CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

TLC Calibrations Company, LLC
2720 Mounds View Blvd., Suite 400
Mounds View, MN 55112
(and satellite site 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.

Jason Stine, Vice President
Expiry Date: 28 January 2027
Certificate Number: AC-2949

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

TLC Calibrations Company, LLC

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CALIBRATION

ISO/IEC 17025 Accreditation Granted: **27 January 2025**

Certificate Number: **AC-2949** Certificate Expiry Date: **28 January 2027**

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source [1]	Up to 120 mV (> 0 to 1.2) V (> 0 to 12) V (12 to 120) V (120 to 1 020) V	9.4 nV/mV + 0.83 µV 6.5 µV/V + 1 µV 6.3 µV/V + 10 µV 8.8 µV/V + 98 µV 8.7 µV/V + 0.98 mV	Comparison to Multiproduct Calibrator (Ranges Locked)
DC Voltage – Measure [1]	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1 000) V	10 nV/mV + 0.3 nV 2.8 µV/V + 0.5 µV 2.9 µV/V + 1.4 µV 4.5 µV/V + 27 µV 4.3 µV/V + 0.52 mV	Comparison to 8.5 Digit Multimeter
DC Current – Source [1]	Up to 120 µA (0.12 to 1.2) mA (1.2 to 12) mA (12 to 120) mA (0.12 to 1.2) A (1.2 to 12) A (12 to 30.2) A	97 pA/µA + 6 nA 79 pA/µA + 15 nA 78 nA/mA + 82 nA 5.8 nA/mA + 0.76 µA 0.12 mA/A + 10 µA 0.24 mA/A + 0.24 mA 0.8 mA/A + 0.22 mA	Comparison to Multiproduct Calibrator (Ranges Locked)
DC Current – Measure [1]	Up to 10 µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 10) A (10 to 30) A	25 pA/µA + 0.46 nA 10 pA/µA + 0.47 nA 10 nA/mA + 3.9 nA 9.8 nA/mA + 41 nA 45 nA/mA + 47 nA 0.1 mA/A + 0.1 mA 0.18 mA/A + 0.4 mA 0.5 mA/A + 4.4 mA	Comparison to 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]	Up to 12 mV		Comparison to Multiproduct Calibrator
	(3 to 5) Hz	1.9 µV/mV + 7.2 µV	
	(5 to 10) HZ	0.66 nV/mV + 7.3 µV	
	10 Hz to 20 kHz	2.2 nV/mV + 6.1 µV	
	(20 to 50) kHz	2.4 nV/mV + 6.1 µV	
	(50 to 100) kHz	17 nV/mV + 15 µV	
	(100 to 300) kHz	52 nV/mV + 30 µV	
	(300 to 500) kHz	0.15 µV/mV + 30 µV	
	(12 to 120) mV		
	(3 to 5) Hz	25 nV/mV + 7.3 µV	
	(5 to 10) HZ	0.77 µV/mV – 1.8 µV	
	10 Hz to 20 kHz	9 nV/mV + 7.1 µV	
	(20 to 50) kHz	7.7 nV/mV + 8.1 µV	
	(50 to 100) kHz	62 nV/mV + 19 µV	
	(100 to 300) kHz	3.2 µV/mV – 8.3 µV	
	(300 to 500) kHz	1.4 mV/V + 56 µV	
	(0.12 to 1.2) V		
	(3 to 5) Hz	4.8 µV/V + 0.31 mV	
	(5 to 10) Hz	0.68 mV/V + 74 µV	
	(10 to 40) Hz	0.11 mV/V + 61 µV	
	40 Hz to 20 kHz	0.11 mV/V + 8.5 µV	
	(20 to 50) kHz	0.23 mV/V + 15 µV	
	(50 to 100) kHz	0.54 mV/V + 41 µV	
	(100 to 300) kHz	1.5 mV/V + 81 µV	
	(300 to 500) kHz	1.5 mV/V + 83 µV	
	(1.2 to 12) V		
	(3 to 5) Hz	1.9 mV/V + 0.82 mV	
	(5 to 10) HZ	0.68 mV/V + 0.75 mV	
	(10 to 40) Hz	0.11 mV/V + 0.36 mV	
	40 Hz to 20 kHz	0.11 mV/V + 48 µV	
	(20 to 50) kHz	0.24 mV/V + 45 µV	
	(50 to 100) kHz	0.55 mV/V + 0.12 mV	
	(100 to 300) kHz	1.6 mV/V + 0.6 mV	
	(300 to 500) kHz	1.6 mV/V + 0.62 mV	

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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]	(12 to 120) V		Comparison to Multiproduct Calibrator
	(3 to 5) Hz	1.9 mV/V + 7.6 mV	
	(5 to 10) HZ	0.68 mV/V + 7.5 mV	
	(10 to 40) Hz	0.12 mV/V + 3.5 mV	
	40 Hz to 20 kHz	0.12 mV/V + 0.42 mV	
	(20 to 50) kHz	0.25 mV/V + 0.69 mV	
	(50 to 100) kHz	0.56 mV/V + 1.2 mV	
	(120 to 330) V		
	(3 to 5) Hz	1.9 mV/V + 77 mV	
	(5 to 10) Hz	0.68 mV/V + 78 mV	
	10 Hz to 20 kHz	0.12 mV/V + 7.5 mV	
	(20 to 50) kHz	0.25 mV/V + 8.2 mV	
	(50 to 100) kHz	1.2 mV/V + 12 mV	
	(330 to 1 020) V		
	(3 to 5) Hz	1.6 mV/V + 0.45 V	
	(5 to 10) Hz	0.6 mV/V + 0.16 V	
	10 Hz to 10 kHz	82 µV/V + 0.11 V	
AC Voltage – Measure [1]	Up to 10 mV		Comparison to 8.5 Digit Multimeter
	1 Hz to 2 kHz	4.2 µV	
	(2 to 10) kHz	4.9 µV	
	(10 to 30) kHz	5 µV	
	(30 to 100) kHz	31 µV	
	(100 to 300) kHz	0.1 mV	
	300 kHz to 1 MHz	0.21 mV	
	(10 to 100) mV		
	1 Hz to 2 kHz	70 nV/mV + 1.8 µV	
	(2 to 10) kHz	80 nV/mV + 4.1 µV	
	(10 to 30) kHz	0.2 µV/mV + 3.1 µV	
	(30 to 100) kHz	0.3 µV/mV + 28.3 µV	
	(100 to 300) kHz	1.5 µV/mV + 89.2 µV	
	300 kHz to 1 MHz	10.3 µV/mV + 0.1 mV	
	(1 to 2) MHz	2 mV	
	(2 to 4) MHz	5.1 mV	
	(4 to 8) MHz	9.1 mV	
	(8 to 10) MHz	16 mV	

