CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Accura Calibration
2834 West Kingsley Road
Garland, TX 75041

Fulfills the requirements of

ISO/IEC 17025:2017

and national standards

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

In the field of

CALIBRATION

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 01 February 2024
Certificate Number: AC-2548

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

AND

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

Accura Calibration
2834 West Kingsley Road
Garland, TX 75041
Dwight Martin 972-278-7878

CALIBRATION

Valid to: **February 1, 2024** Certificate Number: **AC-2548**

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Accelerometers Frequency Response (1 g Reference)	(7 to 10) Hz (10 to 30) Hz (30 to 99) Hz 100 Hz (101 to 2 000) Hz (2 000 to 10 000) Hz	7 % of reading 4.6 % of reading 3.8 % of reading 3.8 % of reading 3.8 % of reading 5.3 % of reading	Modal Shop 9110D Workstation

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Clamp Meter [1] Toroidal Clamp			
(45 to 65) Hz	(20 to 300) A (300 to 600) A (600 to 1 000) A	11 mA/A + 90 mA 9.8 mA/A + 90 mA 11 mA/A + 0.09 A	Fluke 5500A/Coil, Valhalla 2575A Current Shunt, Keysight 3458A 8.5 Digit Multimeter, Current Source
400 Hz	(20 to 300) A (300 to 600) A	19 mA/A + 0.1 A 18 mA/A + 0.1 A	
200 Hz	(600 to 1 000) A	18 mA/A + 0.1 A	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Clamp Meter [1]			Fluke 5500A/Coil, Valhalla 2575A Current Shunt, Keysight 3458A 8.5 Digit Multimeter, Current Source
Non-Toroidal Clamp			
(45 to 65) Hz	(20 to 300) A	15 mA/A + 0.9 A	
	(300 to 600) A	14 mA/A + 0.9 A	
	(600 to 1 000) A	14 mA/A + 0.9 A	
400 Hz	(20 to 300) A	22 mA/A + 0.9 A	
	(300 to 600) A	21 mA/A + 0.9 A	
200Hz	(600 to 1 000) A	22 mA/A + 0.9 A	
DC Voltage – Source [1] (Locked Ranges)	(0 to 329.999 9) mV	16 µV/V + 0.78 µV	Fluke Multiproduct Calibrator
	(0 to 3.299 999) V	9.1 µV/V + 1.6 µV	
	(0 to 32.999 99) V	9.7 µV/V + 16 µV	
	(30 to 329.999 9) V	14 µV/V + 0.12 µV	
	(100 to 1 020) V	15 µV/V + 1.2 µV	
DC Voltage – Measure [1]	Up to 120 mV	6.1 µV/V + 0.3 µV	Keysight 3458A 8.5 Digit Multimeter
	(0.12 to 1.2) V	5.1 µV/V + 0.3 µV	
	(1.2 to 12) V	5.1 µV/V + 0.5 µV	
	(12 to 120) V	7.3 µV/V + 30 µV	
	(120 to 1 050) V	7.3 µV/V + 0.1 mV	
DC High Voltage – Source/Measure [1]	(1 to 60) kV	1.8 mV/V	Ross Engineering VD60-6.2Y-A-LB-AL High Voltage Divider, Keysight 3458A 8.5 Digit Multimeter
DC Current – Source [1] (Locked Ranges)	(0 to 329) µA	0.12 µA/µA + 16 nA	Fluke Multiproduct Calibrator
	(0 to 3.299 999) mA	79 µA/µA + 39 nA	
	(0 to 32.999 99) mA	79 µA/µA + 0.19 µA	
	(0 to 329.999 9) mA	82 µA/µA + 1.9 µA	
	(0 to 1.099 999) A	0.15 mA/A + 31 µA	
	(1.1 to 2.999 99) A	0.3 mA/A + 31 µA	
	(0 to 10.999 9) A	0.39 mA/A + 0.39 mA	
	(11 to 20.5) A	0.78 mA/A + 0.58 mA	
DC Current – Measure [1]	(0.1 to 2) mA	3.9 mA/A + 3 nA	Keysight 3458A 8.5 Digit Multimeter
	(2 to 20) mA	0.41 mA/A + 30 nA	
	(20 to 200) mA	0.11 mA/A +0.3 µA	
	(0.2 to 2) A	0.2 mA/A + 3 µA	
	(2 to 20) A	0.2 mA/A + 30 µA	
	(20 to 100) A	0.5 mA/A + 0.3 mA	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source [1]	(1 to 32.999) mV		Fluke Multiproduct Calibrator
	(10 to 45) Hz	0.64 mV/V + 4.7 µV	
	45 Hz to 10 kHz	0.15 mV/V + 4.7 µV	
	(10 to 20) kHz	0.18 mV/V + 4.7 µV	
	(20 to 50) kHz	0.79 mV/V + 4.7 µV	
	(50 to 100) kHz	2.7 mV/V + 9.3 µV	
	(100 to 500) kHz	6.4 mV/V + 39 µV	
	(33 to 329.999) mV		
	(10 to 45) Hz	0.36 mV/V + 6.2 µV	
	45 Hz to 10 kHz	0.3 mV/V + 6.2 µV	
	(10 to 20) kHz	0.3 mV/V + 6.2 µV	
	(20 to 50) kHz	0.52 mV/V + 6.2 µV	
	(50 to 100) kHz	0.97 mV/V + 27 µV	
	(100 to 500) kHz	2.8 mV/V + 54 µV	
	(0.33 to 3.299 99) V		
	(10 to 45) Hz	0.23 mV/V + 39 µV	
	45 Hz to 10 kHz	0.12 mV/V + 47 µV	
	(10 to 20) kHz	0.15 mV/V + 47 µV	
	(20 to 50) kHz	0.24 mV/V + 39 µV	
	(50 to 100) kHz	0.55 mV/V + 97 µV	
	(100 to 500) kHz	1.9 mV/V + 0.47 mV	
	(3.3 to 32.999 9) V		
	(10 to 45) Hz	0.23 mV/V + 0.5 mV	
	45 Hz to 10 kHz	0.12 mV/V + 0.47 mV	
	(10 to 20) kHz	0.2 mV/V + 4.7 mV	
	(20 to 50) kHz	0.23 mV/V + 4.7 mV	
	(50 to 100) kHz	0.7 mV/V + 1.2 mV	
	(33 to 329.999) V		
	45 Hz to 1 kHz	0.15 mV/V + 1.6 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 + 4.7 mV	
	(50 to 100) kHz	0.7 mV/V + 39 mV	
