



CERTIFICATE OF ACCREDITATION

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

This is to certify that

Micro Precision Calibration Pte. Ltd.
Blk 5008 Ang Mo Kio Ave 5, #07-02/03, Tech Place II
Singapore 569874

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

ISO/IEC 17025:2017

and national standards

ANSI/NCSL Z540-1-1994 (R2002) and
ANSI/NCSL Z540.3-2006 (R2013)

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-1969.15

Certificate Number


ANAB Approval

Certificate Valid Through: 10/31/2020
Version No. 007 Issued: 06/04/2019



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,
ANSI/NCSL Z540-1-1994 (R2002) AND ANSI/NCSL Z540.3-2006 (R2013)**

Micro Precision Calibration Pte. Ltd.

Blk 5008 Ang Mo Kio Ave 5, #07-02/03, Tech Place II
Singapore 569874

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CALIBRATION

Valid to: **October 31, 2020**

Certificate Number: **AC-1969.15**

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound ¹ (125 to 2 000) Hz 4 000 Hz	(74 to 114) dB SPL (74 to 114) dB SPL	0.34 dB 0.45 dB	Sound calibrator Sound meter Electronic counter

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conductivity Meters ¹	1015.6 µS 1408.8 µS 111.32 mS	3.4 µS 3.9 µS 0.4 mS	Standard Conductivity Solutions
pH Meters ¹	(4, 7, 10) pH units	0.019 pH unit	Standard pH Solutions

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source ¹ Fixed Values	1 V 1.018V 10 V	1.6 µV/V 1.6 µV/V 1.2 µV/V	DC Reference Standard



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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 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	10 $\mu\text{V/V} + 0.5 \mu\text{V}$ 6 $\mu\text{V/V} + 0.8 \mu\text{V}$ 4 $\mu\text{V/V} + 3 \mu\text{V}$ 4 $\mu\text{V/V} + 4.5 \mu\text{V}$ 4 $\mu\text{V/V} + 4 \mu\text{V}$ 5 $\mu\text{V/V} + 5 \mu\text{V}$	Multiproduct Calibrator
DC Voltage - Measure	Up to 100 mV 100 mV to 1 V (1 to 10) V (20 to 100) V 100 V to 1 kV	6.1 $\mu\text{V/V} + 0.3 \mu\text{V}$ 5.0 $\mu\text{V/V} + 0.3 \mu\text{V}$ 5.0 $\mu\text{V/V} + 0.5 \mu\text{V}$ 7.3 $\mu\text{V/V} + 30 \mu\text{V}$ 26 $\mu\text{V/V} + 0.10 \text{ mV}$	Multimeter
	(1 to 10) kV (10 to 20) kV (20 to 70) kV	0.3 mV/V 0.3 mV/V 0.3 mV/V	High Voltage Meter with Probe
DC Current - Source ¹	Up to 220 μA 220 μA to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A	41 $\mu\text{A/A} + 7 \text{ nA}$ 34 $\mu\text{A/A} + 8 \text{ nA}$ 35 $\mu\text{A/A} + 45 \text{ nA}$ 46 $\mu\text{A/A} + 0.8 \mu\text{A}$ 82 $\mu\text{A/A} + 13 \mu\text{A}$	Multiproduct Calibrator
DC High Current - Source ¹	(2.2 to 11) A	0.17 mA/A	Multiproduct Calibrator
	(11 to 20) A (20 to 1 000) A	1.5 mA/A + 1 mA 4.6 mA/A	Multiproduct Calibrator with 50 turn Coil
DC Current ¹ – Measure	Up to 100 nA 100 nA to 1 μA (1 to 10) μA (10 to 100) μA 100 μA to 10 mA (10 to 100) mA 100 mA to 1 A	35 $\mu\text{A/A} + 400 \mu\text{A}$ 25 $\mu\text{A/A} + 40 \mu\text{A}$ 25 $\mu\text{A/A} + 10 \mu\text{A}$ 25 $\mu\text{A/A} + 5 \mu\text{A}$ 25 $\mu\text{A/A} + 5 \mu\text{A}$ 40 $\mu\text{A/A} + 5 \mu\text{A}$ 0.12 mA/A + 10 μA	Multimeter
	(1 to 20) A (20 to 300) A	0.14 mA/A 3.2 mA/A	Fluke Shunt w/ Multimeter
Inductance – Source at 1 kHz	(1 to 10) mH (10 to 100) mH 100 mH to 1 H (1 to 10) H	0.03 mH 0.15 mH 2 mH 11 mH	Decade Inductor
Resistance - Source ¹ Fixed Points	1 Ω 10 k Ω 1 M Ω to 1G Ω	10 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 1.5 m Ω/Ω	Standard Resistors