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AC Voltage – Measure [1]	(0.1 to 10) V		Comparison to 8.5 Digit Multimeter
	1 Hz to 2 kHz	72 µV/V + 1.1 µV	
	(2 to 10) kHz	0.12 mV/V + 0.42 µV	
	(10 to 30) kHz	0.23 mV/V + 0.2 µV	
	(30 to 100) kHz	0.57 mV/V + 0.21 µV	
	(100 to 300) kHz	2.4 mV/V + 1.9 µV	
	300 kHz to 1 MHz	11.1 mV/V + 0.22 mV	
	(1 to 2) MHz	20 mV/V + 16.5 µV	
	(2 to 4) MHz	50.1 mV/V + 24.2 µV	
	(4 to 8) MHz	90.1 mV/V + 0.13 mV	
	(8 to 10) MHz	0.16 V/V + 0.12 mV	
	(10 to 100) V		
	1 Hz to 2 kHz	74 µV/V + 0.43 mV	
	(2 to 10) kHz	0.1 mV/V + 0.21 mV	
	(10 to 30) kHz	0.24 mV/V + 38 µV	
	(30 to 100) kHz	0.59 mV/V + 45.1 µV	
	(100 to 300) kHz	4 mV/V + 0.4 mV	
	300 kHz to 1 MHz	15.2 mV/V + 0.38 mV	
	(100 to 1 000) V		
	1 Hz to 2 kHz	0.12 mV/V + 1 mV	
	(2 to 10) kHz	0.11 mV/V + 13.6 mV	
	(10 to 30) kHz	0.25 mV/V + 0.82 mV	
	(30 to 100) kHz	0.62 mV/V + 4.6 mV	
AC Current – Source [1]	Up to 120 µA		Comparison to Multiproduct Calibrator
	(3 to 45) Hz	0.18 nA/µA + 12 nA	
	45 Hz to 1 kHz	0.19 nA/µA + 12 nA	
	(1 to 5) kHz	0.19 nA/µA + 11 nA	
	(5 to 10) kHz	1.2 nA/µA + 40 nA	
	(10 to 30) kHz	3.9 nA/µA + 1 µA	
	(0.12 to 1.2) mA		
	(3 to 45) Hz	0.19 nA/µA + 0.1 µA	
	45 Hz to 1 kHz	0.2 nA/µA + 0.1 µA	
	(1 to 5) kHz	0.2 nA/µA + 0.1 µA	
	(5 to 10) kHz	1 nA/µA + 0.13 µA	
	(10 to 30) kHz	4 nA/µA + 0.1 µA	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source [1]	(1.2 to 12) mA		Comparison to Multiproduct Calibrator
	(3 to 45) Hz	0.2 nA/µA + 1 µA	
	45 Hz to 1 kHz	0.19 µA/mA + 1 µA	
	(1 to 5) kHz	0.2 µA/mA + 1 µA	
	(5 to 10) kHz	1.2 µA/mA + 1 µA	
	(10 to 30) kHz	3.9 µA/mA + 10 µA	
	(12 to 120) mA		
	(3 to 45) Hz	0.19 µA/mA + 10 µA	
	45 Hz to 1 kHz	0.12 µA/mA + 5.1 µA	
	(1 to 5) kHz	0.19 µA/mA + 8.1 µA	
	(5 to 10) kHz	1.2 µA/mA + 10 µA	
	(10 to 30) kHz	3.9 µA/mA + 0.1 mA	
	(0.12 to 1.2) A		
	(3 to 45) Hz	0.19 mA/A + 0.1 mA	
	45 Hz to 1 kHz	0.19 mA/A + 50 µA	
	(1 to 5) kHz	0.19 mA/A + 81 µA	
	(5 to 10) kHz	1.9 mA/A + 0.3 mA	
	(10 to 30) kHz	4 mA/A + 0.28 mA	
	(1.2 to 3.1) A		
	(3 to 45) Hz	0.3 mA/A + 0.49 mA	
	45 Hz to 1 kHz	0.24 mA/A + 0.29 mA	
	(1 to 5) kHz	0.30 mA/A + 0.31 mA	
	(5 to 10) kHz	1.9 mA/A + 0.5 mA	
	(3.1 to 12) A		
	(3 to 45) Hz	0.29 mA/A + 1 mA	
	45 Hz to 1 kHz	0.24 mA/A + 0.49 mA	
	(1 to 5) kHz	0.32 mA/A + 0.74 mA	
	(5 to 10) kHz	1.9 mA/A + 0.93 mA	
	(12 to 30.2) A		
	(3 to 45) Hz	0.78 mA/A + 10 mA	
	45 Hz to 1 kHz	0.59 mA/A + 7.8 mA	
	(1 to 5) kHz	3.9 mA/A + 7.9 mA	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure [1]	(1 to 10) µA 1 Hz to 10 kHz (10 to 100) µA 1 Hz to 2 kHz 10 µA to 1 mA (2 to 10) kHz 10 µA to 10 mA (10 to 30) kHz (0.1 to 100) mA 1 Hz to 2 kHz (1 to 100) mA (2 to 10) kHz (10 to 100) mA (10 to 30) kHz (0.1 to 1) A 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (1 to 10) A 10 Hz to 2 kHz (10 to 30) A 10 Hz to 2 kHz (2 to 10) kHz	 1.7 nA/µA + 8nA 0.12 nA/µA + 23.3 nA 0.55 nA/µA + 18.7 nA 1 nA/µA + 14.3 nA 0.33 nA/µA + 2.81 nA 0.55 µA/mA + 10.6 nA 0.97 µA/mA + 0.24 µA 0.37 mA/A + 7.6 µA 0.65 mA/A + 15.1 µA 0.84 mA/A + 12.7 µA 0.85 mA/A + 47 µA 1 mA/A + 6.1 mA 1.6 mA/A + 50 µA	Comparison to 8.5 Digit Multimeter
Resistance – Source [1] (Simulation)	Up to 12 Ω (12 to 120) Ω (0.12 to 1.2) kΩ (1.2 to 12) kΩ	19 µΩ/Ω + 1 mΩ 20 µΩ/Ω + 1 mΩ 20 µΩ/Ω + 2.1 mΩ 21 mΩ/kΩ + 21 mΩ	Comparison to Multiproduct Calibrator
Resistance – Source [1] (Simulation)	(12 to 120) kΩ (0.12 to 1.2) MΩ (1.2 to 12) MΩ (12 to 120) MΩ (120 to 1 200) MΩ	21 mΩ/kΩ + 0.2 Ω 21 Ω/MΩ + 2.1 Ω 29 Ω/MΩ + 31 Ω 0.34 kΩ/MΩ + 2.4 kΩ 3.2 kΩ/MΩ + 86 kΩ	Comparison to Multiproduct Calibrator
Resistance – Measure [1]	(1 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 (0.1 to 1) GΩ	27 µΩ /Ω + 38.5 µΩ 6.7 µΩ/Ω + 0.14 mΩ 7.9 µΩ/Ω + 27.4 mΩ 8 µΩ/Ω + 1.8 mΩ 7.8 µΩ/Ω + 3.8 mΩ 12.4 µΩ/Ω + 0.25 Ω 0.25 mΩ/Ω + 14.8 Ω 0.16 mΩ/Ω + 1.4 kΩ 1.7 mΩ/Ω + 0.15 MΩ	Comparison to 8.5 Digit Multimeter