	(330 to 1 020) V		
	45 Hz to 1 kHz	0.24 mV/V + 7.8 mV	
	(1 to 5) kHz	0.2 mV/V + 7.8 mV	
	(5 to 10) kHz	0.24 mV/V + 7.8 mV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure [1]	10 nV to 12 mV		Keysight 3458A 8.5 Digit Multimeter
	(1 to 40) Hz	0.7 mV/V	
	40 Hz to 1 kHz	0.36 mV/V	
	(1 to 20) kHz	0.48 mV/V	
	(20 to 50) kHz	1.3 mV/V	
	(50 to 100) kHz	5.9 mV/V	
	(100 to 300) kHz	46 mV/V	
	12 mV to 12 V		
	(1 to 40) Hz	0.13 mV/V	
	40 Hz to 1 kHz	0.11 mV/V	
	(1 to 20) kHz	0.22 mV/V	
	(20 to 50) kHz	0.37 mV/V	
	(50 to 100) kHz	0.95 mV/V	
	(100 to 300) kHz	3.6 mV/V	
	(0.3 to 1) MHz	1.2 mV/V	
	(1 to 2) MHz	17 mV/V	
	(12 to 120) V		
	(1 to 40) Hz	0.28 mV/V	
	40 Hz to 1 kHz	0.26 mV/V	
	(1 to 20) kHz	0.26 mV/V	
	(20 to 50) kHz	0.43 mV/V	
	(50 to 100) kHz	1.4 mV/V	
	(100 to 300) kHz	4.7 mV/V	
	(0.3 to 1) MHz	17 mV/V	
	(120 to 700) V		
	(1 to 40) Hz	0.53 mV/V	
	40 Hz to 1 kHz	0.5 mV/V	
	(1 to 20) kHz	0.73 mV/V	
	(20 to 50) kHz	1.4 mV/V	
	(50 to 100) kHz	3.5 mV/V	
AC High Voltage – Source/Measure [1]	(1 to 60) kV 60 Hz	5.9 mV/V	Ross Engineering VD60-6.2Y-A-LB-AL High Voltage Divider, Keysight 3458A 8.5 Digit Multimeter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source [1]	(29 to 329.99) uA		Fluke Multiproduct Calibrator
	(10 to 20) Hz	1.6 nA/µA + 78 nA	
	(20 to 45) Hz	1.2 nA/µA + 78 nA	
	45 Hz to 1 kHz	0.97 nA/µA + 78 nA	
	(1 to 5) kHz	2.3 nA/µA + 0.12 µA	
	(5 to 10) kHz	6.4 nA/µA + 0.16 µA	
	(10 to 30) kHz	12 nA/µA + 0.31 µA	
	(0.33 to 3.299 99) mA		
	(10 to 20) Hz	1.6 µA/mA + 0.12 µA	
	(20 to 45) Hz	0.97 µA/mA + 0.12 µA	
	45 Hz to 1 kHz	0.79 µA/mA + 78 nA	
	(1 to 5) kHz	1.5 µA/mA + 0.16 µA	
	(5 to 10) kHz	3.9 µA/mA + 0.23 µA	
	(10 to 30) kHz	7.9 µA/mA + 0.47 µA	
	(3.3 to 32.999 9) mA		
	(10 to 20) Hz	1.4 µA/mA + 1.6 µA	
	(20 to 45) Hz	0.7 µA/mA + 1.6 µA	
	45 Hz to 1 kHz	0.3 µA/mA + 0.16 µA	
	(1 to 5) kHz	0.64 µA/mA + 0.16 µA	
	(5 to 10) kHz	1.5 µA/mA + 2.3 µA	
	(10 to 30) kHz	3 µA/mA + 3.1 µA	
	(33 to 329.999) mA		
	(10 to 20) Hz	1.4 µA/mA + 16 µA	
	(20 to 45) Hz	0.7 µA/mA + 16 µA	
	45 Hz to 1 kHz	0.33 µA/mA + 16 µA	
	(1 to 5) kHz	0.79 µA/mA + 39 µA	
	(5 to 10) kHz	1.6 µA/mA + 78 µA	
	(10 to 30) kHz	3.3 µA/mA + 0.16 mA	
	(0.33 to 1.099 99) A		
	(10 to 45) Hz	0.11 mA/A + 78 µA	
	45 Hz to 1 kHz	0.11 mA/A + 78 µA	
	(1 to 5) kHz	0.16 mA/A + 0.78 mA	
	(5 to 10) kHz	0.4 mA/A + 3.9 mA	
	(1.1 to 2.999 99) A		
	(10 to 45) Hz	1.4 mA/A + 78 µA	
	45 Hz to 1 kHz	0.53 mA/A + 78 µA	
	(1 to 5) kHz	4.7 mA/A + 0.78 mA	
	(5 to 10) kHz	19 mA/A + 3.9 mA	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source [1]	(3 to 10.9999) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (3 to 10.9999) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (11 to 20.5) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	 1 mA/A + 1.6 mA 1.2 mA/A + 1.6 mA 23 mA/A + 1.6 mA 1 mA/A + 1.6 mA 1.2 mA/A + 1.6 mA 23 mA/A + 1.6 mA 1.8 mA/A + 3.9 mA 1.9 mA/A + 3.9 mA 23 mA/A + 3.9 mA	Fluke Multiproduct Calibrator
AC Current – Source/Measure [1]	45 Hz to 1 kHz (0.1 to 2) mA (2 to 20) mA (20 to 200) mA (0.2 to 2) A (2 to 20) A (20 to 100) A	 4.1 mA/A + 3 nA 1.1 mA/A + 30 nA 1 mA/A + 0.3 µA 1 mA/A + 3 µA 1 mA/A + 30 µA 1 mA/A + 0.15 mA	Valhalla 2575A Current Shunt, Keysight 3458A 8.5 Digit Multimeter, Current Source
DC Power – Source [1] 33 mV to 1 020 V 33 mV to 1 020 V	 0.33 mA to 2.9999 A 11 µW to 3.06 kW (3 to 20.5) A 0.1 W to 20.9 kW	 0.018 % of reading 0.054 % of reading	Fluke Multiproduct Calibrator
AC Power – Source [1] 33 mV to 1 020 V (45 to 65) Hz Power Factor: PF=1	 (3 to 20.5) A 0.11 mW to 20.9 kW	 0.11 % of reading	Fluke Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source [1]			Fluke Multiproduct Calibrator
10 Hz to 10 kHz	(220 to 399.9) pF	0.55 % of reading + 7.8 pF	
10 Hz to 10 kHz	(0.4 to 1.099 9) nF	0.42 % of reading + 10 pF	
10 Hz to 3 kHz	(1.1 to 3.299 9) nF	0.39 % of reading + 10 pF	
10 Hz to 1 kHz	(3.3 to 10.999 9) nF	0.2 % of reading + 10 pF	
10 Hz to 1 kHz	(11 to 32.999 9) nF	0.2 % of reading + 8 pF	
10 Hz to 1 kHz	(33 to 109.999) nF	0.2 % of reading + 8 pF	
10 Hz to 1 kHz	(110 to 329.999) nF	0.27 % of reading + 0.23 nF	
(10 to 600) Hz	(0.33 to 1.099 99) µF	0.21 % of reading + 0.78 nF	
(10 to 300) Hz	(1.1 to 3.299 99) µF	0.2 % of reading + 2.3 nF	