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance - Source ¹ Fixed Points	1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 k Ω 1.9 k Ω 10 k Ω 19 k Ω 100 k Ω 190 k Ω 1 M Ω 1.9 M Ω 10 M Ω 19 M Ω 100 M Ω	91 $\mu\Omega/\Omega$ 24 $\mu\Omega/\Omega$ 24 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 8.5 $\mu\Omega/\Omega$ 8.5 $\mu\Omega/\Omega$ 8.5 $\mu\Omega/\Omega$ 8.5 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 18 $\mu\Omega/\Omega$ 18 $\mu\Omega/\Omega$ 37 $\mu\Omega/\Omega$ 46 $\mu\Omega/\Omega$ 0.1 m Ω/Ω	Multiproduct Calibrator
Resistance – Measure ¹	(0 to 100) Ω 100 Ω to 100 k Ω 100 k Ω to 1 M Ω (1 to 10) M Ω (10 to 100) M Ω 100 M Ω to 1 G Ω	14 $\mu\Omega/\Omega$ 12 $\mu\Omega/\Omega$ 18 $\mu\Omega/\Omega$ 55 $\mu\Omega/\Omega$ 0.57 m Ω/Ω + 1.1 k Ω 5.7 m Ω/Ω + 11 k Ω	Multimeter
Electrical Simulation of Thermocouple Indicating Systems ¹	Type E (-250 to -100) $^{\circ}\text{C}$ (-100 to 650) $^{\circ}\text{C}$ (650 $^{\circ}\text{C}$ to 1 000) $^{\circ}\text{C}$ Type J (-210 to -100) $^{\circ}\text{C}$ (-100 to 760) $^{\circ}\text{C}$ (760 to 1 200) $^{\circ}\text{C}$ Type K (-200 to -100) $^{\circ}\text{C}$ (-100 to 120) $^{\circ}\text{C}$ (120 to 1 000) $^{\circ}\text{C}$ (1 000 to 1 372) $^{\circ}\text{C}$ Type S (0 to 250) $^{\circ}\text{C}$ (250 to 1 000) $^{\circ}\text{C}$ (1 000 to 1 400) $^{\circ}\text{C}$ (1 400 to 1 767) $^{\circ}\text{C}$	0.5 $^{\circ}\text{C}$ 0.17 $^{\circ}\text{C}$ 0.21 $^{\circ}\text{C}$ 0.27 $^{\circ}\text{C}$ 0.17 $^{\circ}\text{C}$ 0.23 $^{\circ}\text{C}$ 0.5 $^{\circ}\text{C}$ 0.43 $^{\circ}\text{C}$ 0.46 $^{\circ}\text{C}$ 0.46 $^{\circ}\text{C}$ 0.53 $^{\circ}\text{C}$ 0.41 $^{\circ}\text{C}$ 0.42 $^{\circ}\text{C}$ 0.52 $^{\circ}\text{C}$	Multiproduct Calibrator



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Systems ¹	Type T		Multiproduct Calibrator
	(-250 to -150) °C	0.71 °C	
	(-150 to 0) °C	0.27 °C	
	(0 to 120) °C	0.18 °C	
	(120 to 400) °C	0.16 °C	
	Type B		
	(600 to 800) °C	0.5 °C	
	(800 to 1 000) °C	0.38 °C	
	(1 000 to 1 550) °C	0.34 °C	
	(1 550 to 1 820) °C	0.37 °C	
	Type N		
	(-200 to -100) °C	0.45 °C	
	(-100 to -25) °C	0.25 °C	
	(-25 to 120) °C	0.22 °C	
	(120 to 410) °C	0.2 °C	
	(410 to 1 300) °C	0.31 °C	
	Type R		
	(0 to 250) °C	0.65 °C	
	(250 to 400) °C	0.40 °C	
	(400 to 1 000) °C	0.37 °C	
	(1 000 to 1 767) °C	0.45 °C	
	Type C		
	(0 to 150) °C	0.34 °C	
	(150 to 650) °C	0.29 °C	
	(650 to 1 000) °C	0.35 °C	
	(1 000 to 1 800) °C	0.57 °C	
	(1 800 to 2 316) °C	0.95 °C	
Electrical Calibration of RTD Indicating Systems ¹	Pt 385, 100 Ω		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 600) °C	0.12 °C	



