



CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board

500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

Diamond Technical Services

11 Depot Street

South Grafton, MA 01560

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

ISO/IEC 17025:2005

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 calibrations to which this accreditation applies.

AC-1196

Certificate Number


ANAB Approval

Certificate Valid: 09/27/2018-11/18/2019
Version No. 008 Issued: 09/27/2018



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. 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 17025:2005
AND ANSI/NCSL Z540-1-1994 (R2002)**

Diamond Technical Services

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CALIBRATION

Valid to: **November 18, 2019**

Certificate Number: **AC-1196**

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	8.8 $\mu\text{V/V} + 0.63 \mu\text{V}$	Fluke 5720A Multifunction Calibrator
	220 mV to 2.2 V	5.9 $\mu\text{V/V} + 1.5 \mu\text{V}$	
	(2.2 to 11) V	4.1 $\mu\text{V/V} + 3.1 \mu\text{V}$	
	(11 to 22) V	4.1 $\mu\text{V/V} + 4.9 \mu\text{V}$	
	(22 to 220) V	5.8 $\mu\text{V/V} + 48 \mu\text{V}$	
	220 V to 1.1 kV	7.7 $\mu\text{V/V} + 0.48 \text{ mV}$	
DC Voltage – Measure ¹	Up to 100 mV	11 $\mu\text{V/V} + 3.6 \mu\text{V}$	HP 3458A Precision Multimeter
	100 mV to 1V	11 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	(1 to 10) V	11 $\mu\text{V/V} + 5 \mu\text{V}$	
	(10 to 100) V	13 $\mu\text{V/V} + 40 \mu\text{V}$	
	100 V to 1 kV	14 $\mu\text{V/V} + 0.38 \text{ mV}$	
	(1 to 30) kV	1.2 $\text{mV/V} + 27 \text{ mV}$	Ross VD30 High Voltage Divider HP34401A Multimeter
AC Voltage - Source ¹	Up to 2.2 mV		Fluke 5720A Multifunction Calibrator
	(10 to 20) Hz	0.28 $\text{mV/V} + 4.6 \mu\text{V}$	
	(20 to 40) Hz	0.11 $\text{mV/V} + 4.6 \mu\text{V}$	
	40 Hz to 20 kHz	93 $\mu\text{V/V} + 4.6 \mu\text{V}$	
	(20 to 50) kHz	0.23 $\text{mV/V} + 4.6 \mu\text{V}$	
	(50 to 100) kHz	0.58 $\text{mV/V} + 5.8 \mu\text{V}$	
	(100 to 300) kHz	1.2 $\text{mV/V} + 12 \mu\text{V}$	
	(300 to 500) kHz	1.6 $\text{mV/V} + 23 \mu\text{V}$	
	500 kHz to 1 MHz	3.1 $\text{mV/V} + 23 \mu\text{V}$	