(10 to 150) Hz	(3.3 to 10.999 9) µF	0.21 % of reading + 7.8 nF	
(10 to 120) Hz	(11 to 32.999 9) µF	0.3 % of reading + 23 nF	
(10 to 80) Hz	(33 to 109.999) µF	0.35 % of reading + 78 nF	
(0 to 50) Hz	(110 to 329.999) µF	0.36 % of reading + 0.23 µF	
(0 to 20) Hz	(0.33 to 1.099 99) mF	0.36 % of reading + 0.78 µF	
(0 to 6) Hz	(1.1 to 3.299 99) mF	0.36 % of reading + 2.3 µF	
(0 to 2) Hz	(3.3 to 10.999 9) mF	0.35 % of reading + 7.8 µF	
(0 to 0.6) Hz	(11 to 32.999 9) mF	0.58 % of reading + 23 µF	
(0 to 0.2) Hz	(33 to 110) mF	0.85 % of reading + 77 µF	
Capacitance – Measure [1]	1 pF to 6.4 nF	1.2 mF/F	General Radio 1689M RLC Bridge
	(6.4 to 100) nF	3.8 mF/F	
	100 nF to 1.6 µF	8.1 mF/F	
	(1.6 to 100) µF	5.7 mF/F	
Inductance – Source/Measure [1] (100 Hz – 1 kHz)	1 mH to 11.11 H	2.7 mH/H	General Radio 1689M RLC Bridge, General Radio 1490D Decade Inductor
Resistance – Source [1]	(0 to 11) Ω	33 µΩ/Ω + 0.78 mΩ	Fluke Multiproduct Calibrator
	(11 to 33) Ω	24 µΩ/Ω + 1.2 mΩ	
	(33 to 110) Ω	22 µΩ/Ω + 1.1 mΩ	
	(110 to 330) Ω	22 µΩ/Ω + 1.6 mΩ	
	(0.33 to 1.1) kΩ	23 µΩ/Ω + 1.6 µΩ	
	(1.1 to 3.3) kΩ	23 mΩ/Ω + 16 mΩ	
	(3.3 to 11) kΩ	23 mΩ/Ω + 16 mΩ	
	(11 to 33) kΩ	22 mΩ/Ω + 0.16 Ω	
	(33 to 110) kΩ	23 mΩ/Ω + 0.16 Ω	
	(110 to 330) kΩ	26 mΩ/Ω + 1.6 Ω	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source [1]	(0.33 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 (330 to 1 100) MΩ	25 mΩ/Ω + 1.6 Ω 48 mΩ/Ω + 23 Ω 0.23 Ω/Ω + 39 Ω 0.2 Ω/Ω + 1.9 kΩ 0.4 Ω/Ω + 2.3 kΩ 2.3 Ω/kΩ + 78 kΩ 12 Ω/kΩ + 0.39 MΩ	Fluke Multiproduct Calibrator
Resistance – Measure [1]	(0 to 12) Ω (12 to 120) Ω (0.12 to 1.2) kΩ (1.2 to 12) kΩ (1.2 to 120) kΩ (0.12 to 1.2) MΩ (1.2 to 12) MΩ (12 to 120) MΩ (0.12 to 1.2) GΩ	19 µΩ/ Ω + 50 µΩ 15 µΩ/ Ω + 0.5 mΩ 13 µΩ/ Ω + 0.5 mΩ 12 µΩ/ Ω + 5 mΩ 13 µΩ/ Ω + 50 µΩ 24 µΩ/ Ω + 2 Ω 65 µΩ/ Ω + 100 Ω 0.58 mΩ/ Ω + 1 kΩ 5.8 mΩ/ Ω + 10 kΩ	Keysight 3458A 8.5 Digit Multimeter
AC Resistance – Source/Measure [1] (1 kHz)	1 Ω to 100 kΩ	0.39 mΩ/Ω	General Radio 1689M RLC Bridge, HP 16074A Standard Set
Oscilloscopes [1,2] DC Voltage into 50 Ω into 1 M Ω Square Wave into 50 Ω into 1 M Ω Time Markers into 50 Ω	 ± (0 to 6.6) V ± (0 to 130) V ± 1 mV to 6.6 V p-p ± 1 mV to 130 V p-p 1 ns to 20 ms 50 ms to 5 s	 0.25 % of reading + 40 µV 0.05 % of reading + 40 µV 0.25 % of reading + 40 µV 0.1 % of reading + 40 µV 2.5 µs/s (25 + 1 000t) µs/s	Fluke Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes [1,2]			
Leveled Sine Wave			
Frequency	50 kHz to 1.1 GHz	0.25 µHz/Hz	
Flatness			
50 kHz (reference)	5 mV to 5.5 V	2 % of reading + 0.3 mV	
50 kHz to 100 MHz	5 mV to 5.5 V	3.5 % of reading + 0.3 mV	
(100 to 300) MHz	5 mV to 5.5 V	4 % of reading + 0.3 mV	
(300 to 600) MHz	5 mV to 5.5 V	6 % of reading + 0.3 mV	
(0.6 to 1.1) GHz	5 mV to 3.5 V	7 % of reading + 0.3 mV	
Edge Characteristics			
into 50 Ω			
Rise Time	≤ 300 ps	+ 0 ps / - 100 ps	
Amplitude	5 mV to 2.5 V	2 % of reading + 0.2 mV	Fluke Multiproduct Calibrator
Frequency	900 Hz to 11 MHz	2.5 µHz/Hz	
Wave Generator Amplitude (Square, Sine, Triangle)			
into 50Ω	1.8 mV to 2.5 Vp-p	30 mV/V + 0.1 mV	
into 1 MΩ	1.8 mV to 55 Vp-p	30 mV/V + 0.1 mV	
Frequency	10 Hz to 100 kHz	25 µHz/Hz + 15 mHz	
Input Resistance Measurement			
into 50 Ω	(40 to 60) Ω	0.1 % of reading	
into 1 MΩ	500 kΩ to 1.5 MΩ	0.1 % of reading	
Input Capacitance Measurement			
into 1 MΩ	(5 to 50) pF	5 % of reading + 0.5 pF	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure [1]	Type B		Fluke Multiproduct Calibrator
	(600 to 800) °C	0.34 °C	
	(800 to 1 000) °C	0.27 °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	0.23 °C	
	(150 to 650) °C	0.2 °C	
	(650 to 1 000) °C	0.24 °C	
	(1 000 to 1 800) °C	0.39 °C	
	(1 800 to 2 316) °C	0.65 °C	
	Type E		
	(-250 to -100) °C	0.39 °C	
	(-100 to -25) °C	0.13 °C	
	(-25 to 350) °C	0.11 °C	
	(350 to 650) °C	0.13 °C	
	(650 to 1 000) °C	0.17 °C	
	Type J		
	(-210 to -100) °C	0.21 °C	
	(-100 to -30) °C	0.13 °C	
	(-30 to 150) °C	0.11 °C	
	(150 to 760) °C	0.14 °C	
	(760 to 1 200) °C	0.18 °C	
	Type K		
	(-200 to -100) °C	0.26 °C	
	(-100 to -25) °C	0.14 °C	
	(-25 to 120) °C	0.13 °C	
	(120 to 1 000) °C	0.2 °C	
	(1 000 to 1 372) °C	0.31 °C	
	Type L		
	(-200 to -100) °C	0.29 °C	
	(-100 to 800) °C	0.2 °C	
	(800 to 900) °C	0.14 °C	