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source [1] (Simulation)			Comparison to Multiproduct Calibrator
100 Hz to 10 kHz	Up to 1.2 nF	1.3 pF/nF + 2.2 pF	
150 Hz to 5 kHz	(1.2 to 12) nF	0.74 pF/nF + 8.2 pF	
200 Hz to 1.3 kHz	(12 to 120) nF	1.1 pF/nF + 29 pF	
2 Hz to 310 Hz	(0.12 to 1.2) µF	1.1 nF/µF + 0.29 nF	
500 mHz to 110 Hz	(1.2 to 12) µF	1.1 nF/µF + 3 nF	
500 mHz to 40 Hz	(12 to 120) µF	1.3 nF/µF + 25 nF	
100 mHz to 11 Hz	(0.12 to 1.2) mF	2.1 µF/mF + 0.24 µF	
30 mHz to 4 Hz	(1.2 to 12) mF	2 µF/mF + 2.9 µF	
10 mHz to 1.3 Hz	(12 to 120) mF	4 µF/mF + 30 µF	
Capacitance – Measure [1]	(1 to 10) nF	6.8 pF/nF + 2 pF	Comparison to 8.5 Digit Multimeter
	(10 to 100) nF	0.5 pF/nF + 3.9 pF	
	(0.1 to 1) µF	0.56 pF/µF + 5.6 pF	
	(1 to 10) µF	0.57 pF/µF + 7.2 pF	
	(10 to 100) µF	0.9 nF/µF + 2.9 nF	
	(0.1 to 1) mF	0.74 µF /mF + 12.1 nF	
	(1 to 10) mF	0.85 µF/mF + 0.1 µF	
	(10 to 100) mF	0.9 µF/mF + 90 nF	
Electrical Simulation of RTD Indicating Devices – Source [1]	Pt 385, 100 Ω		Comparison to Multiproduct Calibrator
	(-200 to -0) °C	0.04 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 300) °C	0.07 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 630) °C	0.09 °C	
	(630 to 800) °C	0.18 °C	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicating Devices – Source [1]	Pt 385, 100 Ω		Comparison to Multiproduct Calibrator
	(-200 to -0) °C	0.04 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 300) °C	0.07 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 630) °C	0.09 °C	
	(630 to 800) °C	0.18 °C	
	Pt 385, 200 Ω		
	(-200 to 100) °C	0.03 °C	
	(100 to 260) °C	0.04 °C	
	(260 to 300) °C	0.09 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 600) °C	0.11 °C	
	(600 to 630) °C	0.12 °C	
	Pt 385, 500 Ω		
	(-200 to -80) °C	0.03 °C	
	(-80 to 100) °C	0.04 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 400) °C	0.06 °C	
	(400 to 600) °C	0.07 °C	
	(600 to 630) °C	0.09 °C	
	Pt 385, 1 000 Ω		
	(-200 to 0) °C	0.02 °C	
	(0 to 100) °C	0.03 °C	
	(100 to 260) °C	0.04 °C	
	(260 to 300) °C	0.05 °C	
	(300 to 600) °C	0.05 °C	
	(600 to 630) °C	0.18 °C	
	Pt 3916, 100 Ω		
	(-200 to -190) °C	0.19 °C	
	(-190 to -80) °C	0.03 °C	
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.06 °C	
	(300 to 400) °C	0.07 °C	
	(400 to 600) °C	0.08 °C	
	(600 to 630) °C	0.18 °C	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicating Devices – Source [1]	Pt 3926, 100 Ω		Comparison to Multiproduct Calibrator
	(-200 to 0) °C	0.04 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 300) °C	0.07 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 630) °C	0.09 °C	
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure [1]	Type B		Comparison to Multiproduct Calibrator
	(600 to 800) °C	0.34 °C	
	(800 to 1 000) °C	0.26 °C	
	(1 000 to 1 550) °C	0.23 °C	
	(1 550 to 1 820) °C	0.26 °C	
	Type C		
	(0 to 150) °C	0.19 °C	
	(150 to 650) °C	0.16 °C	
	(650 to 1 000) °C	0.2 °C	
	(1 000 to 1 800) °C	0.35 °C	
	(1 800 to 2 315) °C	0.61 °C	
	Type E		
	(-250 to -150) °C	0.31 °C	
	(-150 to -25) °C	0.11 °C	
	(-25 to 350) °C	0.09 °C	
	(650 to 650) °C	0.12 °C	
	(650 to 1 000) °C	0.16 °C	
	Type J		
	(-210 to -100) °C	0.19 °C	
	(-100 to -30) °C	0.1 °C	
	(-30 to 150) °C	0.09 °C	
	(150 to 760) °C	0.11 °C	
	(760 to 1 200) °C	0.16 °C	
	Type K		
	(-200 to -100) °C	0.22 °C	
	(-100 to -25) °C	0.1 °C	
	(-25 to 120) °C	0.09 °C	
	(120 to 1 000) °C	0.16 °C	
	(1 000 to 1 372) °C	0.27 °C	
	Type L		
	(-200 to -100) °C	0.16 °C	
	(-100 to 800) °C	0.16 °C	
	(800 to 900) °C	0.09 °C	

