV/V + 6 μV	
	(20 to 50) kHz	0.13 mV/V + 16 μV	
	(50 to 100) kHz	0.26 mV/V + 70 μV	
	(100 to 300) kHz	0.44 mV/V + 0.13 mV	
	(300 to 500) kHz	1.8 mV/V + 35 mV	
	500 kHz to 1 MHz	2.6 mV/V + 8.5 mV	
(2.2 to 22) V			
(10 to 20) Hz	0.55 mV/V + 0.8 mV		
(20 to 40) Hz	0.16 mV/V + 0.25 mV		
40 Hz to 20 kHz	80 μV/V + 0.06 mV		
(20 to 50) kHz	0.13 mV/V + 0.16 mV		
(50 to 100) kHz	0.27 mV/V + 0.35 mV		
(100 to 300) kHz	0.5 mV/V + 1.5 mV		
(300 to 500) kHz	1.9 mV/V + 4.3 mV		
500 kHz to 1 MHz	3.1 mV/V + 8.5 mV		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(22 to 220) V (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 220 V to 1.1 kV (15 to 50) Hz 50 Hz to 1 kHz	0.5 mV/V + 8 mV 0.16 mV/V + 2.5 mV 80 μV/V + 0.8 mV 0.22 mV/V + 3.5 mV 0.5 mV/V + 8 mV 2 mV/V + 90 mV 0.4 mV/V + 16 mV 80 μV/V + 3.5 mV	Fluke 5700A w Opt 03 Multiproduct Calibrator
AC Voltage – Measure ¹	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 (1 to 2) MHz 100 mV to 1 V (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 (1 to 2) MHz	0.36 mV/V + 3.5 μV 0.24 mV/V + 1.3 μV 0.35 mV/V + 1.3 μV 1.2 mV/V + 1.3 μV 5.9 mV/V + 1.3 μV 47 mV/V + 2.4 μV 0.008 mV/V + 2.4 μV 0.017 mV/V + 2.4 μV 0.035 mV/V + 2.4 μV 0.095 mV/V + 2.4 μV 0.35 mV/V + 12 μV 1.2 mV/V + 12 μV 1.8 mV/V + 12 μV 18 mV/V + 12 μV 0.08 mV/V + 48 μV 0.08 mV/V + 24 μV 0.17 mV/V + 24 μV 0.35 mV/V + 24 μV 0.95 mV/V + 24 μV 0.36 mV/V + 0.12 mV 12 mV/V + 0.12 mV 18 mV/V + 0.12 mV	Agilent 3458A w Opt 002 Multimeter



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(1 to 10) V		Agilent 3458A w Opt 002 Multimeter
	(1 to 40) Hz	0.08 mV/V + 0.47 mV	
	40 Hz to 1 kHz	0.08 mV/V + 0.24 mV	
	(1 to 20) kHz	0.17 mV/V + 0.24 mV	
	(20 to 50) kHz	0.35 mV/V + 0.24 mV	
	(50 to 100) kHz	0.95 mV/V + 0.24 V	
	(100 to 300) kHz	3.6 mV/V + 1.2 mV	
	300 kHz to 1 MHz	12 mV/V + 1.2 mV	
	(1 to 2) MHz	18 mV/V + 1.2 mV	
	(10 to 100) V		
	(1 to 40) Hz	0.24 mV/V + 4.7 mV	
	40 Hz to 1 kHz	0.24 mV/V + 2.4 mV	
	(1 to 20) kHz	0.24 mV/V + 2.4 mV	
	(20 to 50) kHz	0.43 mV/V + 2.4 mV	
	(50 to 100) kHz	0.43 mV/V + 2.4 mV	
(100 to 300) kHz	4.7 mV/V + 12 mV		
300 kHz to 1 MHz	4.7 mV/V + 12 mV		
AC Voltage – Measure ¹	100 V to 1 kV		Kikusui Digital High Voltage Meter, High Voltage Probe
	(1 to 40) Hz	0.47 mV/V + 47 mV	
	40 Hz to 1 kHz	0.47 mV/V + 47 mV	
	(1 to 20) kHz	0.71 mV/V + 24 mV	
	(20 to 50) kHz	1.5 mV/V + 24 mV	
	(50 to 100) kHz	3.6 mV/V + 2.4 mV	
AC Current – Source ¹	(1 to 30) kV		Fluke 5700A w Opt 03 Multiproduct Calibrator
	(50 to 60) Hz	0.38 kV	
	Up to 220 μA		
	(10 to 20) Hz	0.9 mA/A	
	(20 to 40) Hz	0.5 mA/A	
	40 Hz to 1 kHz	0.3 mA/A	
	(1 to 5) kHz	0.8 mA/A	
	(5 to 10) kHz	2 mA/A	
	220 μA to 2.2 mA		
	(10 to 20) Hz	0.9 mA/A	
	(20 to 40) Hz	0.6 mA/A	
	40 Hz to 1 kHz	0.3 mA/A	
	(1 to 5) kHz	2.5 mA/A	
	(5 to 10) kHz	5.3 mA/A	



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(2.2 to 22) mA		Fluke 5700A w Opt 03 Multiproduct Calibrator
	(10 to 20) Hz	2.6 mA/A	
	(20 to 40) Hz	2 mA/A	
	40 Hz to 1 kHz	1.8 mA/A	
	(1 to 5) kHz	19 mA/A	
	(5 to 10) kHz	38 mA/A	
	(22 to 220) mA		
	(10 to 20) Hz	0.7 mA/A	
	(20 to 40) Hz	0.4 mA/A	
	40 Hz to 1 kHz	0.2 mA/A	
	(1 to 5) kHz	0.8 mA/A	
	(5 to 10) kHz	1.9 mA/A	
220 mA to 2.2 A	20 Hz to 1 kHz	0.8 μA/A	
	(1 to 5) kHz	1.1 mA/A	
	(5 to 10) kHz	8.8 mA/A	
AC Current – Source ¹	(1 to 1 000) A 50Hz / 60Hz	5.4 mA/A	Fluke 5520A Multiproduct Calibrator with Coil
AC Current – Measure ¹	(5 to 100) μA		Agilent 3458A w Opt 002 Multimeter
	(10 to 20) Hz	4.8 mA/A + 24 nA	
	(20 to 45) Hz	1.8 mA/A + 24 nA	
	(45 to 100) Hz	0.7 mA/A + 24 nA	
100 Hz to 5 kHz	0.7 mA/A + 24 nA		
AC Current – Measure ¹	100 μA to 10 mA		Agilent 3458A w Opt 002 Multimeter
	(10 to 20) Hz	4.7 mA/A + 2.4 nA	
	(20 to 45) Hz	1.8 mA/A + 2.4 nA	
	(45 to 100) Hz	0.7 mA/A + 2.4 nA	
	100 Hz to 5 kHz	0.4 mA/A + 2.4 nA	
	(5 to 20) kHz	0.7 mA/A + 2.4 nA	
	(20 to 50) kHz	4.7 mA/A + 4.7 nA	
	(50 to 100) kHz	6.5 mA/A + 18 μA	
	(10 to 100) mA		
	(10 to 20) Hz	4.7 mA/A + 24 μA	
	(20 to 45) Hz	1.8 mA/A + 24 μA	
	(45 to 100) Hz	0.7 mA/A + 24 μA	
	100 Hz to 5 kHz	0.4 mA/A + 24 μA	
	(5 to 20) kHz	0.7 mA/A + 24 μA	
	(20 to 50) kHz	4.7 mA/A + 47 μA	
	(50 to 100) kHz	6.5 mA/A + 0.18 mA	



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	100 mA to 1 A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (1 to 10) A (3 to 300) kHz (10 to 300) A (50 to 400) Hz	4.7 mA/A + 0.24 mA 1.9 mA/A + 0.24 mA 0.9 mA/A + 0.24 mA 1.2 mA/A + 0.24 mA 3.5 mA/A + 0.24 mA 12 mA/A + 0.47 mA 47 mA/A + 0.47 mA 0.007 1 A + 0.01 mA 0.34 A	Keysight 34461A Multimeter, Prodigit 7550A Precision Shunt Clamp Meter w Flexible Probe
DC Power – Generate 33 mV to 1 020 V	0.33 mA to 330 mA 10 μW to 330 W 0.33 A to 3 A 10 mW to 3 kW 3 A to 20.5 100 mW to 21 kW	0.01 % of reading + 1.5 nW 0.11 W + 0.012 nW 1.1 W + 0.031 μW	Fluke 5520A Multiproduct Calibrator
AC Power – Generate PF = 1 (10 to 45) Hz 33 mV to 32.9999 V 3.3 mA to 2.999 99 A (45 to 65) Hz 33 mV to 1 000 V 3.3 mA to 20.5 A	110 μW to 99 W 110 μW to 20 kW	0.18 % of reading 0.14 % of reading	Fluke 5520A Multiproduct Calibrator
Oscilloscopes ¹ - DC Voltage Into 50 Ω Into 1 MΩ Square Wave in to 50 Ω 10 Hz to 10 kHz	(0 to ± 6.6) V (0 to ± 130) V 1 mV to 6.6 Vp-p	0.2 % of reading + 36 μV 0.039 % of reading + 37 μV 0.2% of reading + 65 μV 0.039 % of reading + 37 μV	Fluke 5520A Multiproduct Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes ¹ - In to 1 MΩ 10 Hz to 10 kHz Level Sine Amplitude Reference @ 50 kHz Bandwidth (relative to 50 kHz) 5 mV to 5.5 V Time Markers Into 50 Ω Edge Transition Time (Rise time)	1 mV to 130 Vp-p 5 mV to 5.5 V 50 kHz to 100 MHz (100 to 300) MHz 300 to 600) MHz (600 to 1 100) MHz (1 to 50) ns 100 ns to 20 ms 50 ms to 5 s < 300 ps	0.19 % of reading + 39 μV 15 mV/V + 0.49 mV 14 mV/V + 0.12 mV 17 mV/V + 0.14 mV 32 mV/V + 0.15 mV 40 mV/V + 0.16 mV 0.001 1 % of reading + 0.048 ps 0.000 2 % of reading + 7 ps 0.4 % of reading 80 ps	Fluke 5520A Multiproduct Calibrator
LCR Meters ¹ (20 Hz to 1 MHz)	Up to 100 MΩ Up to 100 μF Up to 10 H	0.02 % of reading 0.01 % of reading 0.1 % of reading	M550 MEATEST RLC Calibrator
HiPot Testers ¹ Impulse Tester	Up to 10 kV, 50 Hz Up to 40 kV, 50 Hz	0.001 2 kV + 0.012 kV	Kikusui 149-10A Voltmeter High Voltage Probe w Multimeter, Kikusui TOS 1200 Current Calibrator Digital Oscilloscope
	Up to 100 mA, 50 Hz	0.015 mA + 0.000 62 mA/ mA	
Insulation Testers ¹	Up to 10 kV Up to 100 GΩ	0.002 % of reading + 1.5 V 0.09 % of reading + 1.5 MΩ	Kikusui 149-10A Voltmeter Time Electronics 5069 Ins-Cal Insulation Tester
Resistance – Source ¹	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) k (33 to 110) kΩ (110 to 330) kΩ 0.33 kΩ to 1.1 MΩ	0.1 mΩ/Ω + 8 mΩ 0.1 mΩ/Ω + 17 mΩ 1 mΩ/Ω + 17 mΩ 1 mΩ/Ω + 17 mΩ 0.1 mΩ/Ω + 0.07 Ω 0.1 mΩ/Ω + 0.08 Ω 0.1 mΩ/Ω + 0.71 Ω 0.1 mΩ/Ω + 0.70 Ω 0.1 mΩ/Ω + 7 Ω 0.1 mΩ/Ω + 7 Ω 0.2 mΩ/Ω + 64 Ω	Fluke 5520A Multiproduct Calibrator