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		Fluke Multiproduct Calibrator
	(-200 to -100) °C	0.31 °C	
	(-100 to -25) °C	0.17 °C	
	(-25 to 120) °C	0.15 °C	
	(120 to 410) °C	0.14 °C	
	(410 to 1 300) °C	0.21 °C	
	Type R		
	(0 to 250) °C	0.44 °C	
	(250 to 400) °C	0.27 °C	
	(400 to 1 000) °C	0.26 °C	
	(1 000 to 1 767) °C	0.31 °C	
	Type S		
	(0 to 250) °C	0.37 °C	
	(250 to 1 000) °C	0.28 °C	
	(1 000 to 1 400) °C	0.29 °C	
	(1 400 to 1 767) °C	0.36 °C	
	Type T		
	(-250 to -150) °C	0.49 °C	
	(-150 to 0) °C	0.19 °C	
	(0 to 120) °C	0.13 °C	
	(120 to 400) °C	0.11 °C	
	Type U		
	(-200 to 0) °C	0.44 °C	
	(0 to 600) °C	0.21 °C	
Electrical Simulation of RTD Indicating Devices – Source [1]	Pt 385, 100 Ω		Fluke Multiproduct Calibrator
	(-200 to -80) °C	0.04 °C	
	(-80 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 3926, 100 Ω		
	(-200 to -80) °C	0.04 °C	
	(-80 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 – 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		Fluke Multiproduct Calibrator
	(-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	
	Pt 385, 200 Ω		
	(-200 to -80) °C	0.03 °C	
	(-80 to 0) °C	0.03 °C	
	(0 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 0) °C	0.04 °C	
	(0 to 100) °C	0.04 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.06 °C	
	(300 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 -80) °C	0.02 °C	
	(-80 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 400) °C	0.05 °C	
	(400 to 600) °C	0.05 °C	
	(600 to 630) °C	0.18 °C	
	Ni 385, 120 Ω		
	(-80 to 0) °C	0.06 °C	
	(0 to 100) °C	0.06 °C	
	(100 to 260) °C	0.01 °C	