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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 N (-200 to -100) °C (-100 to -25) °C (25 to 120) °C (120 to 410) °C (410 to 1 300) °C Type R (0 to 250) °C (250 to 400) °C (400 to 1 000) °C (1 000 to 1 767) °C Type S (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C Type U (-200 to 0) °C (0 to 600) °C	 0.26 °C 0.12 °C 0.09 °C 0.09 °C 0.16 °C 0.4 °C 0.23 °C 0.21 °C 0.26 °C 0.33 °C 0.24 °C 0.25 °C 0.32 °C 0.47 °C 0.16 °C 0.1 °C 0.09 °C 0.09 °C 0.27 °C	Comparison to Multiproduct Calibrator

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers [1,2] (Outside, Inside, Depth, Step)	Up to 6 in	$(290 + 0.62L)$ µin	Comparison to Gage Blocks
Outside Micrometers [1,2]	Up to 1 in	$(29 + 0.2L)$ µin	Comparison to Gage Blocks
Dial/Digital Indicators [1,2]	Up to 1 in	$(58 + 0.14L)$ µin	Comparison to Gage Blocks

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure Devices [1]	(0 to 2.9) psig (2.9 to 14.5) psig (14.5 to 290) psig (290 to 1 015) psig	0.005 7 % of reading + 0.000 2 psi 0.005 5 % of reading + 0.000 4 psi 0.004 2 % of reading + 0.012 psi 0.006 % of reading + 0.027 psi	Comparison to Pressure Controller/Calibrator with Modules
Absolute Pressure Devices	Up to 150 psia	0.024 % of reading + 0.036 psi	Comparison to Pressure Controller
Barometric Pressure – Measure	(11.5 to 17.5) psia	0.003 4 psi	Comparison to Pressure Controller
Vacuum Devices [1]	(-13.5 to 0) psi	0.012 psi	Comparison to Pressure Controller/Calibrator with Modules
Analytical Balances [1,3]	(1 to 500) mg (0.5 to 5) g (5 to 10) g (10 to 20) g (20 to 50) g (50 to 100) g (100 to 500) g (500 to 1 000) g (1 000 to 2 000) g (2 000 to 4 000) g (4 000 to 5 000) g (5 000 to 10 000) g	58 µg 61 µg 63 µg 67 µg 81 µg 0.12 mg 1.6 mg 3.1 mg 6.1 mg 10 mg 60 mg 61 mg	ASTM E617 Class 1 weights and internal calibration procedure CP-500-0001 utilized in the calibration of the weighing system.
Mass Determination	(0.1 to 220) g (220 to 2 200) g (2 200 to 10 000) g	1 mg 11 mg 0.1 g	Comparison to Class 1 Weights, Electronic Analytical Balances
Pipettes	(0.2 to 2) µl 10 µl 20 µl 100 µl 200 µl 1 000 µl 5 000 µl 10 000 µl	8.5 nl 15 nl 21 nl 84 nl 0.3 µl 1.2 µl 5.8 µl 12 µl	Comparison to Pipette Calibrator
Mass Flow – Gas	(500 to 5 000) sccm (5 000 to 50 000) sccm (50 to 500) slpm	0.25 % of reading + 0.052 sccm 0.23 % of reading + 1.2 sccm 0.4 % of reading + 0.003 slpm	Comparison to MesaLab DryCal Primary Volumetric Piston Prover System

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass Flow – Gas	(0.1 to 1) slpm	0.16 5of reading + 0.000 012 slpm	Comparison to Fluke molBox 1, Fluke molBloc-L-1 Laminar Flow Element
Mass Flow – Gas	(1 to 10) slpm	0.16 % of reading + 0.000 14 slpm	Comparison to Fluke molBox 1, Fluke molBloc-L-30 Laminar Flow Element
Mass Flow – Gas	(1 to 30) slpm	0.16 % of reading + 0.000 38 slpm	Comparison to Fluke molBox 1, Fluke molBloc-L-30 Laminar Flow Element
Mass Flow – Gas	(30 to 300) slpm	0.13 % of reading	Comparison to Fluke molBox 1, Fluke molBloc-S-300 Sonic Flow Element
Torque Measuring Instruments [1]	(5 to 50) lbf·in (50 to 400) lbf·in (400 to 1 000) lbf·in (80 to 250) lbf·ft	0.29 % of reading + 0.011 lbf·in 0.13 % of reading + 1.4 lbf·in 0.29 % of reading + 0.29 lbf·in 0.31 % of reading + 0.002 lbf·ft	Comparison to Torque Calibration System
Force	(10 to 500) lbf	0.06 % of reading + 0.003 7 lbf	Comparison to Morehouse Precision and Shimpo Force Gage

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity – Source/Measure	(5 to 95) %RH	0.32 % of reading + 1.3 %RH	Comparison to Temperature/Humidity Transmitter.
Temperature – Source	(-25 to 50) ºC (50 to 140) °C (140 to 150) °C	0.037 °C 0.042 °C 0.058 °C	Comparison to Portable Calibration Bath, Dry-well Calibrator, Temperature Indicator w/RTD
Temperature – Measure [1]	(-40 to 50) ºC (50 to 150) °C	0.026 °C 0.033 °C	Comparison to Temperature Indicator w/RTD

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Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Infrared Thermometers [1]	-15 °C 0 °C 50 °C 100 °C 120 °C	1.1 °C 1.1 °C 1.2 °C 1.2 °C 1.2 °C	Comparison to Blackbody Source (Flat Plate) Ɛ = (0.9 to 1), λ = (8 to 14) µm