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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 3916, 100 Ω		Multiproduct Calibrator
	(-200 to 190) $^{\circ}\text{C}$	0.25 $^{\circ}\text{C}$	
	(-190 to 0) $^{\circ}\text{C}$	0.05 $^{\circ}\text{C}$	
	(0 to 300) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$	
	(300 to 600) $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$	
	(600 to 630) $^{\circ}\text{C}$	0.23 $^{\circ}\text{C}$	
	Pt 385, 200 Ω		
	(-200 to 100) $^{\circ}\text{C}$	0.04 $^{\circ}\text{C}$	
	(100 to 260) $^{\circ}\text{C}$	0.05 $^{\circ}\text{C}$	
	(260 to 600) $^{\circ}\text{C}$	0.14 $^{\circ}\text{C}$	
	(600 to 630) $^{\circ}\text{C}$	0.16 $^{\circ}\text{C}$	
	Pt 385, 500 Ω		
	(-200 to 100) $^{\circ}\text{C}$	0.05 $^{\circ}\text{C}$	
	(100 to 260) $^{\circ}\text{C}$	0.06 $^{\circ}\text{C}$	
	(260 to 600) $^{\circ}\text{C}$	0.09 $^{\circ}\text{C}$	
	(600 to 630) $^{\circ}\text{C}$	0.11 $^{\circ}\text{C}$	
	Pt 385, 1k Ω		Multiproduct Calibrator
	(-200 to 100) $^{\circ}\text{C}$	0.03 $^{\circ}\text{C}$	
	(100 to 260) $^{\circ}\text{C}$	0.05 $^{\circ}\text{C}$	
	(260 to 600) $^{\circ}\text{C}$	0.07 $^{\circ}\text{C}$	
	(600 to 630) $^{\circ}\text{C}$	0.23 $^{\circ}\text{C}$	
	PtNi 385, 100 Ω		
	(-80 to 100) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$	
	(100 to 260) $^{\circ}\text{C}$	0.14 $^{\circ}\text{C}$	
	Cu 427, 10 Ω		
	(-100 to 260) $^{\circ}\text{C}$	0.3 $^{\circ}\text{C}$	
AC Voltage – Source ¹	200 μV to 2.2 mV		Multiproduct Calibrator
	(10 to 20) Hz	0.55 mV/V + 4.5 μV	
	(20 to 40) Hz	0.21 mV/V + 4.5 μV	
	40 Hz to 20 kHz	0.11 mV/V + 4.5 μV	
	(20 to 50) kHz	0.37 mV/V + 4.5 μV	
	(50 to 100) kHz	0.85 mV/V + 7 μV	
	(100 to 300) kHz	1.1 mV/V + 13 μV	
	(300 to 500) kHz	1.7 mV/V + 25 μV	
	500 kHz to 1 MHz	3.4 mV/V + 25 μV	



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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	(2.2 to 22) mV		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	0.32 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	0.16 mV/V + 6 μ V	
	(20 to 50) kHz	0.12 mV/V + 16 μ V	
	(50 to 100) kHz	0.25 mV/V + 70 μ V	
	(100 to 300) kHz	0.43 mV/V + 130 μ V	
	(300 to 500) kHz	1.1 mV/V + 350 μ V	
	500 kHz to 1 MHz	2.2 mV/V + 850 μ V	
	(2.2 to 220) V		
	(10 to 20) Hz	0.5 mV/V + 8 mV	
	(20 to 40) Hz	0.16 mV/V + 2.5 mV	
	40 Hz to 20 kHz	0.16 mV/V + 0.8 mV	
	(20 to 50) kHz	0.22 mV/V + 3.5 mV	
	(50 to 100) kHz	0.5 mV/V + 8 mV	
	(100 to 300) kHz	1.5 mV/V + 90 mV	
	(300 to 500) kHz	4.7 mV/V + 90 mV	
	500 kHz to 1 MHz	12 mV/V + 190 mV	
	(220 to 1 100) V		
	(15 to 50) Hz	0.4 mV/V + 16 mV	
	50 Hz to 1 kHz	0.5 mV/V + 4 mV	