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]	Cu 427, 10 Ω (-100 to 260) °C	0.31 °C	Fluke Multiproduct Calibrator

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF/Microwave Power – Source/Measure [1]	100 kHz to 4.2 GHz (-30 to +20) dBm	0.13 dB	Keysight 8482A Power Sensor, Keysight E4418B Power Meter, Signal Generator
	10 MHz to 26.5 GHz (-30 to +20) dBm	0.11 dB	Keysight 8485A Power Sensor, Keysight E4418B Power Meter, Signal Generator
	10 MHz to 18 GHz (-70 to -20) dBm	0.13 dB	Keysight 8481D Power Sensor, Keysight E4418B Power Meter, Signal Generator
Attenuation – Measure or Tuned RF Power 2.5 MHz to 18 GHz	(0 to 10) dB (-10 to 0) dB (-20 to -10) dB (-30 to -20) dB (-40 to -30) dB (-50 to -40) dB (-60 to -50) dB (-70 to -60) dB (-80 to -70) dB (-90 to -80) dB (-100 to -90) dB (-110 to -100) dB (-120 to -110) dB (-127 to -120) dB	0.15 dB 0.15 dB 0.15 dB 0.15 dB 0.15 dB 0.15 dB 0.17 dB 0.17 dB 0.2 dB 0.22 dB 0.22 dB 0.33 dB 0.43 dB 0.43 dB	Keysight 8902A Measuring Receiver, Keysight 11793A Microwave Converter