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source [1]	10 mHz to 120 Hz 120 Hz to 1.2 kHz (1.2 to 12) kHz (12 to 120) kHz 120 kHz to 1.2 MHz (1.2 to 2) MHz	5.8 mHz 57.7 mHz 0.58 Hz 5.8 Hz 57.8 Hz 0.6 kHz	Comparison to Multiproduct Calibrator
Frequency – Measure [1]	Up to 10 Hz 10 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz 100 kHz to 1 MHz (1 to 10) MHz (10 to 100) MHz	14 µHz 1.2 mHz 12 mHz 13 mHz 0.11 Hz 50 Hz 88 Hz	Comparison to 8.5 Digit Multimeter
Stopwatches/Timers [1]	Up to 24 hr	35 ms/24 hr	Comparison to Timometer

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CALIBRATION

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source [1] (Ranges Locked)	(> 0 to 330) mV (> 0 to 3.3) V (> 0 to 33) V (30 to 330) V (100 to 1 020) V	20 nV/mV + 1.2 µV 9.3 µV/V + 2.3 µV 11 µV/V + 20 µV 16 µV/V + 0.15 mV 14 µV/V + 2.1 mV	Comparison to Multiproduct Calibrator (Ranges Locked)
DC Voltage – Measure [1]	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1 000) V	10 nV/mV + 0.3 nV 2.8 µV/V + 0.5 µV 2.9 µV/V + 1.4 µV 4.5 µV/V + 27 µV 4.3 µV/V + 0.52 mV	Comparison to 8.5 Digit Multimeter
DC Current – Source [1] (Ranges Locked)	(> 0 to 330) µA (> 0 to 3.3) mA (> 0 to 33) mA (> 0 to 330) mA (> 0 to 1.1) A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	0.13 nA/µA + 16.4 nA 0.1 µA/mA + 39 nA 80 nA/mA + 0.22 µA 80 nA/mA + 2 µA 0.16 mA/A + 32 µA 0.32 A/A + 20.2 µA 0.4 mA/A + 0.4 mA 0.8 mA/A + 0.58 mA	Multiproduct Calibrator (Ranges Locked)
DC Current – Measure [1]	Up to 10 µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 10) A (10 to 30) A	25 pA/µA + 0.46 nA 10 pA/µA + 0.47 nA 10.5 nA/mA + 3.9 nA 9.8 nA/mA + 41 nA 45 nA/mA + 47 nA 0.1 mA/A + 0.1 mA 0.18 mA/A + 0.4 mA 0.5 mA/A + 4.4 mA	Comparison to 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 33) mV		Comparison to Multiproduct Calibrator
	(10 to 45) Hz	0.53 µV/mV + 7.8 µV	
	45 Hz to 10 kHz	0.11 µV/mV + 5.4 µV	
	(10 to 20) kHz	0.13 µV/mV + 5.5 µV	
	(20 to 50) kHz	0.73 µV/mV + 6.4 µV	
	(50 to 100) kHz	2.6 µV/mV + 12 µV	
	(100 to 500) kHz	6.1 µV/mV + 44 µV	
	(33 to 330) mV		
	(10 to 45) Hz	0.23 µV/mV + 6.5 µV	
	45 Hz to 10 kHz	0.11 µV/mV + 6.7 µV	
	(10 to 20) kHz	0.13 µV/mV + 6.5 µV	
	(20 to 50) kHz	0.28 µV/mV + 6.9 µV	
	(50 to 100) kHz	0.62 µV/mV + 25.6 µV	
	(100 to 500) kHz	1.6 µV/mV + 56 µV	
	(0.33 to 3.3) V		
	(10 to 45) Hz	0.23 mV/V + 40 µV	
	45 Hz to 10 kHz	0.12 mV/V + 47 µV	
	(10 to 20) kHz	0.15 mV/V + 46 µV	
	(20 to 50) kHz	0.23 mV/V + 87 µV	
	(50 to 100) kHz	0.53 mV/V + 0.16 mV	
	(100 to 500) kHz	1.9 mV/V + 0.5 mV	
	(3.3 to 33) V		
	(10 to 45) Hz	0.23 mV/V + 0.79 mV	
	45 Hz to 10 kHz	0.12 mV/V + 0.5 mV	
	(10 to 20) kHz	0.19 mV/V + 0.5 mV	
	(20 to 50) kHz	0.26 mV/V + 1.1 mV	
	(50 to 100) kHz	0.7 mV/V + 1.2 mV	
	(33 to 330) V		
	45 Hz to 1 kHz	0.15 mV/V + 1.5 mV	
	(1 to 10) kHz	0.16 mV/V + 4.7 mV	
	(10 to 20) kHz	0.2 mV/V + 4.7 mV	
	(20 to 50) kHz	0.25 mV/V + 4.3 mV	
	(50 to 100) kHz	1.5 mV/V + 39 mV	
	(330 to 1 020) V		
	45 Hz to 1 kHz	0.23 mV/V + 7.8 mV	
	(1 to 5) kHz	0.2 mV/V + 7.7 mV	
	(5 to 10) kHz	0.23 mV/V + 7.7 mV	