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source ¹	(1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ	0.2 mΩ/Ω + 64 Ω 0.7 mΩ/Ω + 6.4 kΩ 1 mΩ/Ω + 6.1 kΩ 6 mΩ/Ω + 6.4 kΩ 6 mΩ/Ω + 19 kΩ	Fluke 5520A Multiproduct Calibrator
Resistance – Source Fixed Points ¹	1.9 Ω 10 Ω 10 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	95 μΩ/Ω 28 μΩ/Ω 27 μΩ/Ω 17 μΩ/Ω 17 μΩ/Ω 20 μΩ/Ω 20 μΩ/Ω 18 μΩ/Ω 18 μΩ/Ω 19 μΩ/Ω 19 μΩ/Ω 26 μΩ/Ω 26 μΩ/Ω 50 μΩ/Ω 50 μΩ/Ω 10 mΩ/Ω	Fluke 5700A Multiproduct Calibrator
Resistance – Measure ¹	(0 to 10) Ω (10 to 100) Ω 100 to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ	16 μΩ/Ω + 81 μΩ 14 μΩ/Ω + 0.59 μΩ 12 μΩ/Ω + 0.61 μΩ 12 μΩ/Ω + 6.2 mΩ 12 μΩ/Ω + 61 mΩ 18 μΩ/Ω + 2.4 Ω 59 μΩ/Ω + 0.12 kΩ 0.59 mΩ/Ω + 1.2 kΩ 5.9 mΩ/Ω + 12 kΩ	Agilent 3458A w Opt 002 Multimeter
Capacitance 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 to 600) Hz (10 to 300) Hz	(220 to 399.9) pF (0.4 to 1.099 9) nF (1.1 to 3.299 9) nF (3.3 to 10.999 9) nF (11 to 32.999 9) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 to 1.099 99) μF (1.1 to 3.299 99) μF	0.58 % of reading + 12 pF 0.57 % of reading + 12 pF 0.57 % of reading + 12 pF 0.22 % of reading + 27 pF 0.29 % of reading + 0.12 nF 0.29 % of reading + 0.13 nF 0.29 % of reading + 0.35 nF 0.28 % of reading + 1.5 nF 0.29 % of reading + 3.5 nF	Fluke 5520A Multiproduct Calibrator



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance ¹ (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (0 to 50) Hz (0 to 20) Hz (0 to 6) Hz (0 to 2) Hz (0 to 0.6) Hz (0 to 0.2) Hz	(3.3 to 10.999 9) μ F (11 to 32.999 9) μ F (33 to 109.999) μ F (110 to 329.999) μ F (0.33 to 1.099 99) mF (1.1 to 3.299 99) mF (3.3 to 10.999 9) mF (11 to 32.999 9) mF (33 to 110) mF	0.29 % of reading + 1.3 nF 0.46 % of reading + 36 nF 0.53 % of reading + 0.12 μ F 0.53 % of reading + 0.35 μ F 0.5 % of reading + 1.5 μ F 0.52 % of reading + 3.6 μ F 0.51 % of reading + 13 μ F 0.86 % of reading + 35 μ F 1.3 % of reading + 0.13 mF	Fluke 5520A Multiproduct Calibrator
Temperature Indicator Thermocouple Simulation 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 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	0.5 °C 0.41 °C 0.36 °C 0.4 °C 0.36 °C 0.32 °C 0.37 °C 0.59 °C 0.98 °C 0.59 °C 0.22 °C 0.2 °C 0.23 °C 0.29 °C 0.33 °C 0.22 °C 0.2 °C 0.23 °C 0.29 °C 0.41 °C 0.26 °C 0.24 °C 0.3 °C 0.47 °C	Fluke 5520A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature Indicator Thermocouple Simulation ¹	Type R (0 to 250) °C	0.66 °C	Fluke 5520A Multiproduct Calibrator
	(250 to 400) °C	0.43 °C	
	(400 to 1 000) °C	0.38 °C	
	(1 000 to 1 767) °C	0.46 °C	
	Type T (-250 to -150) °C	0.73 °C	
	(-150 to 0) °C	0.32 °C	
	(0 to 120) °C	0.24 °C	
Electrical Calibration of RTD Indicating Systems ¹	(120 to 400) °C	0.17 °C	Fluke 5520A Multiproduct Calibrator
	Pt 385, 100 Ω (-200 to 0) °C	0.05 °C	
	(0 to 100) °C	0.07 °C	
	(100 to 400) °C	0.1 °C	
	(400 to 630) °C	0.12 °C	
	(630 to 800) °C	0.23 °C	
	Pt 3926, 100 Ω (-200 to 0) °C	0.05 °C	
	(0 to 100) °C	0.07 °C	
	(100 to 400) °C	0.1 °C	
	(400 to 630) °C	0.12 °C	
	Pt 385, 500 Ω (-200 to 0) °C	0.05 °C	
	(0 to 100) °C	0.06 °C	
	(100 to 400) °C	0.09 °C	
	(400 to 630) °C	0.09 °C	
	Pt 385, 1 kΩ (-200 to 0) °C	0.11 °C	
	(0 to 100) °C	0.03 °C	
	(100 to 400) °C	0.05 °C	
	(400 to 630) °C	0.07 °C	
	(400 to 630) °C	0.23 °C	
	Pt Ni 385, 100 Ω (-80 to 100) °C	0.08 °C	
(100 to 260) °C	0.14 °C		
Cu 427, 10 Ω (-100 to 260) °C	0.3 °C		



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Tesla Meter ¹ (Gauss Meter)	Up to 200 mT 200 mT to 1500 mT	5.1 % of reading + 0.35 mT 5.1 % of reading + 12 mT	Kanetec Reference Magnetic Field KanetecTM-SMF-003, TM-SMF-050, TM-SMF- 300

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure	0 dBm 50 MHz	0.027 dB	HP 432A Power Meter, HP 478A Thermistor Mount
RF Absolute Power - Measure	(-20 to 30) dBm 100 kHz to 2.6 GHz 50 MHz to 1.3 GHz (1.3 to 18) GHz (18 to 26.5) GHz	0.058 dB 0.077 dB 0.082 dB 0.09 dB	HP 8902A Measuring Receiver w /11722A Power Sensor
	(-70 to 20) dBm 10 MHz to 30 MHz 30 MHz to 4 GHz (4 to 10) GHz (10 to 15) GHz (15 to 18) GHz	0.089 dB 0.092 dB 0.094 dB 0.094 dB 0.096dB	Power Meter w /HP 8481D Power Sensor
Tuned RF Power – Measure 2.5 MHz to 26.5 MHz	(-22 to 10) dBm (-42 to -22) dBm (-50 to -42) dBm (-60 to -50) dBm (-72 to -60) dBm (-80 to -72) dBm (-92 to -80) dBm (-102 to -92) dBm (-110 to -102) dBm (-120 to -110) dBm (-127 to -120) dBm	0.15 dB 0.15 dB 0.18 dB 0.19 dB 0.21 dB 0.23 dB 0.24 dB 0.26 dB 0.28 dB 0.32 dB 0.37 dB	HP 8902A Measuring Receiver w /11792A Power Sensor
Distortion – Measure 250 kHz to 26.5 GHz	(0.01 to 100) % Distortion	0.065 % Distortion	N5531S Measuring Receiver
Distortion – Measure Fundamental Frequency	(-99 to 0) dB 20 Hz to 20 kHz 20 to 100 kHz	1.2 dB 2.3 dB	Agilent 8903A Audio Analyzer



Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation – Measure	Depths: 5 % to 99 % 150 kHz to 10 MHz	0.86 % Depth + 1 digit	HP 8902A Measuring Receiver w /11722A, 11792A, or 11793A Power Sensor
	Depths: 5 % to 20 % 10MHz to 3 GHz	2.9 % Depth + 1 digit	
	Depths: 20 % to 99 % 10 MHz to 3 GHz	0.69 % Depth + 1 digit	
	Depths: 5 % to 20 % 3 GHz to 26.5 GHz	5.2 % Depth + 1 digit	
	Depths: 20 % to 99 % 3 GHz to 26.5 GHz	1.7 % Depth + 1 digit	
	Depths: 5 % to 20 % 26.5 GHz to 31.15GHz	7.8 % Depth + 1 digit	
	Depths: 20 % to 99 % 26.5 GHz to 31.15 GHz	2.2 % Depth + 1 digit	
Amplitude Modulation – Generate	Depths: 0 % to 95 % (11 to 13.5) MHz Rate: 20 Hz to 100 kHz	0.34 % Depth	HP 11715A AM/FM Test Source
	Depths: 95 % to 99 % (11 to 13.5) MHz Rate: 20 Hz to 100 kHz	0.39 % Depth	
Frequency Modulation – Generate	10 kHz to 432 MHz Rate: DC to 100 kHz Dev.: ≤ 400 kHz peak	0.59 % Deviation	HP 11715A AM/FM Test Source
	10 kHz to 432 MHz Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	0.63% Deviation	
Frequency Modulation – Measure	250 kHz to 10 MHz Rate: 20 Hz to 10 kHz Dev.: ≤ 40 kHz peak	1.7 % of reading +5.7 Hz 1.1 % of reading +6.6 Hz	HP 8902A Measuring Receiver with HP 11722A Power Sensor
	10 MHz to 1.3 GHz Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz peak	1.8 % of reading + 5.1 Hz 1.2 % of reading + 6.1 Hz	
	10 MHz to 1.3 GHz Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	2.9 % of reading + 4 Hz 1.2 % of reading + 6.4 Hz	
	(1.3 to 26.5) GHz Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz peak	4.4 % of reading + 3.8Hz 1.2 % of reading + 7.6 Hz	

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks ¹	(1 to 100) mm (100 to 500) mm	0.11 μm + 0.6L/1000 (L: mm) 0.2 μm + 0.6L/1000 (L: mm)	DMS 680 Universal Length Measuring System, Gage Block Set Grade 0, Block Set Grade K, Long Gage Block Set
Protractors	Up to 360 °	0.13 °	Coordinate Measuring Machine/ Profile projector/ Angle Gauge Block Set
Calipers ¹	Up to 1 000 mm (Up to 39.37 inch)	0.017 mm + 0.51L	Mitutoyo Gage Block Set
Micrometers ¹ External, Internal, Depth	Up to 25 mm Up to 1 000 mm	1.2 μm + 0.002 5 μm / mm	Optical Flat, Mitutoyo Gage Block Set
Height Gages ¹	Up to 1 000 mm (Up to 24 inch)	0.005 mm	Mitutoyo Gage Block Set
Steel Ruler ^{1,2}	Up to 5 000 mm	0.037L ml	Standard Steel Ruler & Scale Lupe & Granite Surface Plate - Mitutoyo
Tape Ruler ^{1,2}	(0 to 1 000) mm (1 000 to 5 000) mm (5 000 to 10 000) mm (10 to 50 000) mm	0.039L mm	Tape and scale calibration unit KUDALE 1000mm
Laser Distance Meter	Up to 40 m	2.7 mm	Long Gage Blocks Laser Distance Meter
Glass Scales ^{1,2}	Up to 300 mm	(0.7 + 0.001 6l) μm	Standard Glass Scale Microscope
Thickness Gages ¹	Up to 12 mm (Up to 0.4 inch)	0.002 mm	Mitutoyo Gage Block Set
Feeler Gauge	Up to 1 mm (Up to 0.04 inch)	0.001 mm	DMS 680 Universal Length Measuring System
Digimatic, Dial Indicators ¹	Up to 25 mm (Up to 1 inch)	0.003 mm	Mitutoyo Dial Gage Tester (UDT-2)
Dial Test Indicators ¹	Up to 1 mm (Up to 0.04 in)	0.001 mm	Mitutoyo Calibration Tester (UDT-3)
Pin Gages, Plug Gages ¹	Up to 100 mm (Up to 4 inch)	0.002 mm	DMS 680 Universal Length Measuring System

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calibration tester Resolution: 1 μm 0.2 μm	(0 to 100) mm (0 to 5) mm	0.38 μm 0.25 μm	Gauge Block Set Grade 0
Thread Plug Gauge Pitch Diameter Major Diameter	Up to 100 mm Up to 100 mm	0.002 mm	DMS 680 Universal Length Measuring System Thread Wire Set
Thread Ring Gauge Pitch Diameter Minor Diameter	Up to 100 mm Up to 100 mm	0.002 mm	
Dial Bore Gages	Up to 50 mm (Up to 2 inch)	0.003 mm	DMS 680 Universal Length Measuring System
Ring Gauge	Up to 100 mm (Up to 4 inch)	0.82 μm	DMS 680 Universal Length Measuring System
Coordinate Measuring Machines (CMM) ^{1,2}	Axis X: 1 000 mm Axis Y: 1 000 mm Axis Z: 1 000 mm	(0.23 + 0.035 <i>l</i>) μm	Mitutoyo Long Gauge Block Set, Grade 0. Caliper Checker
	Probe Performance	0.52 μm	Sphere
Surface Roughness Tester	2.97 μm Ra 3.17 μm Ra 9.40 μm Ry	0.06 μm	Mitutoyo 178-603, Tokyo Seimitsu E-MC-S24B Roughness Specimen.
Roundness Testing Machines	Roundness (10, 50) mm	0.021 μm	Master Roundness Standard
Master Ball ²	Up to 50 mm	(0.93 + 0.0026 <i>l</i>) μm	Universal Length Measuring System Gauge Block Set Grade 0
Contour Measuring Machine ²	X axis: up to 100 mm Z axis: up to 30 mm	(0.53 + 0.002 3 <i>l</i>) μm (1.4 + 0.008 4 <i>l</i>) μm	Mitutoyo Gauge Block Set Pin Gauge Set, Master Ball
Measuring Microscopes / Profile Projectors	Up to 300 mm (Up to 12 inch)	0.004 mm	Standard Glass Scale.
Length Counter ²	0 to 30 km	0.38 <i>L</i> mm/m	Laser Distance Meter
Levels	(0 to 30) °	0.015 °	Angle Reference Standards
Length Bar / Micrometer Standard Bar ²	Up to 1 000 mm	(0.23 <i>L</i> + 6.7) μm	DMS 680 Universal Length Measuring System Long Gauge Block Set

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dimensional ² (length, hole)	Length: Up to 500 mm Hole: Up to 50 mm	$1 \mu\text{m} + 1.7L/10^6$ $0.18 \mu\text{m} + 1.2L/10^6$	CMM ACCRETECH MJUNEX Long Gauge Block Set
Surface Flatness – Local Area Flatness	Up to (1.8 X 3.6) m	41 μm	Rahn Repeat-o-Meter
Coating Thickness Meters ¹	Up to 3000 μm Up to 25 mm	2 μm 13 μm	Coating Thickness Standards
Sieves	Up to 5 mm	0.003 6 mm + 0.014 mm/mm	Profile Projector
	(5 to 125) mm	0.098 mm + 0.014 mm/mm	Digital Caliper
Needle Detector	(0.5 to 1.5) mm	0.017 mm	Ferrous and Non Ferrous Dimensional Reference Standards

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Tools ¹	(1 to 10) lbf.in (2 to 25) lbf.in (5 to 50) lbf.in (10 to 100) lbf.in (5 to 50) lbf.ft (25 to 250) lbf.ft	0.7 % of reading + 0.008 lbf.in 0.7 % of reading + 0.02 lbf.in 0.7 % of reading + 0.04 lbf.in 0.7 % of reading + 0.07 lbf.in 0.7 % of reading + 0.04 lbf.ft 0.7 % of reading + 0.19 lbf.ft	Mountz Torque Transducers BMX10i BMX25i BMX50i BMX100i BMX50F BMX250F
Torque Wrench ¹	(100 to 1 000) N·m	1.2 % of reading + 0.085 N.m	Torque Wrench Tester TOHNICHI DOTE1000N4-G
Torque Transducers ¹	(20 to 200) lbf-ft	0.01 % of reading + 0.001 lbf-ft	Mountz Arm & Standard Weight Set
Mass	(1 to 500 g), OIML E2	0.01 mg + 0.002 mg / g	Weight Set E1, XPE205, XP504
	(1 to 500 g), OIML F1	0.36 mg + 0.005 mg / g	Weight Set E2, XPE205, XP504



Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
	(1 mg to 500 g), OIML F2 (1 to 20) kg, OIML F2 (1 to 20) kg, OIML M1	0.006 mg + 0.02 mg / g 0.2 g + 0.01 mg / g 0.5 g + 0.04 mg / g	Weight Set F1, XP504 Weight Set F1, XS32001LDR Electronic Balance, Weight Set F2
Balances / Scales ¹ Class I	(1 to 20) mg (20 to 500) mg 500 mg to 5 g (5 to 10) g (10 to 20) g (20 to 50) g (50 to 100) g (100 to 150) g (150 to 200) g (200 to 300) g (300 to 500) g	0.004 8 mg 0.01 mg 0.000 021 g 0.000 027 g 0.000 038 g 0.00 0075 g 0.000 14 g 0.000 29 g 0.000 44 g 0.000 6 g 0.001 g	Weight Set E1
Balances / Scales ¹ Class II	Up to 150 g (150 to 500) g (500 to 1 200) g (1 200 to 2 500) g (2 500 to 5 000) g (5 000 to 9 000) g	0.001 7 g 0.003 8 g 0.0013 g 0.02 g 0.036g 0.039 g	Weight Set E2
Balances / Scales ¹ Class III	(0 to 500) g (0.5 to 6) kg (6 to 35) kg (35 to 60) kg (60 to 100) kg (100 to 300) kg (300 to 1 000) kg (1 000 to 2 000) kg (2 000 to 5 000) kg	0.018 g 0.17 g 5.4 g 0.013 kg 0.024 kg 0.048 kg 0.2 kg 0.46 kg 0.78 kg	Weight Set F1 Weight Set F1 Weight Set F1, F2 Weight Set F2, M2 Weight Set M2 Weight Set M2 Weight Set M2 Weight Set M2
Balances / Scales ^{1,2} Class IIII	(1 to 200) kg	0.6 R	Weight Set M2
Compression & Tension Machines, Loadcell	Up to 500 kN Up to 20 kgf	0.05 kN + 0.01 kN/kN 0.03 kgf	Load cell & Indicator Standard Weight
Force Gages	Up to 5 kgf (5 to 20) kgf (20 to 100) kgf	0.006 5 kgf 0.001 7 kgf 0.025 kgf	Class M1 and F Mass Set



Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure Gauge ¹	Up to -0.98 bar (0 to 70) bar (70 to 700) bar (700 to 1 000) bar	0.003 1 bar 0.041 bar 0.081 bar 0.38 bar	Digital Pressure Gauge
Air Velocity ¹	Up to 45 m/s	0.17 m/s + 0.004 4 m/s	Wind Tunnel and Standard Anemometer
Pneumatic Volume Flow Meters ¹	Up to 200 LPM	0.025 LPM + 0.011 LPM/LPM	Primary Air Flow Calibrator/ Mass Flow Meter TSI 4140
Hardness Testers ¹	Up to 63.2 HRC Up to 84.4 HRB	0.56 HRC 1.5 HRB	ASTM E18 Indirect Verification using Yamamoto Scientific Standard Block for Hardness
	Up to 1000 HV Up to 500 HMV	2.3 HV + 1.3 % HV 2.3 HMV + 1.3 % HMV	ASTM E92 Indirect Verification using Yamamoto Scientific Standard Block for Hardness
	Up to 83.2 HRBS	1.5 HRBS	ASTM E18 Indirect Verification using Yamamoto Scientific Standard Block for Hardness
Hardness Blocks	Up to 63.2 HRC Up to 84.4 HRB Up to 774 HV Up to 500 HMV Up to 83.2 HRBS	0.56 HRC 1.5 HRB 1.4 HV 1.5 HMV 1.5 HRBS	DLVN 62: 2000 Hardness Tester w Hardness Blocks
Burette ¹	(1 to 100) ml	0.5 µl/ml + 10 µl	Analytical Scale, Standard Weight Set, Temperature Calibrator
Pipettes & Micropipettes	(1 to 100) ml	0.4 µl/ml + 6.6 µl	
Volumetric Flasks ¹	(10 to 2 000) ml	450 µl	
Grain Moisture Tester ¹	(6 to 40) % Moisture Content	0.8 % Moisture Content	Temperature & Humidity Chamber, Analytical Balance

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Wood Moisture Tester ¹	(up to 30) %Moisture Content	0.8 %Moisture Content	Standard Decade Resistance Temperature & Humidity Chamber Analytical Balance
Hydrometer ¹	(1.12 to 1.18) g/ml	0.38 % of reading + 0.048 g/ml	Analytical Balance Standard Thermometer
Durometer – Shore A, B, C, D, D0, O Force Only	(0 to 100) duro	0.43 duro	Rubber Hardness Tester Calibrator Kudale 0-100 Electronic Balance

Photometry and Radiometry

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Light Meters ¹	(100 to 20 000) lx	1.4 % of reading	Light System Calibration VMI-PRI-002
UV-VIS Spectrophotometers ¹	(200 to 650) nm (0 to 2) Au	0.5 nm 0.007 9 Au	Standard UV-VIS Spectrophotometer HELLMA 666.000
Gloss Meter ¹	92.4 GU / 20° 94.8 GU / 60° 99.5 GU / 85°	0.7 GU 0.6 GU 0.6 GU	Standards High Gloss
Light Box Day Light D65 Day Light D50 CWF A TL84/U35	6 500 K 5 000 K 4 150 K 2 856 K 4 100 K	230 K 180 K 150 K 100 K 140 K	CL-200A Chroma Meter

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity ¹	Up to 97 %RH	2.1 %RH	Temperature and Humidity Chamber, Temp. & Humidity Meter Vaisala MI70 w HMP77B

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature - Source ¹	(-45 to 150) °C (150 to 1 200) °C (1 200 to 1 800) °C	0.06 °C 4.2 °C 6.5 °C	Ametek RTC-157B ISOTECH Pegasus 1200 Fluke 1523 w 5616-12 Nabertherm Furnace Type B Thermocouple Standard
Thermocouples (All Type)	(-45 to 150) °C (150 to 600) °C	0.17 °C 0.27 °C	Fluke 1523 w 5616-12, Temperature Bath
	(600 to 1 800) °C	3.6 °C	Type B TC with Ice Bath and Thermocouple Readout
IR Thermometers ¹	(-15 to 120) °C (100 to 200) °C (200 to 350) °C (350 to 500) °C	0.61 °C 0.75 °C 1.3 °C 1.7 °C	Fluke 4181,4180 $\lambda = 8$ to $14 \mu\text{m}$, $\epsilon = 0.95$
Temperature & Humidity Chambers ¹ Dry Oven, furnace, Autoclave, Incubator, Vacuum Oven	(-80 to 400) °C (150 to 1 200) °C (1 200 to 1 800) °C (10 to 97) %RH	0.065 °C 4.2 °C 3.2 °C 2.1 %RH	Agilent 34972A w 34901A Thermocouples Types T, K, & B, Madgetech Data Logger HiTemp 140 Madgetech Pressure data logger

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Stopwatches/Timers ¹	Up to 3 600 s	120 ms	Agilent 58503A Frequency Standard /53132A Counter
Frequency - Source ¹	1 μHz to 80 MHz 80 MHz to 26.5 GHz	5 pHz/Hz + floor needed 5 pHz/Hz	Agilent 58503A Frequency Standard / 33250A Wave Generator, Agilent 58503A Frequency Standard / 8340A Signal Generator
Frequency - Measure ¹	100 μHz to 10 Hz 10 Hz to 3 GHz (3 to 12.4) GHz (12.4 to 26.5) GHz	5 pHz/Hz	Agilent 58503A Frequency Standard /53132A Counter Agilent 58503A Frequency Standard /53151A Counter
Tachometers ¹	(1 to 100 000) rpm	0.01 % of reading	Signal Generator w Lamp



Services performed at satellite location

D1 Phu Dien UZ, Dong Nguyen Ward, Tu Son Town,
 Bac Ninh Province, Viet Nam.Satellite
 Branch Manager: Tri Nguyen

Email: tri.nguyen@techmaster.com.vn

Phone: (+28) 6266 2333

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Level Meters ¹	94 dB, 1 kHz 114 dB, 1 kHz	0.39 dB	Sound Calibrator
Vibration Meters ¹ Acceleration, Velocity	(10 to 2 000) Hz, (0.1 to 100) m/s ²	1.9 % of reading + 0.25 g 2.6 % of reading + 0.25 g	Vibration Calibration System, VMI International AB-CA200

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH meters ¹	4.00 pH 7.00 pH 10.00 pH	0.013 pH 0.013 pH 0.015 pH	Control Company Solutions
Conductivity meters ¹	1 µS/cm 10 µS/cm 84 µS/cm 1 413 µS/cm	0.83 µS/cm 0.93 µS/cm 1.4 µS/cm 9.2 µS/cm	
Refractometers	(0, 15, 40) °Brix (1 to 20) % Salinity	0.22 °Brix 0.18 % Refraction	Brix Reference Solutions Analytical Balance
Viscosity Meters ¹	1 000 mPa.s (cP) Up to 200 000 mPa.s (cP)	0.95 % of reading 2.1 % of reading	Paragon Scientific Solutions, Cannon Solutions



Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gas Detectors ¹	H ₂ S 25 ppm Concentration CO 50 ppm Concentration 100 ppm Concentration CH ₄ 50% Concentration LEL O ₂ 12% Concentration in N ₂ 18% Concentration in N ₂ NH ₃ 50 ppm Concentration	2 ppm Concentration 2.6 ppm Concentration 3.4 ppm Concentration 3 % of reading 1.4 % of reading 2.7 % of reading 3 % of reading	Standard Gases
Total Volatile Organic Compounds (TVOC) ¹	Up to 100 ppm Concentration	0.8 ppm Concentration	Standard Gas
Turbidity Meter ¹	(0 to 500) NTU (0 to 1 000) NTU	0.1 NTU + 0.01 NTU / NTU 0.2 NTU + 0.001 NTU / NTU	Turbidity Calibration Standards Solution
Alcohol meter ¹	(0 to 100) % Vol / Vol	0.24 % Vol / Vol	Reference Alcohol meter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage - Source ¹	Up to 220 mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V 220 V to 1.1 kV	8.1 μV/V + 0.8 μV 7.1 μV/V + 1 μV 8.1 μV/V + 3.5 μV 7.1 μV/V + 6.5 μV 8.1 μV/V + 80 μV 11 μV + 0.5 μV	Fluke 5700 A w Opt 03 Multiproduct Calibrator
DC Voltage - Measure ¹	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1 000) V	11 μV/V + 1.2 μV 9.5 μV/V + 1.2 μV 9.5 μV + 2.6 μV 12 μV/V + 36 μV 118 μV/V + 12 μV/V	Agilent 3458A w Opt 002 Multimeter
	(1 to 10) kV	12 μV/V + 0.12 mV	Kikusui Digital High Voltage Meter
	(10 to 40) kV	1 mV/V + 4 V	High Voltage Probe