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation – Measure			Agilent 8902A Measuring Receiver
150 kHz to 10 MHz	Rate: 50 Hz to 10 kHz Depths: (5 to 99) %	2.3 % of reading	
10 MHz to 1.3 GHz	Rate: 50 Hz to 50 kHz Depths: (5 to 99) %	1.2 % of reading	
10 MHz to 1.3 GHz	Rate: 20 Hz to 100 kHz Depths: (5 to 99) %	3.5 % of reading	
(1.3 to 26.5) GHz	Rate: 20 Hz to 100 kHz Depths: (5 to 99) %	1.8 % of reading	
(1.3 to 26.5) GHz	Rate: 20 Hz to 100 kHz Depths: (5 to 99) %	3.5 % of reading	
Frequency Modulation – Measure Carrier Frequency: 250 kHz to 10 MHz	Rate: 20 Hz to 10 kHz Dev.: ≤ 40 kHz peak	2.3 % of reading	Keysight 8902A Measuring Receiver
10 MHz to 1.3 GHz	Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	5.8 % of reading	
Frequency Modulation – Measure Carrier Frequency: (1.3 to 26.5) GHz	Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	5.8 % of reading	Keysight 8902A Measuring Receiver
Phase Modulation – Measure			Agilent 8902A Measuring Receiver, Keysight 11722A / 11792A Sensor Modules
10 MHz to 1.3 GHz	Rate: 200 Hz 20 kHz Dev.: .1 to 400 rad	3.5 % of reading	
1.3 GHz to 26.5 GHz	Rate: 200 Hz 20 kHz Dev.: > .1 to 400 rad	4.6 % of reading	