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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]	Up to 10 mV		Comparison to 8.5 Digit Multimeter
	1 Hz to 2 kHz	4.2 µV	
	(2 to 10) kHz	4.9 µV	
	(10 to 30) kHz	5 µV	
	(30 to 100) kHz	31 µV	
	(100 to 300) kHz	0.1 mV	
	300 kHz to 1 MHz	0.21 mV	
	(10 to 100) mV		
	1 Hz to 2 kHz	70 nV/mV + 1.8 µV	
	(2 to 10) kHz	80 nV/mV + 4.1 µV	
	(10 to 30) kHz	0.2 µV/mV + 3.1 µV	
	(30 to 100) kHz	0.3 µV/mV + 28.3 µV	
	(100 to 300) kHz	1.5 µV/mV + 89.2 µV	
	300 kHz to 1 MHz	10.3 µV/mV + 0.1 mV	
	(1 to 2) MHz	2 mV	
	(2 to 4) MHz	5.1 mV	
	(4 to 8) MHz	9.1 mV	
	(8 to 10) MHz	16 mV	
	(0.1 to 10) V		
	1 Hz to 2 kHz	72 µV/V + 1.1 µV	
	(2 to 10) kHz	0.12 mV/V + 0.42 µV	
	(10 to 30) kHz	0.23 mV/V + 0.2 µV	
	(30 to 100) kHz	0.57 mV/V + 0.21 µV	
	(100 to 300) kHz	2.4 mV/V + 1.9 µV	
	300 kHz to 1 MHz	11.1 mV/V + 0.22 mV	
	(1 to 2) MHz	20 mV/V + 16.5 µV	
	(2 to 4) MHz	50.1 mV/V + 24.2 µV	
	(4 to 8) MHz	90.1 mV/V + 0.13 mV	
	(8 to 10) MHz	0.16 V/V + 0.12 mV	
	(10 to 100) V		
	1 Hz to 2 kHz	74 µV/V + 0.43 mV	
	(2 to 10) kHz	0.1 mV/V + 0.21 mV	
	(10 to 30) kHz	0.24 mV/V + 38 µV	
	(30 to 100) kHz	0.59 mV/V + 45.1 µV	
	(100 to 300) kHz	4 mV/V + 0.4 mV	
	300 kHz to 1 MHz	15.2 mV/V + 0.38 mV	
	(100 to 1 000) V		
	1 Hz to 2 kHz	0.12 mV/V + 1 mV	
	(2 to 10) kHz	0.11 mV/V + 13.6 mV	
	(10 to 30) kHz	0.25 mV/V + 0.82 mV	
	(30 to 100) kHz	0.62 mV/V + 4.6 mV	

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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 330) µA		Comparison to Multiproduct Calibrator
	(10 to 20) Hz	1.6 nA/µA + 78 nA	
	(20 to 45) Hz	1.2 nA/µA + 82 nA	
	45 Hz to 1 kHz	1 nA/µA + 78 nA	
	(1 to 5) kHz	2.4 nA/µA + 0.12 µA	
	(5 to 10) kHz	6.3 nA/µA + 0.16 µA	
	(10 to 30) kHz	12.4 nA/µA + 0.31 µA	
	(0.33 to 3.3) mA		
	(10 to 20) Hz	1.6 µA/mA + 0.11 µA	
	(20 to 45) Hz	1 µA/mA + 0.12 µA	
	45 Hz to 1 kHz	0.8 µA/mA + 0.12 µA	
	(1 to 5) kHz	1.6 µA/mA + 0.16 µA	
	(5 to 10) kHz	3.9 µA/mA + 0.23 µA	
	(10 to 30) kHz	7.8 µA/mA + 0.5 µA	
	(3.3 to 33) mA		
	(10 to 20) Hz	1.4 µA/mA + 1.6 µA	
	(20 to 45) Hz	0.7 µA/mA + 2 µA	
	45 Hz to 1 kHz	0.4 µA/mA + 2 µA	
	(1 to 5) kHz	0.7 µA/mA + 2 µA	
	(5 to 10) kHz	2 µA/mA + 3 µA	
	(10 to 30) kHz	4 µA/mA + 4 µA	
	(33 to 330) mA		
	(10 to 20) Hz	1.4 µA/mA + 16 µA	
	(20 to 45) Hz	0.7 µA/mA + 17 µA	
	45 Hz to 1 kHz	0.4 µA/mA + 18 µA	
	(1 to 5) kHz	0.8 µA/mA + 45 µA	
	(5 to 10) kHz	1.6 µA/mA + 78 µA	
	(10 to 30) kHz	3.2 µA /mA + 0.2 mA	
	(0.33 to 1.1) A		
	(10 to 45) Hz	1.4 mA/A + 0.1 mA	
	45 Hz to 1 kHz	0.4 mA/A + 0.1 mA	
	(1 to 5) kHz	5 mA/A + 0.8 mA	
	(5 to 10) kHz	20 mA/A + 4 mA	
	(1.1 to 3) A		
	(10 to 45) Hz	1.4 mA/A + 0.1 mA	
	45 Hz to 1 kHz	0.5 mA/A + 0.1 mA	
	(1 to 5) kHz	4.7 mA/A + 1 mA	
	(5 to 10) kHz	19.5 mA/A + 4 mA	