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current - Measure ¹	Up to 100 nA 100 nA to 1 μ A (1 to 100) μ A 100 μ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	35 μ A/A + 0.05 nA 24 μ A/A + 0.05 nA 24 μ A/A + 0.95 nA 24 μ A/A + 5.9 nA 24 μ A/A + 5.9 nA 41 μ A/A + 0.6 nA 0.13 μ A/A + 0.01 mA	Agilent 3458A w Opt 002 Multimeter
	(1 to 10) A (10 to 300) A (300 to 1000) A (1 000 to 2 000) A	0.58 μ A/A 0.14 μ A/A 6.8 mA/A 4.1A	Multimeter with Current Shunt Clamp Meter
DC Current – Source ¹	Up to 220 μ A 220 μ A to 22 mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A	50 μ A/A + 8 nA 50 μ A/A + 8 nA 50 μ A/A + 80 nA 60 μ A/A + 0.8 μ A 80 μ A/A + 25 μ A	Fluke 5700A w Opt 03 Multiproduct Calibrator
	330 μ A to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 2.2 A (2.2 to 20) A	0.15 mA/A + 0.06 μ A 0.11 mA/A + 0.46 μ A 0.1 μ A/A + 8.8 μ A 0.32 μ A/A + 0.12 mA 0.66 μ A/A + 0.81 mA	Fluke 5520A Multiproduct Calibrator
	(20 to 1000) A	5.4 mA/A	Multiproduct Calibrator w Fluke Coil
AC Voltage – Source ¹	Up to 2.2 mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.55 mV/V + 4.5 μ V 0.21 mV/V + 4.5 μ V 0.11 mV/V + 4.5 μ V 0.37 mV/V + 4.5 μ V 0.85 mV/V + 7 μ V 1.1 mV/V + 13 μ V 1.7 mV/V + 25 μ V 3.4 mV/V + 25 μ V	Fluke 5700A w Opt 03 Multiproduct Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(2.2 to 22) mV		Fluke 5700A w Opt 03 Multiproduct Calibrator
	(10 to 20) Hz	0.55 mV/V + 5 μ V	
	(20 to 40) Hz	0.21 mV/V + 5 μ V	
	40 Hz to 20 kHz	0.11 mV/V + 5 μ V	
	(20 to 50) kHz	0.37 mV/V + 5 μ V	
	(50 to 100) kHz	0.85 mV/V + 7 μ V	
	(100 to 300) kHz	1.1 mV/V + 12 μ V	
	(300 to 500) kHz	1.7 mV/V + 25 μ V	
	500 kHz to 1 MHz	3.4 mV/V + 25 μ V	
	(22 to 220) mV		
	(10 to 20) Hz	0.55 mV/V + 13 μ V	
	(20 to 40) Hz	0.21 mV/V + 8 μ V	
	40 Hz to 20 kHz	0.11 mV/V + 8 μ V	
	(20 to 50) kHz	0.37 mV/V + 8 μ V	
	(50 to 100) kHz	0.85 mV/V + 25 μ V	
	(100 to 300) kHz	1.1 mV/V + 25 μ V	
	(300 to 500) kHz	1.7 mV/V + 35 μ V	
	500 kHz to 1 MHz	3.4 mV/V + 80 μ V	
	220 mV to 2.2 V		
	(10 to 20) Hz	0.5 mV/V + 80 μ V	
	(20 to 40) Hz	0.16 mV/V + 25 μ V	
	40 Hz to 20 kHz	80 μ V/V + 6 μ V	
	(20 to 50) kHz	0.13 mV/V + 16 μ V	
	(50 to 100) kHz	0.26 mV/V + 70 μ V	
(100 to 300) kHz	0.44 mV/V + 0.13 mV		
(300 to 500) kHz	1.8 mV/V + 35 mV		
500 kHz to 1 MHz	2.6 mV/V + 8.5 mV		
(2.2 to 22) V			
(10 to 20) Hz	0.55 mV/V + 0.8 mV		
(20 to 40) Hz	0.16 mV/V + 0.25 mV		
40 Hz to 20 kHz	80 μ V/V + 0.06 mV		
(20 to 50) kHz	0.13 mV/V + 0.16 mV		
(50 to 100) kHz	0.27 mV/V + 0.35 mV		
(100 to 300) kHz	0.5 mV/V + 1.5 mV		
(300 to 500) kHz	1.9 mV/V + 4.3 mV		
500 kHz to 1 MHz	3.1 mV/V + 8.5 mV		



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(22 to 220) V (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 220 V to 1.1 kV (15 to 50) Hz 50 Hz to 1 kHz	0.5 mV/V + 8 mV 0.16 mV/V + 2.5 mV 80 μV/V + 0.8 mV 0.22 mV/V + 3.5 mV 0.5 mV/V + 8 mV 2 mV/V + 90 mV 0.4 mV/V + 16 mV 80 μV/V + 3.5 mV	Fluke 5700A w Opt 03 Multiproduct Calibrator
AC Voltage – Measure ¹	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 (1 to 2) MHz 100 mV to 1 V (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 (1 to 2) MHz	0.36 mV/V + 3.5 μV 0.24 mV/V + 1.3 μV 0.35 mV/V + 1.3 μV 1.2 mV/V + 1.3 μV 5.9 mV/V + 1.3 μV 47 mV/V + 2.4 μV 0.008 mV/V + 2.4 μV 0.017 mV/V + 2.4 μV 0.035 mV/V + 2.4 μV 0.095 mV/V + 2.4 μV 0.354 mV/V + 12 μV 1.2 mV/V + 12 μV 1.8 mV/V + 12 μV 18 mV/V + 12 μV 0.08 mV/V + 48 μV 0.08 mV/V + 24 μV 0.17 mV/V + 24 μV 0.35 mV/V + 24 μV 0.95 mV/V + 24 μV 0.36 mV/V + 0.12 mV 12 mV/V + 0.12 mV 18 mV/V + 0.12 mV	Agilent 3458A w Opt 002 Multimeter



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(1 to 10) V		Agilent 3458A w Opt 002 Multimeter
	(1 to 40) Hz	0.08 mV/V + 0.47 mV	
	40 Hz to 1 kHz	0.08 mV/V + 0.24 mV	
	(1 to 20) kHz	0.17 mV/V + 0.24 mV	
	(20 to 50) kHz	0.35 mV/V + 0.24 mV	
	(50 to 100) kHz	0.95 mV/V + 0.24 V	
	(100 to 300) kHz	3.6 mV/V + 1.2 mV	
	300 kHz to 1 MHz	12 mV/V + 1.2 mV	
	(1 to 2) MHz	18 mV/V + 1.2 mV	
	(10 to 100) V		
	(1 to 40) Hz	0.24 mV/V + 4.7 mV	
	40 Hz to 1 kHz	0.24 mV/V + 2.4 mV	
	(1 to 20) kHz	0.24 mV/V + 2.4 mV	
	(20 to 50) kHz	0.43 mV/V + 2.4 mV	
	(50 to 100) kHz	0.43 mV/V + 2.4 mV	
(100 to 300) kHz	4.7 mV/V + 12 mV		
300 kHz to 1 MHz	4.7 mV/V + 12 mV		
100 V to 1 kV			
(1 to 40) Hz	0.47 mV/V + 47 mV		
40 Hz to 1 kHz	0.47 mV/V + 47 mV		
(1 to 20) kHz	0.71 mV/V + 24 mV		
(20 to 50) kHz	1.5 mV/V + 24 mV		
(50 to 100) kHz	3.6 mV/V + 2.4 mV		
	(1 to 30) kV		Kikisui Digital High Voltage Meter High Voltage Probe
	(50 to 60) Hz	0.38 kV	
AC Current – Source ¹	Up to 220 μ A		Fluke 5700A w Opt 03 Multiproduct Calibrator
	(10 to 20) Hz	0.9 mA/A	
	(20 to 40) Hz	0.5 mA/A	
	40 Hz to 1 kHz	0.3 mA/A	
	(1 to 5) kHz	0.8 mA/A	
	(5 to 10) kHz	2 mA/A	
	220 μ A to 2.2 mA		
	(10 to 20) Hz	0.9 mA/A	
	(20 to 40) Hz	0.6 mA/A	
	40 Hz to 1 kHz	0.3 mA/A	
	(1 to 5) kHz	2.5 mA/A	
	(5 to 10) kHz	5.3 mA/A	



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(2.2 to 22) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	2.6 mA/A 2 mA/A 1.8 mA/A 19 mA/A 38 mA/A	Fluke 5700A w Opt 03 Multiproduct Calibrator
	(22 to 220) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz 220 mA to 2.2 A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.7 mA/A 0.4 mA/A 0.2 mA/A 0.8 mA/A 1.9 mA/A 0.8 μA/A 1.1 mA/A 8.8 mA/A	
	(1 to 1000) A 50Hz / 60Hz	5.4 mA/A	Fluke 5520A Multiproduct Calibrator with Coil
AC Current – Measure ¹	(5 to 100) μA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz 100 μA to 10 mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz (10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	4.8 mA/A + 24 nA 1.8 mA/A + 24 nA 0.7 mA/A + 24 nA 0.7 mA/A + 24 nA 4.7 mA/A + 2.4 nA 1.8 mA/A + 2.4 nA 0.7 mA/A + 2.4 nA 0.4 mA/A + 2.4 nA 0.7 mA/A + 2.4 nA 4.7 mA/A + 4.7 nA 6.5 mA/A + 18 μA 4.7 mA/A + 24 μA 1.8 mA/A + 24 μA 0.7 mA/A + 24 μA 0.4 mA/A + 24 μA 0.7 mA/A + 24 μA 4.7 mA/A + 47 μA 6.5 mA/A + 0.18 mA	Agilent 3458A w Opt 002 Multimeter