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Height Gage [1,2]	Up to 24 in	(22 + 13*L*) µin	Gage Blocks, Height Gage, Repeat-O-Meter
Micrometer [1]	Up to 1 in	16 µin/in	Gage Blocks
Calipers [1,2]	Up to 36 in	(345 + 5*L*) µin	Gage Blocks

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Caliper – Parallelism [1]	(0.15 to 0.5) in	8.8 µin/in	Pin Gage
External Diameter [2] (Pin Gages, Set Plugs)	Up to 12 in	(4.5 + 5.6*L*) µin	Universal Length Measuring Machine
Internal Diameter [2]	(0.04 to 3) in	(9.4 + 3.2*L*) µin	Universal Length Measuring Machine
Radius Gages [2]	(0.031 25 to 1) in	(291 + 98*L*) µin	Keyence
Gage Blocks [2]	Up to 12 in	(1.5 + 5.7*L*) µin	Universal Length Measuring Machine, Master Gage Blocks
Angle Measurement [2] Digital Protractors, Levels, Inclinometers	Up to 90°	22″ (0.006°)	Sine Bar, Gage Blocks, Surface Plate, Right Angles

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Class I Balances [1]			ASTM E617 Class 1 Weights and NIST Handbook 44 utilized for the calibration of the weighing system.
(0.000 01 g resolution)	Up to 100 g	0.29 mg	
(0.000 02 g resolution)	Up to 100 g	0.29 mg	
(0.000 05 g resolution)	Up to 100 g	0.3 mg	
(0.000 1 g resolution)	Up to 200 g	0.6 mg	
(0.000 2 g resolution)	Up to 200 g	0.6 mg	
(0.000 5 g resolution)	Up to 200 g	0.87 mg	