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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]	(3 to 11) A (45 to 100) Hz 100 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	 0.5 mA/A + 2 mA 0.8 mA/A + 2 mA 23.4 mA/A + 2 mA 1 mA/A + 4 mA 1.3 mA/A + 4 mA 24 mA/A + 4 mA	Comparison to Multiproduct Calibrator
AC Current – Measure [1]	(1 to 10) µA 1 Hz to 10 kHz (10 to 100) µA 1 Hz to 2 kHz 10 µA to 1 mA (2 to 10) kHz 10 µA to 10 mA (10 to 30) kHz (0.1 to 100) mA 1 Hz to 2 kHz (1 to 100) mA (2 to 10) kHz (10 to 100) mA (10 to 30) kHz (0.1 to 1) A 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (1 to 10) A 10 Hz to 2 kHz (10 to 30) A 10 Hz to 2 kHz (2 to 10) kHz	 1.7 nA/µA + 8 nA 0.12 nA/µA + 23.3 nA 0.55 nA/µA + 18.7 nA 1 nA/µA + 14.3 nA 0.33 nA/µA + 2.81 nA 0.55 µA/mA + 10.6 nA 0.97 µA/mA + 0.24 µA 0.37 mA/A + 7.6 µA 0.65 mA/A + 15.1 µA 0.84 mA/A + 12.7 µA 0.85 mA/A + 47 µA 1 mA/A +6.1 mA 1.6 mA/A + 50 µA	Comparison to 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
Resistance – Source [1] (Simulation)	Up to 11 Ω	32 μΩ/Ω + 0.8 mΩ	Comparison to Multiproduct Calibrator
	(11 to 33) Ω	23 μΩ/Ω + 1.2 mΩ	
	(33 to 110) Ω	21 μΩ/Ω + 1.3 mΩ	
	(110 to 330) Ω	23 μΩ/Ω + 1.6 mΩ	
	(0.33 to 1.1) kΩ	22 μΩ/Ω + 1.9 mΩ	
	(1.1 to 3.3) kΩ	24 μΩ/Ω + 14.1 mΩ	
	(3.3 to 11) kΩ	23 μΩ/Ω + 18 mΩ	
	(11 to 33) kΩ	23 μΩ/Ω + 0.15 Ω	
	(33 to 110) kΩ	23 μΩ/Ω + 0.16 Ω	
	(110 to 330) kΩ	29 μΩ/Ω + 1.2 Ω	
	(0.33 to 1.1) MΩ	27 μΩ/Ω + 2 Ω	
	(1.1 to 3.3) MΩ	38 μΩ/Ω + 0.13 kΩ	
	(3.3 to 11) MΩ	0.11 mΩ/Ω + 74 Ω	
	(11 to 33) MΩ	0.42 mΩ/Ω + 0.65 kΩ	
	(33 to 110) MΩ	0.51 mΩ/Ω + 2.6 kΩ	
	(110 to 330) MΩ	3.9 mΩ/Ω + 4.1 kΩ	
	(330 to 1 100) MΩ	12 mΩ/Ω + 0.45 MΩ	
Resistance – Measure [1]	(1 to 10) Ω	27 μΩ /Ω + 38.5 μΩ	Comparison to 8.5 Digit Multimeter
	(10 to 100) Ω	6.7 μΩ/Ω + 0.14 mΩ	
	(0.1 to 1) kΩ	7.9 μΩ/Ω + 27.4 mΩ	
	(1 to 10) kΩ	8 μΩ/Ω + 1.8 mΩ	
	(10 to 100) kΩ	7.8 μΩ/Ω + 3.8 mΩ	
	(0.1 to 1) MΩ	12.4 μΩ/Ω + 0.25 Ω	
	(1 to 10) MΩ	0.25 mΩ/Ω + 14.8 Ω	
	(10 to 100) MΩ	0.16 mΩ/Ω + 1.4 kΩ	
	(0.1 to 1) GΩ	1.7 mΩ/Ω + 0.15 MΩ	
Capacitance – Source [1] (Simulation)			Comparison to Multiproduct Calibrator
10 Hz to 10 kHz	(220 to 400) pF	4 fF/pF + 8 pF	
10 Hz to 10 kHz	(0.4 to 1.1) nF	4 fF/pF + 9 pF	
10 Hz to 3 kHz	(1.1 to 3.3) nF	3.5 pF/nF + 9 pF	
10 Hz to 1 kHz	(3.3 to 11) nF	2.2 pF/nF + 12.8 pF	
10 Hz to 1 kHz	(11 to 33) nF	4.2 pF/nF + 62 pF	
10 Hz to 1 kHz	(33 to 110) nF	2.2 pF/nF + 0.1 nF	
10 Hz to 1 kHz	(110 to 330) nF	4.8 pF/nF + 74 pF	
(10 to 600) Hz	(0.33 to 1.1) μF	5.4 pF/nF + 0.2 nF	
(10 to 300) Hz	(1.1 to 3.3) μF	4.6 pF/μF + 1.2 nF	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source [1] (Simulation)			Comparison to Multiproduct Calibrator
(10 to 150) Hz	(3.3 to 11) µF	3.8 nF/µF + 7.3 nF	
(10 to 120) Hz	(11 to 33) µF	3.2 nF/µF + 35 nF	
(10 to 80 Hz	(33 to 110) µF	4.2 nF/µF + 0.3 µF	
(0 to 50) Hz	(110 to 330) µF	3.5 nF/µF + 0.2 µF	
(0 to 20) Hz	(0.33 to 1.1) mF	3.5 µF/mF + 0.8 µF	
(0 to 6) Hz	(1.1 to 3.3) mF	3.5 µF/mF + 2.3 µF	
(0 to 2) Hz	(3.3 to 11) mF	3.5 µF/mF + 8 µF	
(0 to 0.6) Hz	(11 to 33) mF	5.8 µF/mF + 24 µF	
(0 to 0.2) Hz	(33 to 110) mF	8.5 µF/mF + 78 µF	
Capacitance – Measure [1]	(1 to 10) nF	6.8 pF/nF + 2 pF	Comparison to 8.5 Digit Multimeter
	(10 to 100) nF	0.5 pF/nF + 3.9 pF	
	(0.1 to 1) µF	0.56 pF/µF + 5.6 pF	
	(1 to 10) µF	0.57 pF/µF + 7.2 pF	
	(10 to 100) µF	0.9 nF/µF + 2.9 nF	
	(0.1 to 1) mF	0.74 µF /mF + 12.1 nF	
	(1 to 10) mF	0.85 µF/mF + 0.1 µF	
	(10 to 100) mF	0.9 µF/mF + 90 nF	
Electrical Simulation of RTD Indicating Devices – Source [1]	Pt 385, 100 Ω		Comparison to Multiproduct Calibrator
	(-200 to 0) °C	0.05 °C	
	(0 to 100) °C	0.07 °C	
	(100 to 300) °C	0.09 °C	
	(300 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 300) °C	0.09 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 630) °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 Simulation of RTD Indicating Devices – Source [1]	Pt 3916, 100 Ω		Comparison to Multiproduct Calibrator
	(-200 to -190) °C	0.25 °C	
	(-190 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.05 °C	
	(0 to 100) °C	0.06 °C	
	(100 to 260) °C	0.07 °C	
	(260 to 300) °C	0.08 °C	
	(300 to 400) °C	0.09 °C	
	(400 to 600) °C	0.1 °C	
	(600 to 630) °C	0.23 °C	
	Pt 385, 200 Ω		
	(-200 to 100) °C	0.04 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.12 °C	
	(300 to 400) °C	0.13 °C	
	(400 to 600) °C	0.14 °C	
	(600 to 630) °C	0.16 °C	
	Pt 385, 500 Ω		
	(-200 to -80) °C	0.04 °C	
	(-80 to 100) °C	0.05 °C	
	(100 to 260) °C	0.06 °C	
	(260 to 400) °C	0.08 °C	
	(400 to 600) °C	0.09 °C	
	(600 to 630) °C	0.11 °C	
	Pt 385, 1 kΩ		
	(-200 to 0) °C	0.03 °C	
	(0 to 100) °C	0.04 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.06 °C	
	(300 to 600) °C	0.07 °C	
	(600 to 630) °C	0.23 °C	
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure [1]	Type B		Comparison to Multiproduct Calibrator
	(600 to 800) °C	0.37 °C	
	(800 to 1 000) °C	0.29 °C	
	(1 000 to 1 550) °C	0.25 °C	
	(1 550 to 1 820) °C	0.28 °C	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure [1]	Type C		Comparison to Multiproduct Calibrator
	(0 to 150) °C	0.3 °C	
	(150 to 650) °C	0.26 °C	
	(650 to 1 000) °C	0.31 °C	
	(1 000 to 1 800) °C	0.5 °C	
	(1 800 to 2 316) °C	0.84 °C	
	Type E		
	(-250 to -100) °C	0.4 °C	
	(-100 to -25) °C	0.14 °C	
	(-25 to 350) °C	0.12 °C	
	(350 to 650) °C	0.14 °C	
	(650 to 1 000) °C	0.17 °C	
	Type J		
	(-210 to -100) °C	0.22 °C	
	(-100 to -30) °C	0.14 °C	
	(-30 to 150) °C	0.12 °C	
	(150 to 760) °C	0.14 °C	
	(760 to 1 200) °C	0.19 °C	
	Type K		
	(-200 to -100) °C	0.28 °C	
	(-100 to -25) °C	0.23 °C	
	(-25 to 120) °C	0.16 °C	
	(120 to 1 000) °C	0.23 °C	
	(1 000 to 1 372) °C	0.33 °C	
	Type L		
	(-200 to -100) °C	0.29 °C	
	(-100 to 800) °C	0.21 °C	
	(800 to 900) °C	0.14 °C	
	Type N		
	(-200 to -100) °C	0.32 °C	
	(-100 to -25) °C	0.18 °C	
	(25 to 120) °C	0.16 °C	
	(120 to 410) °C	0.15 °C	
	(410 to 1 300) °C	0.22 °C	
	Type R		
	(0 to 250) °C	0.46 °C	
	(250 to 400) °C	0.29 °C	
	(400 to 1 000) °C	0.27 °C	
	(1 000 to 1 767) °C	0.33 °C	