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	100 mA to 1 A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (1 to 10) A (3 to 300) kHz (10 to 300) A (50 to 400) Hz	4.7 mA/A + 0.24 mA 1.9 mA/A + 0.24 mA 0.9 mA/A + 0.24 mA 1.2 mA/A + 0.24 mA 3.5 mA/A + 0.24 mA 12 mA/A + 0.47 mA 47 mA/A + 0.47 mA 0.007 1 A + 0.01 mA 0.34 A	Keysight 34461A Multimeter, Prodigit 7550A Precision Shunt, Clamp Meter w Flexible Probe
DC Power – Generate 33 mV to 1 020 V	0.33 mA to 330 mA 10 μW to 330 W 0.33 A to 3 A 10 mW to 3 kW 3 A to 20.5 100 mW to 21 kW	0.01 % of reading + 1.5 nW 0.11 W + 0.012 nW 1.1 5W + 0.031 μW	Fluke 5520A Multiproduct Calibrator
AC Power – Generate PF = 1 (10 to 45) Hz 33 mV to 32.9999 V 3.3 mA to 2.999 99 A (45 to 65) Hz 33 mV to 1 000 V 3.3 mA to 20.5 A	110 μW to 99 W 110 μW to 20 kW	0.18 % of reading 0.14 % of reading	Fluke 5520A Multiproduct Calibrator
Oscilloscopes ¹ - DC Voltage Into 50 Ω Into 1 MΩ Square Wave In to 50 Ω 10 Hz to 10 kHz In to 1 MΩ 10 Hz to 10 kHz Level Sine Amplitude Reference @ 50 kHz	(0 to ± 6.6) V (0 to ± 130) V 1 mV to 6.6 Vp-p 1 mV to 130 Vp-p 5 mV to 5.5 V	0.2 % of reading + 36 μV 0.039 % of reading + 37 μV 0.2 % of reading + 65 μV 0.039 % of reading + 37 μV 0.19 % of reading + 39 μV 15 mV/V + 0.49 mV	Fluke 5520A Multiproduct Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes ¹ - Edge Transition Time (Rise time) Bandwidth (relative to 50 kHz) 5 mV to 5.5 V Time Markers Into 50 Ω	< 300 ps 50 kHz to 100 MHz 100 to 300) MHz (300 to 600) MHz (600 to 1 100) MHz (1 to 50) ns 100 ns to 20 ms 50 ms to 5 s	80 ps 14 mV/V + 0.12 mV 17 mV/V + 0.14 mV 32 mV/V + 0.15 mV 40 mV/V + 0.16 mV 0.001 1 % of reading + 0.048 ps 0.000 2 % of reading + 7 ps 0.4% of reading	Fluke 5520A Multiproduct Calibrator
LCR Meters ¹ Resistance (20 Hz to 1 MHz)	Up to 0.1mΩ 0.1mΩ to 1 Ω 1Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ 1kΩ to 10 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1 MΩ 1MΩ to 10 MΩ 10 MΩ to 100 MΩ	0.2 % of reading + 0.003 mΩ 0.1 % of reading + 2.4 mΩ 0.05 % of Reading + 0.0026 Ω 0.02 % of Reading + 0.01 Ω 0.02 % of Reading + 0.092 Ω 0.02 % of Reading + 0.92Ω 0.02 % of Reading + 0.01 kΩ 0.03 % of Reading + 0.093 kΩ 0.05 % of Reading + 1.3 kΩ 0.5 % of Reading + 0.63 MΩ	M550 MEATEST RLC Calibrator
LCR Meters ¹ Capacitance (20 Hz to 1 MHz)	Up to 10 pF 10 pF to 100 pF 100 pF to 1 nF 1 nF to 10 nF 10 nF to 100 nF 100 nF to 1 μF 1 μF to 10 μF 10 μF to 100 μF	1 % of Reading + 0.14 pF 0.1 % of Reading+ 0.15 pF 0.05 % of Reading + 0.28 pF 0.05 % of Reading + 0.0014 nF 0.05 % of Reading + 0.014 nF 0.05 % of Reading + 0.14 nF' 0.1 % of Reading + 0.004 μF 0.1 % of Reading + 0.058 μF	M550 MEATEST RLC Calibrator
LCR Meters ¹ Inductance (20 Hz to 1 MHz)	Up to 10 μH 10 μH to 100 μH 100 μH to 1 mH 1 mH to 10 mH 10 mH to 100 mH 10 mH to 1 H 1H to 10 H	0.3 % of Reading + 0.006 μH 0.2 % of Reading + 0.058 μH 0.1 % of Reading + 0.63 μH 0.1 % of Reading + 1.3 μH 0.1 % of Reading + 13 μH 0.1 % of Reading + 0.9 mH 0.1 % of Reading + 1.5 mH	M550 MEATEST RLC Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
HiPot Testers ¹ Impulse Tester	Up to 10 kV, 50 Hz Up to 40 kV, 50 Hz	0.001 2 kV+0.012 kV	Kikisui 149-10A Voltmeter High Voltage Probe w Multimeter, Kikisui TOS 1200 Current Calibrator Digital Oscilloscope
HiPot Testers ¹ Impulse Tester	Up to 100 mA, 50 Hz	0.015 mA+0.000 6 2mA/ mA	High Voltage Probe w Multimeter, Kikisui TOS 1200 Current Calibrator Digital Oscilloscope
Insulation Testers ¹	Up to 10 kV Up to 100 GΩ	0.002 % of reading + 1.5 V 0.09 % of reading + 1.5 MΩ	Kikisui 149-10A Voltmeter Time Electronics 5069 Ins- Cal Insulation Tester
Resistance – Source ¹	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) k (33 to 110) kΩ (110 to 330) kΩ 0.33 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ	0.1 mΩ/Ω + 8 mΩ 0.1 mΩ/Ω + 17 mΩ 1 mΩ/Ω + 17 mΩ 1 mΩ/Ω + 17 mΩ 0.1 mΩ/Ω + 0.07 Ω 0.1 mΩ/Ω + 0.08 Ω 0.1 mΩ/Ω + 0.71 Ω 0.1 mΩ/Ω + 0.70 Ω 0.1 mΩ/Ω + 7 Ω 0.1 mΩ/Ω + 7 Ω 0.2 mΩ/Ω + 64 Ω 0.2 mΩ/Ω + 64 Ω 0.7 mΩ/Ω + 6.4 kΩ 1 mΩ/Ω + 6.1 kΩ 6 mΩ/Ω + 6.4 kΩ 6 mΩ/Ω + 19 kΩ	Fluke 5520A Multiproduct Calibrator
Resistance – Source Fixed Points ¹	1.9 Ω 10 Ω 10 Ω 100 Ω 190 Ω	95 μΩ/Ω 28 μΩ/Ω 27 μΩ/Ω 17 μΩ/Ω 17 μΩ/Ω	Fluke 5700A Multiproduct Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
Resistance – Source Fixed Points ¹	1 kΩ	20 μΩ/Ω	Fluke 5700A Multiproduct Calibrator	
	1.9 kΩ	20 μΩ/Ω		
	10 kΩ	18 μΩ/Ω		
	19 kΩ	18 μΩ/Ω		
	100 kΩ	19 μΩ/Ω		
	190 kΩ	19 μΩ/Ω		
	1 MΩ	26 μΩ/Ω		
	1.9 MΩ	26 μΩ/Ω		
	10 MΩ	50 μΩ/Ω		
	19 MΩ	50 μΩ/Ω		
	100 MΩ	10 mΩ/Ω		
Resistance – Measure ¹	(0 to 10) Ω	16 μΩ/Ω + 81 μΩ	Agilent 3458A w Opt 002 Multimeter	
	(10 to 100) Ω	14 μΩ/Ω + 0.59 μΩ		
	100 to 1 kΩ	12 μΩ/Ω + 0.61 μΩ		
	(1 to 10) kΩ	12 μΩ/Ω + 6.2 mΩ		
	(10 to 100) kΩ	12 μΩ/Ω + 61 mΩ		
	(0.1 to 1) MΩ	18 μΩ/Ω + 2.4 Ω		
	(1 to 10) MΩ	59 μΩ/Ω + 0.12 kΩ		
(10 to 100) MΩ	0.59 mΩ/Ω + 1.2 kΩ			
(0.1 to 2) GΩ	5.9 mΩ/Ω + 12 kΩ			
Capacitance ¹	10 Hz to 10 kHz	(220 to 399.9) pF	0.58 % of reading + 12 pF	Fluke 5520A Multiproduct Calibrator
	10 Hz to 10 kHz	(0.4 to 1.099 9) nF	0.57 % of reading + 12 pF	
	10 Hz to 3 kHz	(1.1 to 3.299 9) nF	0.57 % of reading + 12 pF	
	10 Hz to 1 kHz	(3.3 to 10.999 9) nF	0.22 % of reading + 27 pF	
	10 Hz to 1 kHz	(11 to 32.999 9) nF	0.29 % of reading + 0.12 nF	
	10 Hz to 1 kHz	(33 to 109.999) nF	0.29 % of reading + 0.13 nF	
	10 Hz to 1 kHz	(110 to 329.999) nF	0.29 % of reading + 0.35 nF	
	(10 to 600) Hz	(0.33 to 1.099 99) μF	0.28 % of reading + 1.5 nF	
	(10 to 300) Hz	(1.1 to 3.299 99) μF	0.29 % of reading + 3.5 nF	
	(10 to 150) Hz	(3.3 to 10.999 9) μF	0.29 % of reading + 1.3 nF	
	(10 to 120) Hz	(11 to 32.999 9) μF	0.46 % of reading + 36 nF	
	(10 to 80) Hz	(33 to 109.999) μF	0.53 % of reading + 0.12 μF	
	(0 to 50) Hz	(110 to 329.999) μF	0.53 % of reading + 0.35 μF	
	(0 to 20) Hz	(0.33 to 1.099 99) mF	0.5 % of reading + 1.5 μF	
	(0 to 6) Hz	(1.1 to 3.299 99) mF	0.52 % of reading + 3.6 μF	
	(0 to 2) Hz	(3.3 to 10.999 9) mF	0.51 % of reading + 13 μF	
	(0 to 0.6) Hz	(11 to 32.999 9) mF	0.86 % of reading + 35 μF	
(0 to 0.2) Hz	(33 to 110) mF	1.3 % of reading + 0.13 mF		