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	Up to 10 mV (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	0.3 mV/V + 3 μ V 0.3 mV/V + 1 μ V 0.3 mV/V + 1 μ V 0.8 mV/V + 1 μ V 4.1 mV/V + 1 μ V 33 mV/V + 2 μ V	Multimeter in Synchronous sub-sampled mode
	(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 (1 to 10) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (10 to 100) V (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz	0.07 mV/V + 40 μ V 0.07 mV/V + 20 μ V 0.12 mV/V + 20 μ V 0.25 mV/V + 20 μ V 0.67 mV/V + 20 μ V 26 mV/V + 100 μ V 8.4 mV/V + 100 μ V 13 mV/V + 100 μ V 0.07 mV/V + 400 μ V 0.07 mV/V + 200 μ V 0.12 mV/V + 200 μ V 0.26 mV/V + 200 μ V 0.67 mV/V + 200 μ V 2.5 mV/V + 1 mV 8.4 mV/V + 1 mV 13 mV/V + 1 mV 0.07 mV/V + 4 mV 0.07 mV/V + 2 mV 0.12 mV/V + 2 mV 0.26 mV/V + 2mV 0.68 mV/V + 2mV 2.6 mV/V + 10 mV 8.4 mV/V + 10 mV 13 mV/V + 10 mV	
AC Voltage – Measure ¹	(100 to 700) V 1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.4 mV/V + 40 mV 0.4 mV/V + 20 mV 0.6 mV/V + 20 mV 1.3 mV/V + 20 mV 3.1 mV/V + 20 mV	Multimeter in Synchronous sub-sampled mode



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(1 to 10) kV (50 to 100) Hz	1.5 mV/V + 0.6 V	High Voltage Meter with Probe
	(10 to 20) kV (50 to 60) Hz	1.4 mV/V + 0.6 V	
	(20 to 35) kV (rms) (50 to 60) Hz	1.4 mV/V + 0.6 V	
AC Current – Source ¹	(9 to 220) μ A (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.71 mA/A + 25 nA 0.36 mA/A + 20 nA 0.15 mA/A + 16 nA 0.65 mA/A + 40 nA 1.7 mA/A + 80 nA	Multiproduct Calibrator
	220 μ A to 2.2 mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.71 mA/A + 40 nA 0.36 mA/A + 35 nA 0.15 mA/A + 35 nA 0.65 mA/A + 0.4 μ A 1.7 mA/A + 0.8 μ A	
	(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	0.71 mA/A + 0.4 μ A 0.36 mA/A + 0.35 μ A 0.15 mA/A + 0.35 μ A 0.65 mA/A + 4 μ A 1.7 mA/A + 8 μ A	
	(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	0.71 mA/A + 4 μ A 0.36 mA/A + 3.5 μ A 0.15 mA/A + 3.5 μ A 0.65 mA/A + 40 μ A 1.7 mA/A + 80 μ A	
	220 mA to 2.2 A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.7 mA/A + 35 μ A 0.76 mA/A + 80 μ A 8.6 mA/A + 0.16 mA	
	(2.2 to 20.5) A 50 Hz to 1 kHz (1 to 5) kHz	0.51 mA/A + 1 mA 0.5 mA/A + 5.8 mA	
	(20 to 1 000) A (45 to 440) Hz	5.9 mA/A + 40 mA	
AC Current – Source ¹	(2.2 to 20.5) A 50 Hz to 1 kHz (1 to 5) kHz	0.51 mA/A + 1 mA 0.5 mA/A + 5.8 mA	Transconductance Amplifier
	(20 to 1 000) A (45 to 440) Hz	5.9 mA/A + 40 mA	Multiproduct Calibrator with 50 Turn Coil