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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 S (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C Type U (-200 to 0) °C (0 to 600) °C	 0.39 °C 0.3 °C 0.3 °C 0.38 °C 0.51 °C 0.2 °C 0.14 °C 0.12 °C 0.44 °C 0.22 °C	Comparison to Multiproduct Calibrator

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers [1,2] (Outside, Inside, Depth, Step)	Up to 12 in	(360 + 0.96L) µin	Comparison to Gage Blocks
Outside Micrometers [1,2]	Up to 4 in	(29 + 0.42L) µin	Comparison to Gage Blocks
Dial/Digital Indicators [1,2]	Up to 4 in	(72 + 0.57L) µin	Comparison to Gage Blocks

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure Devices [1] (Gauge Pressure)	Up to 300 psi	0.001 2 % of reading + 0.078 psi	Comparison to Pressure Calibrator
Absolute Pressure Devices	(60 to 110) kPa	0.067 kPa	Comparison to Pressure Calibrator
Vacuum Devices [1]	(-12.5 to 0) psi	0.000 04 % of reading + 0.078 psi	Comparison to Pressure Calibrator

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Analytical Balances [1,3]	(1 to 500) mg (0.5 to 5) g (5 to 10) g (10 to 20) g (20 to 50) g (50 to 100) g (100 to 500) g (500 to 1 000) g (1 000 to 2 000) g (2 000 to 4 000) g (4 000 to 5 000) g	11 µg 40 µg 58 µg 86 µg 0.14 mg 0.29 mg 0.58 mg 1.4 mg 2.9 mg 8.2 mg 14 mg	ASTM E617 Class 1 weights and internal calibration procedure CP-500-0001 utilized in the calibration of the weighing system.
Pipettes	(0.2 to 2) µl 10 µl 20 µl 100 µl 200 µl 1 000 µl 5 000 µl 10 000 µl	8.4 nl 15 nl 21 nl 83 nl 0.23 µl 1.2 µl 5.8 µl 12 µl	Comparison to Satorius Cubis MPS Pipette Calibration System
Mass Flow – Gas	(0.1 to 1) slpm (1 to 30) slpm (30 to 300) slpm	0.13 % of reading + 0.000 2 sccm 0.13 % of reading + 0.01 sccm 0.13 % of reading + 0.01 sccm	Comparison to Fluke molBox/molBloc Mass Flow Calibration System
3L Syringe	3 000 mL	3.8 mL	Comparison to Hans Rudolph Syringe Validator

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity – Measure	(15 to 95) %RH	1.1 %RH	Comparison to Vaisala Temp/Humidity Probe
Temperature – Source (PRT, Thermocouple Probes, etc.)	(-25 to 0) ºC (0 to 90) °C (90 to 150) °C	0.087 °C 0.092 °C 0.063 °C	Comparison to Dry-well Calibrator, Temperature Indicator w/RTD

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Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measure [1]	(-200 to- 40) ºC (-40 to 0) °C (0 to 240) °C (240 to 400) °C	0.03 °C 0.019 °C 0.042 °C 0.054 °C	Comparison to Temperature Indicator w/RTD

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source [1]	10 mHz to 120 Hz 120 Hz to 1.2 kHz (1.2 to 12) kHz (12 to 120) kHz	3.2 mHz 4.8 mHz 24 mHz 0.23 Hz	Comparison to Multiproduct Calibrator
Frequency – Measure [1]	Up to 10 Hz 10 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz 100 kHz to 1 MHz (1 to 10) MHz (10 to 100) MHz	14 µHz 1.2 mHz 12 mHz 13 mHz 0.11 Hz 50 Hz 88 Hz	Comparison to 8.5 Digit Multimeter
Stopwatches/Timers [1]	Up to 24 hr	35 ms/24 hr	Comparison to Timometer

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.
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 (MU) at the time of calibration.
4. The values in the Range column are Nominal values. The certified values will be used at the time of calibration, including the associated uncertainty values.
5. Unless otherwise specified in the far-right column, the calibration procedure/method was written and validated internally.

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