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature Indicator Thermocouple Simulation ¹	Type B (600 to 800) °C	0.5 °C	Fluke 5520A Multiproduct Calibrator
	(800 to 1 000) °C	0.41 °C	
	(1 000 to 1 550) °C	0.36 °C	
	(1 550 to 1 820) °C	0.4 °C	
	Type C (0 to 150) °C	0.36 °C	
	(150 to 650) °C	0.32 °C	
	(650 to 1 000) °C	0.37 °C	
	(1000 to 1 800) °C	0.59 °C	
	(1 800 to 2 316) °C	0.98 °C	
	Type E (-250 to -100) °C	0.59 °C	
	(-100 to -25) °C	0.22 °C	
	(-25 to 350) °C	0.2 °C	
	(350 to 650) °C	0.23 °C	
(650 to 1 000) °C	0.29 °C		
Temperature Indicator Thermocouple Simulation ¹	Type J (-210 to -100) °C	0.33 °C	Fluke 5520A Multiproduct Calibrator
	(-100 to -30) °C	0.22 °C	
	(-30 to 150) °C	0.2 °C	
	(150 to 760) °C	0.23 °C	
	(760 to 1 200) °C	0.29 °C	
	Type K (-200 to -100) °C	0.41 °C	
	(-100 to -25) °C	0.26 °C	
	(-25 to 120) °C	0.24 °C	
	(120 to 1 000) °C	0.3 °C	
	(1 000 to 1 372) °C	0.47 °C	
	Type R (0 to 250) °C	0.66 °C	
	(250 to 400) °C	0.43 °C	
	(400 to 1 000) °C	0.38 °C	
	(1 000 to 1 767) °C	0.46 °C	
	Type T (-250 to -150) °C	0.73 °C	
	(-150 to 0) °C	0.32 °C	
	(0 to 120) °C	0.24 °C	
(120 to 400) °C	0.17 °C		



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of RTD Indicating Systems ¹	Pt 385, 100 Ω		Fluke 5520A Multiproduct Calibrator
	(-200 to 0) °C	0.05 °C	
	(0 to 100) °C	0.07 °C	
	(100 to 400) °C	0.1 °C	
	(400 to 630) °C	0.12 °C	
	(630 to 800) °C	0.23 °C	
	Pt 3926, 100 Ω		
	(-200 to 0) °C	0.05 °C	
	(0 to 100) °C	0.07 °C	
	(100 to 400) °C	0.1 °C	
	(400 to 630) °C	0.12 °C	
	Pt 385, 500 Ω		
(-200 to 0) °C	0.05 °C		
(0 to 100) °C	0.06 °C		
(100 to 400) °C	0.09 °C		
(400 to 630) °C	0.11 °C		
Electrical Calibration of RTD Indicating Systems ¹	Pt 385, 1 kΩ		Fluke 5520A Multiproduct Calibrator
	(-200 to 0) °C	0.03 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 400) °C	0.07 °C	
	(400 to 630) °C	0.23 °C	
	Pt Ni 385, 100 Ω		
	(-80 to 100) °C	0.08 °C	
	(100 to 260) °C	0.14 °C	
Cu 427, 10 Ω			
(-100 to 260) °C	0.3 °C		
Tesla Meter ¹ (Gauss Meter)	Up to 200 mT 200 mT to 1500 mT	5.1 % of reading + 0.35mT 5.1 % of reading + 12 mT	Kanetec Reference Magnetic Field Kanetec TM -SMF-003, TM-SMF-050, TM-SMF-300

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure	0 dBm 50 MHz	0.027 dB	RF Power – Measure



Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Absolute Power - Measure	(-20 to 30) dBm 100 kHz to 2.6 GHz 50 MHz to 1.3 GHz (1.3 to 18) GHz (18 to 26.5) GHz	0.058 dB 0.077 dB 0.082 dB 0.09 dB	HP 8902A Measuring Receiver w /11722A Power Sensor
	(-70 to 20) dBm (10 to 30) MHz 30 MHz to 4 GHz (4 to 10) GHz (10 to 15) GHz (15 to 18) GHz	0.089 dB 0.092 dB 0.094 dB 0.094 dB 0.096 dB	Power Meter w /HP 8481D Power Sensor
Tuned RF Power – Measure 2.5 MHz to 26.5 MHz	(-22 to 10) dBm (-42 to -22) dBm (-50 to -42) dBm (-60 to -50) dBm (-72 to -60) dBm (-80 to -72) dBm (-92 to -80) dBm (-102 to -92) dBm (-110 to -102) dBm (-120 to -110) dBm (-127 to -120) dBm	0.15 dB 0.15 dB 0.18 dB 0.19 dB 0.21 dB 0.23 dB 0.24 dB 0.26 dB 0.28 dB 0.32 dB 0.37 dB	HP 8902A Measuring Receiver w /11792A Power Sensor
Distortion – Measure kHz to 26.5 GHz	(0.01 to 100) % Distortion	0.065 % Distortion	N5531S Measuring Receiver
Distortion – Measure Fundamental Frequency 20 Hz to 20 kHz 20 to 100 kHz	(-99 to 0) dB	1.2 dB	Agilent 8903A Audio Analyzer
	(-99 to 0) dB	2.3 dB	



Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation – Measure	Depths: 5 % to 99 % 150 kHz to 10 MHz	0.86 % Depth + 1 digit	HP 8902A Measuring Receiver w /11722A, 11792A, or 11793A Power Sensor
	Depths: 5 % to 20 % 10MHz to 3 GHz	2.9 % Depth + 1 digit	
	Depths: 20 % to 99 % 10 MHz to 3 GHz	0.69 % Depth + 1 digit	
	Depths: 5 % to 20 % 3 GHz to 26.5 GHz	5.2 % Depth + 1 digit	
	Depths: 20 % to 99 % 3 GHz to 26.5 GHz	1.7 % Depth + 1 digit	
	Depths: 5 % to 20 % 26.5 GHz to 31.15GHz	7.8 % Depth + 1 digit	
	Depths: 20 % to 99 % 26.5 GHz to 31.15 GHz	2.2 % Depth + 1 digit	
Amplitude Modulation – Generate	10 kHz to 432 MHz Rate: DC to 100 kHz Dev.: ≤ 400 kHz peak	0.59 % Deviation	HP 11715A AM/FM Test Source
	10 kHz to 432 MHz Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	0.63 % Deviation	
Frequency Modulation – Generate	10 kHz to 432 MHz Rate: DC to 100 kHz Dev.: ≤ 400 kHz peak	0.59 % Deviation	HP 11715A AM/FM Test Source
	10 kHz to 432 MHz Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	0.63 % Deviation	



Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency Modulation – Measure	250 kHz to 10 MHz Rate: 20 Hz to 10 kHz Dev.: ≤ 40 kHz peak	1.7 % of reading + 5.7 Hz 1.1 % of reading + 6.6 Hz	HP 8902A Measuring Receiver with HP 11722A Power Sensor
	10 MHz to 1.3 GHz Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz peak	1.8 % of reading + 5.1 Hz 1.2 % of reading + 6.1 Hz	
	10 MHz to 1.3 GHz Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	2.9 % of reading + 4 Hz 1.2 % of reading + 6.4 Hz	
	(1.3 to 26.5) GHz Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz peak	4.4 % of reading + 3.8Hz 1.2 % of reading + 7.6 Hz	
Frequency Modulation – Measure	(1.3 to 26.5) GHz Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz peak	0.79 % Deviation + 1 digit	HP 8902A Measuring Receiver with HP 11722A Power Sensor

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Protractors	Up to 360 °	0.13 °	Coordinate Measuring Machine/ Profile projector/ Angle Gauge Block Set
Calipers ^{1,2}	Up to 1 000 mm Up to 39.37 inch	0.017 mm + 0.51L	Mitutoyo Gage Block Set
Micrometers ¹ External, Internal, Depth	Up to 25 mm Up to 1 000 mm	1.2 μm + 0.002 5 μm / mm	Optical Flat, Mitutoyo Gage Block Set
Height Gages ¹	Up to 1 000 mm (Up to 24 inch)	0.005 mm	Mitutoyo Gage Block Set
Steel Ruler ^{1,2}	Up to 5 000 mm	0.037L mm	Standard Steel Ruler & Scale Lupe & Granite Surface Plate - Mitutoyo

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Tape Ruler ^{1,2}	(0 to 1 000) mm (1 000 to 5 000) mm (5 000 to 10 000) mm (10 to 50 000) mm	0.039L mm	Tape and scale calibration unit KUDALE 1000mm
Laser Distance Meter	Up to 40 m	2.7 mm	Long Gauge Blocks Laser Distance Meter
Thickness Gages ¹	Up to 12 mm (Up to 0.4 inch)	0.002 mm	Mitutoyo Gage Block Set
Feeler Gauge	Up to 1 mm (Up to 0.04 inch)	0.002 mm	Micrometer
Digimatic, Dial Indicators ¹	Up to 25 mm (Up to 1 inch)	0.003 mm	Mitutoyo Dial Gage Tester (UDT-2)
Dial Test Indicators ¹	Up to 1 mm (Up to 0.04 in)	0.001 mm	Mitutoyo Calibration Tester (UDT-3)
Pin Gages, Plug Gages ¹	Up to 100 mm (Up to 4 inch)	0.001 9 mm	Micrometer
Calibration tester Resolution: 1 μm 0.2 μm	(0 to 100) mm (0 to 5) mm	0.38 μm 0.25 μm	Gauge Block Set Grade 0
Dial Bore Gages	Up to 50 mm (Up to 2 inch)	0.003 mm	DMS 680 Universal Length Measuring System
Ring Gauge	Up to 100 mm (Up to 4 inch)	0.82 μm	DMS 680 Universal Length Measuring System
Coordinate Measuring Machines (CMM) ^{1,2}	Axis X: 1000 mm Axis Y: 1000 mm Axis Z: 1000 mm	(0.23 + 0.035l) μm	Mitutoyo Long Gauge Block Set, Grade 0. Caliper Checker
	Probe Performance	0.52 μm	Sphere
Surface Roughness Tester	2.97 μm Ra 3.17 μm Ra 9.40 μm Ry	0.06 μm	Mitutoyo 178-603, Tokyo Seimitsu E-MC- S24B, Roughness Specimen.
Roundness Testing Machines	Roundness (10, 100) mm	0.021 μm	Master Roundness Standard
Contour Measuring Machine ²	X axis: up to 100 mm Z axis: up to 30 mm	(0.53 + 0.002 3l) μm (1.4 + 0.008 4l) μm	Mitutoyo Gauge Block Set Pin Gauge Set Master Ball