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(5 to 100) μ A		Multimeter in Synchronous sub-sampled mode
	(10 to 20) Hz	4.6 mA/A + 0.03 μ A	
	(20 to 45) Hz	1.7 mA/A + 0.03 μ A	
	(45 to 100) Hz	0.7 mA/A + 0.03 μ A	
	100 Hz to 1 kHz	0.7 mA/A + 0.03 μ A	
	100 μ A to 1 mA		
	(10 to 20) Hz	5.0 mA/A + 0.2 μ A	
	(20 to 45) Hz	1.7 mA/A + 0.2 μ A	
	(45 to 100) Hz	0.7 mA/A + 0.2 μ A	
	100 Hz to 5 kHz	0.4 mA/A + 0.2 μ A	
	(1 to 10) mA		
	10 to 20) Hz	4.6 mA/A + 2 μ A	
	(20 to 45) Hz	1.7 mA/A + 2 μ A	
	(45 to 100) Hz	0.7 mA/A + 2 μ A	
	100 Hz to 5 kHz	0.4 mA/A + 2 μ A	
	(10 to 100) mA		
	(10 to 20) Hz	4.6 mA/A + 20 μ A	
	(20 to 45) Hz	1.7 mA/A + 20 μ A	
	(45 to 100) Hz	0.7 mA/A + 20 μ A	
	100 Hz to 5 kHz	0.4 mA/A + 20 μ A	
	100 mA to 1 A		
	(10 to 20) Hz	4.6 mA/A + 200 μ A	
	(20 to 45) Hz	1.8 mA/A + 200 μ A	
	(45 to 100) Hz	0.9 mA/A + 200 μ A	
	100 Hz to 5 kHz	1.2 mA/A + 200 μ A	
AC Current – Measure ¹	(0.001 to 5) A		Current Shunt
	10 Hz to 50 kHz	0.3 mA/A	
	(5 to 20) A		
	10 Hz to 50 kHz	0.4 mA/A	
AC Resistance ¹ – Generate 100 Hz to 100 kHz	0 Ω	0.13 m Ω	RL Standard
	0.1 Ω	0.022 m Ω	
	1.0 Ω	0.05 m Ω	
	10 Ω	0.49 m Ω	
	100 Ω	15 m Ω	
	1 k Ω	0.1 Ω	
	10 k Ω	1.5 Ω	
	100 k Ω	4.7 Ω	



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance ¹ - Source at 1kHz	(330 to 500) pF 500 pF to 1.1 nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) μ F (33 to 110) μ F (110 to 330) μ F 330 μ F to 1.1 mF (1.1 to 3.3) mF	33 mF/F 14 mF/F 7.3 mF/F 5.1 mF/F 5.4 mF/F 3.2 mF/F 3.2 mF/F 2.9 mF/F 3.7 mF/F	Multiproduct Calibrator
Capacitance ¹ - Source Fixed Values	(1, 10, 100, 1 000) pF (1 to 5) MHz (5 to 13) MHz	1.1 mF/F 3 mF/F	Capacitance Set
Oscilloscope ¹ – Rise/Fall Time (10 to 90) %	7 ps to 3.5s	1.6 ps	Calibration Head
Oscilloscope ¹ Sq Wave 50 Ω or 1 M Ω Load impedance – <10 kHz Horizontal Deflection (Time)	40 μ V to 1 mV (pp) 1 mV to 5 V (pp) 180.10 ps to 55.00 s	2.5 % of reading 0.13 % of reading 0.4 parts in 10 ⁶ s	Oscilloscope Calibrator
Oscilloscope ¹ Vertical Deflection (Amplitude)	$\pm$ 1 mV to 200 V	0.05 % of reading	Oscilloscope Calibrator Multimeter
Oscilloscope ¹ Bandwidth	100 MHz to 300 MHz (300 to 500) MHz	2.4 % of reading 3 % of reading	Oscilloscope Calibrator
	550 MHz to 3 GHz (3 to 26.5) GHz (26.5 to 50) GHz	4.1 % of reading 5.8 % of reading 7 % of reading	Calibration Head, Power Sensors

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pulse – Measure ¹	33 MHz to 3.0 GHz	1.4 % of reading + 5 ps	Oscilloscope



Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Sensors – Calibration Factors	Referenced at 1 mW 100 kHz to 100 MHz 100 MHz to 5 GHz (5 to 10) GHz (10 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz	0.14 % of reading 0.97 % of reading 1.3 % of reading 1.4 % of reading 2.1 % of reading 2.3 % of reading 4.1 % of reading	Coaxial Thermistor, Power Sensors
Tuned RF Power, Relative ¹ – Measure 2.5 MHz to 26.5 GHz	(0.0 to -3) dB (-3 to -10) dB (-10 to -40) dB (-40 to -50) dB (-50 to -80) dB (-80 to -90) dB (-90 to -110) dB (-110 to -127) dB	0.06 dB 0.08 dB 0.11 dB 0.14 dB 0.2 dB 0.31 dB 0.34 dB 0.4 dB	Measuring Receiver, Power Sensors
RF Power – Absolute ¹ Measure 100 kHz to 50 GHz	(-70 to -30) dBm (-30 to -20) dBm (-20 to 0) dBm (0 to 20) dBm	0.64 dB 0.06 dB 0.068 dB 1.2 % of reading	Power Meter, Measuring Receiver, Power Sensors
RF Power - Source ¹	(-127 to 13) dBm 10 kHz to 20 MHz	1.2 dB	Signal Generator
	(-110 to 10) dBm 20 MHz to 2 GHz (2 to 20) GHz (20 to 40) GHz (40 to 50) GHz	1.2 dB 1.3 dB 1.9 dB 2.8 dB	Signal Generator
Amplitude Modulation – Source 10 kHz to 13.5 MHz	Rate: 50 Hz to 100 kHz Depths: 5 % to 95 %	0.6 % of reading	AM/FM Test Source
10 kHz to 13.5 MHz	Rate: 50 Hz to 100 kHz Depths: 95 % to 99 %	0.6 % of reading	



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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation ¹ – Measure 50 Hz to 10 kHz 20 Hz to 10 kHz 50 Hz to 10 kHz 20 Hz to 10 kHz	Rate: 150 kHz to 10 MHz Depth: (5 to 99) % Rate: 10 MHz to 1.3 GHz Depth: (5 to 99) %	2.5 % of reading 3.6 % of reading 1.6 % of reading 3.6 % of reading	Measuring Receiver
Amplitude Modulation ¹ – Measure 50 Hz to 50 kHz 20 Hz to 100 kHz	Depth: (5 to 99) % 1.3 GHz to 26.5 GHz	3.6 % of reading 3.2 % of reading	Measuring Receiver with Power Sensor
Frequency Modulation – Source Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	10 kHz to 432 MHz	0.6 % of reading	AM/FM Test Source
Harmonic Measurements ¹	30 Hz to 50 GHz	1.5 dB	Spectrum Analyzer
Phase Modulation ¹ – Rate: 10 MHz to 1.3 GHz	200 Hz to 20 kHz	3.6 % of reading	Measuring Receiver
Phase Modulation ¹ – Rate: (1.3 to 26.5) GHz	200 Hz to 20 kHz	4.7 % of reading	Measuring Receiver with Power Sensor
Distortion ¹ – Measure (0 to 99.9) dB: 20 Hz to 20 kHz (20 to 100) kHz	(50 to 500) kHz (50 to 500) kHz	1.3 dB 2.4 dB	Audio Analyzer

Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers ^{1,2}	Up to 6 in (6 to 12) in (12 to 24) in (24 to 48) in	(300 + 2.4L) μin (360 + 2.4L) μin (450 + 2.4L) μin (510 + 2.4L) μin	Gage Blocks
Height Gages ^{1,2}	(0.10 to 48) in	(48 μin + 10L) μin	
Gage Blocks	(0.5 to 10) mm (>10 to 50) mm (>50 to 100) mm	0.12 μm 0.13 μm 0.14 μm	Gage Blocks, Measuring machine (Mechanical comparison)



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Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Cylindrical Plug and Pin Gages	Up to 12 in	26 μ in	Measuring Machine
Pin Gages, Diameter ²	(0.02 to 2.00) in	(12 + 3.2L) μ in	Measuring Machine
Indicators ¹ Resolution: 20 μ in 50 μ in 100 μ in	(0.1 to 4) in	14 μ in 30 μ in 74 μ in	Gage Blocks
Micrometers ² - 100 μ in resolution 50 μ in resolution	(0.1 to 48) in	(66 + 10L) μ in (32 + 10L) μ in	Gage Blocks
Rules and Tape Measures ²	Up to 72 in (12 to 72) in	(17+2L) μ in (5 800 + 0.05L) μ in	Gage Blocks
Length Standards ²	Up to 12 in	(120+2.5L) μ in	Measuring machine
Optical Comparators and Vision Systems ^{1,2} X Axis Y Axis Z Axis	Up to 300 mm Up to 300 mm Up to 300 mm	(3 + 0.002L) μ m (3 + 0.002L) μ m (3 + 0.002L) μ m	Glass Scales, gage blocks, precision square, dial test indicator