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Class II Balances [1]			ASTM E617 Class 1 Weights and NIST Handbook 44 utilized for the calibration of the weighing system.
(0.001 g resolution)	Up to 100 g	1.3 mg	
(0.002 g resolution)	Up to 200 g	2.6 mg	
(0.005 g resolution)	Up to 500 g	6.6 mg	
(0.01 g resolution)	Up to 1 kg	13 mg	
(0.02 g resolution)	Up to 2 kg	29 mg	
(0.05 g resolution)	Up to 5 kg	0.15 g	
(0.1 g resolution)	Up to 10 kg	0.31 g	
(0.2 g resolution)	Up to 20 kg	0.36 g	
Class III Light Capacity Scales [1]			NIST Class F Weights and NIST Handbook 44 utilized for the calibration of the weighing system.
(0.000 5 lb resolution)	Up to 5 lb	0.000 87 lb	
(0.001 lb resolution)	Up to 10 lb	0.001 7 lb	
(0.002 lb resolution)	Up to 20 lb	0.002 6 lb	
(0.005 lb resolution)	Up to 50 lb	0.008 7 lb	
(0.01 lb resolution)	Up to 100 lb	0.018 lb	
(0.02 lb resolution)	Up to 200 lb	0.036 lb	
(0.05 lb resolution)	Up to 500 lb	0.087 lb	
(0.1 lb resolution)	Up to 500 lb	0.14 lb	
Force Gages – Tension [1]	(1 to 110) lbf	0.06 lb	NIST Class F Weights, Hangers
Durometers – Spring Force Only Types A, B, O, C, D, DO	209.04 gf to 4.079 kgf	0.01 % of reading	ASTM E617 Class 1 Weights, Triple Beam Balance
Pressure – Source/Measure [1]	(-5 to 5) psi	0.081 psi	Comparison to Fluke 700PD3 Pressure Module

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure – Source/Measure [1]	(-12 to 100) psi	0.19 psi	Fluke 718-300 Pressure Calibrator
	Up to 1 000 psig	0.66 psi	Comparison to Crystal XP2i Master Digital Pressure Gage
	Up to 3 000 psig	2.4 psi	Comparison to Druck DPI 104-3000 Digital Pressure Gage
	Up to 10 000 psig	6 psi	Comparison to Druck DPI 104-10000 Digital Pressure Gage
	Up to 10 inH_2O	0.3 inH_2O	Comparison to Fluke 700PO1 Pressure Module
Torque Indicating Device [1]	(40 to 200) ozf·in (4 to 50) lbf·in (30 to 400) lbf·in (80 to 1 000) lbf·in (20 to 250) lbf·ft (60 to 600) lbf·ft	0.29 % of reading 0.29 % of reading 0.29 % of reading 0.3 % of reading 0.34 % of reading 0.59 % of reading	Torque Transducers
Torque Analyzers, Torque Transducers	(40 to 200) ozf·in (4 to 50) lbf·in (30 to 400) lbf·in (80 to 1 000) lbf·in (20 to 250) lbf·ft (60 to 600) lbf·ft	0.044 % of reading 0.044 % of reading 0.044 % of reading 0.044 % of reading 0.054 % of reading 0.096 % of reading	Torque Wheels/Arms, Master Weights, Weight Hanger

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Generate/Measure [1]	(-25 to 420) °C	0.04 °C	Fluke Blackstack Readout, SPRT, Heat Source
	(400 to 1 200) °C	0.32°C	Fluke Blackstack Readout, Type-S Thermocouple Probe, Heat Source

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Infrared Thermometers [1]	100 °C 300 °C 500 °C	0.6 °C 0.85 °C 1.2 °C	Comparison to SPRT w/ Fluke 9132A Blackbody Calibrator (flat plate) $\varepsilon = 0.95$, $\lambda = (8 \text{ to } 14)$ µm
Humidity – Generate	(10 to 90) %RH	1.2 %RH	Thunder Scientific, Psychrometer

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source/Measure	10 Hz to 26.5 GHz	50 pHz/Hz	GPS Disciplined Oscillator, Signal Generators, Universal Counters

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, T = time in seconds; ″ = arc-second.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2548.

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