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Measuring Microscopes / Profile Projectors	Up to 300 mm (Up to 12 inch)	0.004 mm	Standard Glass Scale.
Length Counter ²	(0 to 30) km	0.38L mm/m	Digimatic Caliper Digital Tachometer
Levels	(0 to 30) °	0.015 °	Angle Reference Standards
Dimensional ² (length, hole)	Length: Up to 500 mm Hole: Up to 50 mm	1 μm + 1.7*L/10 ⁶ 0.18 μm + 1.2*L/10 ⁶	CMM ACCRETECH MJUNEX Long Gauge Block Set
Surface Flatness – Local Area Flatness	Up to (1.8 X 3.6) m	41 μm	Rahn Repeat-o-Meter
Coating Thickness Meters ¹	Up to 3 000 μm Up to 25 mm	2 μm 13 μm	Coating Thickness Standards
Sieves	Up to 5 mm (5 to 125) mm	0.003 6 mm + 0.014 mm/mm 0.098 mm + 0.014 mm/mm	Profile Projector Digital Caliper
Needle Detector	(0.5 to 1.5) mm	0.017 mm	Ferrous and Non Ferrous Dimensional Reference Standards

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Wrench ¹	(100 to 1 000) N·m	1.2 % + 0.085 N.m	Torque Wrench Tester TOHNICHI DOTE1000N4-G
Torque Tools ¹	(1 to 10) lbf.in (2 to 25) lbf.in (5 to 50) lbf.in (10 to 100) lbf.in (5 to 50) lbf-ft (25 to 250) lbf-ft	0.7 % of reading + 0.008 lbf.in 0.7 % of reading + 0.02 lbf.in 0.7 % of reading + 0.04 lbf.in 0.7 % of reading + 0.07 lbf.in 0.7 % of reading + 0.04 lbf-ft 0.7 % of reading + 0.19 lbf-ft	Mountz Torque Transducers BMX10i BMX25i BMX50i BMX100i BMX50F BMX250F
Torque Transducers ¹	(20 to 200) lbf-ft	0.01 % of reading + 0.001 lbf-ft	Mountz Arm & Standard Weight Set
Mass OIML E2	(1 to 500) g	0.01 mg + 0.002 mg / g	Weight Set E1, XPE205, XP504



Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass OIML F1	(1 to 500) g	0.36 mg + 0.005 mg / g	Weight Set E2, XPE205, XP504
Mass OIML F2	1 mg to 500 g (1 to 20) kg	0.006 mg + 0.02 mg / g 0.2 g + 0.01 mg / g	Weight Set F1, XP504 Weight Set F1,
Mass OIML M1	(1 to 20) kg	0.5 g + 0.04 mg / g	XS32001LDR Electronic Balance, Weight Set F2
Balances / Scales ¹ Class I	(1 to 20) mg (20 to 500) mg 500 mg to 5 g (5 to 10) g (10 to 20) g (20 to 50) g (50 to 100) g (100 to 150) g (150 to 200) g (200 to 300) g (300 to 500) g	0.004 8 mg 0.01 mg 0.000 021 g 0.000 027 g 0.000 038 g 0.00 0075 g 0.000 14 g 0.000 29 g 0.000 44 g 0.000 6 g 0.001 g	Weight Set E1
Balances / Scales ¹ Class II	Up to 150 g (150 to 500) g (500 to 1 200) g (1 200 to 2 500) g (2 500 to 5 000) g (5 000 to 9 000) g	0.001 7 g 0.003 8 g 0.0013 g 0.02 g 0.036g 0.039 g	Weight Set E2
Balances / Scales ¹ Class III	(0 to 500) g (0.5 to 6) kg (6 to 35) kg (35 to 60) kg (60 to 100) kg (100 to 300) kg (300 to 1 000) kg (1 000 to 2 000) kg (2 000 to 5 000) kg	0.018 g 0.17 g 5.4 g 0.013 kg 0.024 kg 0.048 kg 0.2 kg 0.46 kg 0.78 kg	Weight Set F1 Weight Set F1 Weight Set F1, F2 Weight Set F2, M2 Weight Set M2 Weight Set M2 Weight Set M2 Weight Set M2
Balances / Scales ^{1,2} Class IIII	(1 to 200) kg	0.6 R	Weight Set M2
Compression & Tension Machines, Loadcell	Up to 500 kN Up to 20 kgf	0.05 kN + 0.01 kN/kN 0.03 kgf	Load cell & Indicator Standard Weight
Force Gages	Up to 5 kgf (5 to 20) kgf (20 to 100) kgf	0.006 5 kgf 0.001 7 kgf 0.025 kgf	Class M1 and F Mass Set

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure Gauge ¹	Up to -0.98 bar (0 to 70) bar (70 to 700) bar (700 to 1 000) bar	0.003 1 bar 0.041 bar 0.081 bar 0.38 bar	Digital Pressure Gauge
Air Velocity ¹	Up to 45 m/s	0.17 m/s + 0.004 4 m/s	Wind Tunnel and Standard Anemometer
Pneumatic Volume Flow Meters ¹	Up to 200 LPM	0.025 LPM + 0.011 LPM/LPM	Primary Air Flow Calibrator/ Mass Flow Meter TSI 4140
Hardness Testers ¹	Up to 63.2 HRC Up to 84.4 HRB	0.56 HRC 1.5 HRB	ASTM E18 Indirect Verification using Yamamoto Scientific Standard Block for Hardness
	Up to 1000 HV Up to 500 HMV	2.3 HV + 1.3% HV 2.3 HMV + 1.3% HMV	ASTM 92 Indirect Verification using Yamamoto Scientific Standard Block for Hardness
Hardness Testers ¹	Up to 83.2 HRBS	1.5 HRBS	ASTM 18 Indirect Verification using Yamamoto Scientific Standard Block for Hardness
Hardness Blocks	Up to 63.2 HRC Up to 84.4 HRB Up to 774 HV Up to 500 HMV Up to 83.2 HRBS	0.56 HRC 1.5 HRB 1.4HV 1.5HMV 1.5 HRBS	DLVN 62: 2000 Hardness Tester w Hardness Blocks
Burette ¹	(1 to 100) ml	0.5 µl/ml + 10 µl	Analytical Scale, Standard Weight Set, Temperature Calibrator
Pipettes & Micropipettes	(1 to 100) ml	0.4 µl/ml + 6.6 µl	
Volumetric Flasks ¹	(10 to 2 000) ml	450 µl	
Grain Moisture Tester ¹	(6 to 40) %Moisture Content	0.8 %Moisture Content	Temperature & Humidity Chamber, Analytical Balance



Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Wood Moisture Tester ¹	Up to 30 %Moisture Content	0.8 %Moisture Content	Standard Decade Resistance Temperature & Humidity Chamber Analytical Balance
Hydrometer ¹	Up to 1.5 g/ml	0.003 g/ml	Analytical Balance Standard Thermometer
Durometer – Shore A, B, C, D, D0, O Force Only	(0 to 100) duro	0.43 duro	Rubber Hardness Tester Calibrator Kudale 0-100 Electronic Balance

Photometry and Radiometry

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
UV-VIS Spectrophotometers ¹	(200 to 650) nm (0 to 2) Au	0.5 nm 0.007 9 Au	Standard UV-VIS Spectrophotometer HELLMA 666.000
Gloss Meter ¹	92.4 GU / 20° 94.8 GU / 60° 99.5 GU / 85°	0.7 GU 0.6 GU 0.6 GU	Standards High Gloss
Light Box ¹ Day Light D65 Day Light D50 CWF A TL84/U35	6 500 K 5 000 K 4 150 K 2 856 K 4 100 K	230 K 180 K 150 K 100 K 140 K	CL-200A Chroma Meter

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity ¹	Up to 97 %RH	2.1 %RH	Temperature and Humidity Chamber, Temp. & Humidity Meter Vaisala MI70 w HMP77B

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature - Source ¹	(-45 to 150) °C (150 to 1 200) °C (1 200 to 1 800) °C	0.06 °C 4.2 °C 6.5 °C	Ametek RTC-157B ISOTECH Pegasus 1200 Fluke 1523 w 5616-12 Nabertherm Furnance Type B thermocouple Standard
Thermocouples (All Type)	(-45 to 150) °C (150 to 600) °C	0.17 °C 0.27 °C	Fluke 1523 w 5616-12, Temperature Bath
	(600 to 1 800) °C	3.6 °C	Type B TC with Ice Bath and Thermocouple Readout
IR Thermometers ¹	(-15 to 120) °C (100 to 200) °C (200 to 350) °C (350 to 500) °C	0.61 °C 0.75 °C 1.3 °C 1.7 °C	Fluke 4181,4180 $\lambda = 8$ to $14 \mu\text{m}$, $\epsilon = 0.95$
Temperature & Humidity Chambers ¹ Dry Oven Furnace Autoclave Incubator Vacuum Oven	(-80 to 400) °C (150 to 1 200) °C (1 200 to 1 800) °C (10 to 97) %RH	0.065 °C 4.2 °C 3.2 °C 2.1 %RH	Agilent 34972A w 34901A Thermocouples Type T & K & B, Madgetech Data Logger HiTemp 140 Madgetech Pressure data logger

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Stopwatches/Timers ¹	Up to 3 600 s	120 ms	Agilent 58503A Frequency Standard /53132A Counter
Frequency - Source ¹	1 μHz to 80 MHz 80 MHz to 26.5 GHz	5 pHz/Hz + floor needed 5 pHz/Hz	Agilent 58503A Frequency Standard / 33250A Wave Generator, Agilent 58503A Frequency Standard / 8340A Signal Generator
Frequency - Measure ¹	100 μHz to 10 Hz 10 Hz to 3 GHz (3 to 12.4) GHz (12.4 to 26.5) GHz	5 pHz/Hz	Agilent 58503A Frequency Standard /53132A Counter Agilent 58503A Frequency Standard /53151A Counter
Tachometers ¹	(1 to 100 000) rpm	0.01 % of reading	Signal Generator w Lamp

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 ($k=2$), corresponding to a confidence level of approximately 95%.

Notes:

1. On-site calibration service is available for this parameter, since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope
2. L = length in meters, l = length in millimeters, R = resolution of unit under test.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-1868.



Vice President