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure ¹	(-15 to 100) psi (0 to 5) psi (0 to 1 000) psi 0 up to 10 000 psi	0.06 psi 0.007 psi 0.53 psi 8.5 psi	Pressure Modules
Scales & Balances ¹	(1 to 200) mg (0 to 200) gm (Up to 1) kg (Up to 5) kg (Up to 30) kg	0.001 mg 0.07 mg 0.8 mg 2.0 mg 4.0 mg	Verification w/ Class E1, E2 and F1 weights
Scales & Balances ¹	Up to 100 kg Up to 1 000 lb	19 mg 0.32 lb	Verification with class F weights



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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass Fixed Points	(1 to 20) mg 50 mg 100 mg 200 mg 500 mg 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg	0.003 7 mg 0.004 9 mg 0.006 1 mg 0.007 4 mg 0.01 mg 0.014 mg 0.02 mg 0.023 mg 0.033 mg 0.039 mg 0.05 mg 0.06 mg 0.13 mg 0.32 mg 0.8 mg 1.4 mg 4.3 mg 9 mg	Class E1 & E2 and Balance
Air Velocity ²	(0.01 to 80.0) mph	2.3 % of reading + <i>R</i>	Wind Tunnel
Torque Testers ¹	(15 to 200) ozf·in (4 to 150) lbf·in (2.5 to 250) lbf·ft	0.12 % of reading 0.12 % of reading 0.12 % of reading	Torque Wheel, Torque Standard, Calibration Arms, Weights
Torque ¹	(2 to 40) N·m (30 to 1 500) N·m	0.55 % of reading 0.72 % of reading	Torque System

Photometry and Radiometry

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Optical Power ¹ – Measure (800 to 1 000) nm (1 000 to 1 310) nm (1 310 to 1 700) nm	(-90 to 10) dB (-110 to 10) dB (-110 to 10) dB	2.9 % of reading + 0.01 dB 2.9 % of reading + 0.01 dB 2.9 % of reading + 0.01 dB	Optical Test System
Optical Power ¹ – Measure	(0.01 to 10) W	2 % of reading	Power Sensors



Photometry and Radiometry

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Optical Wavelength ¹ – Measure	(700 to 1 650) nm	0.007 nm	Wavelength Meter
Fiber Optic Wavelength – Source ¹	(1 510 to 1 540) nm	1.5 parts in 10 ⁶ m	NIST SRM 2519, 2517
Illuminance	(0 to 500) fc	1.8 % of reading	Comparison to Standard Light Meter

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity ¹	(11 to 95) %RH	1.7 %RH	Indicator, Probe w/ Humidity Generator
Infrared Thermometers	(30 to 300) °C	1.9 °C	Black Body Calibrator $\epsilon = 0.95$, $\lambda = (8 \text{ to } 14) \mu\text{m}$
Temperature ¹	(-40 to 400) °C	0.07 °C	Thermometer, PRT

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency ¹ - Source	0.01 Hz to 10 MHz	5.7×10^{-11} Hz/Hz	GPS Receiver, Signal Generator
	10 MHz to 50.0 GHz	1.1×10^{-11} Hz/Hz	GPS Receiver Signal Generator
Frequency ¹ – Measure	0.1 Hz to 3 GHz	2.3×10^{-11} Hz/Hz	GPS Receiver, Counter
	500 MHz to 26.5 GHz	1.4×10^{-11} Hz/Hz	GPS Receiver Counter
Frequency – Measure Fixed Point	10 MHz	6×10^{-12} Hz/Hz	GPS Receiver
Time Interval ¹ – Measure	25 ps to 1 s	1.2 % + 5 ps	Oscilloscope



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Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Photo Tachometer	(0 to 100 000) rpm	0.001 6 rpm + 0.000 17 %	Generator with 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 inches, R = resolution of unit under test.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-1969.15.


Vice President