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 5720A Multifunction Calibrator
	(10 to 20) Hz	0.28 mV/V + 4.6 μV	
	(20 to 40) Hz	0.11 mV/V + 4.6 μV	
	40 Hz to 20 kHz	93 μV/V + 4.6 μV	
	(20 to 50) kHz	0.23 mV/V + 4.6 μV	
	(50 to 100) kHz	0.58 mV/V + 5.8 μV	
	(100 to 300) kHz	1.2 mV/V + 12 μV	
	(300 to 500) kHz	1.6 mV/V + 23 μV	
	500 kHz to 1 MHz	3.1 mV/V + 23 μV	
	(22 to 220) mV		
	(10 to 20) Hz	0.28 mV/V + 4.6 μV	
	(20 to 40) Hz	0.11 mV/V + 4.6 μV	
	40 Hz to 20 kHz	93 μV/V + 4.6 μV	
	(20 to 50) kHz	0.23 mV/V + 4.6 μV	
	(50 to 100) kHz	0.58 mV/V + 5.8 μV	
	(100 to 300) kHz	1.2 mV/V + 12 μV	
	(300 to 500) kHz	1.6 mV/V + 23 μV	
	500 kHz to 1 MHz	3.1 mV/V + 23 μV	
	220 mV to 2.2 V		
	(10 to 20) Hz	0.33 mV/V + 46 μV	
	(20 to 40) Hz	0.13 mV/V + 17 μV	
	40 Hz to 20 kHz	68 μV/V + 9 μV	
	(20 to 50) kHz	0.1 mV/V + 0.12 mV	
	(50 to 100) kHz	0.15 mV/V + 35 μV	
(100 to 300) kHz	5.3 μV/V + 93 μV		
(300 to 500) kHz	1.2 mV/V + 0.23 mV		
500 kHz to 1 MHz	2 mV/V + 0.35 mV		
(2.2 to 22) V			
(10 to 20) Hz	0.29 mV/V + 0.46 mV		
(20 to 40) Hz	0.13 mV/V + 0.17 mV		
40 Hz to 20 kHz	68 μV/V + 58 μV		
(20 to 50) kHz	97 μV/V + 0.12 mV		
(50 to 100) kHz	0.14 mV/V + 0.23 mV		
(100 to 300) kHz	0.38 mV/V + 0.69 mV		
(300 to 500) kHz	1.2 mV/V + 2.3 mV		
500 kHz to 1 MHz	1.9 mV/V + 37 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		Fluke 5720A Multifunction Calibrator	
	(10 to 20) Hz	0.29 mV/V + 4.6 mV		
	(20 to 40) Hz	0.13 mV/V + 1.7 mV		
	40 Hz to 20 kHz	74 μV/V + 0.7 mV		
	(20 to 50) kHz	0.1 mV/V + 12 mV		
	(50 to 100) kHz	0.18 mV/V + 2.9 mV		
	(100 to 300) kHz	1 mV/V + 19 mV		
	(300 to 500) kHz	5.2 mV/V + 46 mV		
	500 kHz to 1 MHz	9.3 mV/V + 93 mV		
	220 V to 1.1 kV			
(15 to 50) Hz	4.9 μV/V + 19 mV	Fluke 5720A Multifunction Calibrator Fluke 5725A Amplifier		
50 Hz to 1 kHz	0.35 mV/V + 4 mV			
750 V				
(30 to 50) kHz	2.7 mV/V + 90 mV			
(50 to 100) kHz	2.7 mV/V + 90 mV			
1.1 kV				
(1 to 20) kHz	5.9 mV/V + 39 mV			
(20 to 30) kHz	6 mV/V + 71 mV			
AC Voltage - Measure ¹	(1 to 10) mV			HP 3458A Precision Multimeter
	(1 to 40) Hz		0.32 mV/V + 4.2 μV	
	40 Hz to 1 kHz	0.26 mV/V + 3.2 μV		
	(1 to 20) kHz	0.36 mV/V + 3.2 μV		
	(20 to 50) kHz	1.2 mV/V + 3.2 μV		
	(50 to 100) kHz	5.8 mV/V + 3.5 μV		
	100 kHz to 1MHz	14 mV/V + 6.5 μV		
	(1 to 4) MHz	81 mV/V + 8.6 μV		
	(4 to 8) MHz	0.23 V/V + 9.7 μV		
	(10 to 100) mV			
	(1 to 40) Hz	0.13 mV/V + 6.1 μV		
	40 Hz to 1 kHz	0.13 mV/V + 3.9 μV		
	(1 to 20) kHz	0.19 mV/V + 3.9 μV		
	(20 to 50) kHz	0.36 mV/V + 3.9 μV		
	(50 to 100) kHz	0.93 mV/V + 3.9 μV		
	(100 to 300) kHz	3.5 mV/V + 13 μV		
	300 kHz to 1 MHz	12 mV/V + 13 μV		
	(1 to 4) MHz	46 mV/V + 81 μV		
	(4 to 8) MHz	46 mV/V + 93 μV		
	(8 to 10) MHz	0.18 V/V + 0.12 mV		



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage - Measure ¹	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 4) MHz (4 to 8) MHz (8 to 10) MHz	0.13 mV/V + 51 μV 0.13 mV/V + 24 μV 0.19 mV/V + 24 μV 0.36 mV/V + 24 μV 0.93 mV/V + 24 μV 3.5 mV/V + 0.12 mV 12 mV/V + 0.12 mV 18 mV/V + 0.12 mV 46 mV/V + 0.93 mV 0.18 V/V + 1.2 mV	HP 3458A Precision Multimeter
	(1 to 10) 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 4) MHz (4 to 8) MHz (8 to 10) MHz	0.13 mV/V + 54 μV 0.13 mV/V + 0.24 mV 0.19 mV/V + 0.24 mV 0.36 mV/V + 0.24 mV 0.93 mV/V + 0.24 mV 3.5 mV/V + 1.2 μV 12 mV/V + 1.2 μV 18 mV/V + 8.1 μV 46 mV/V + 9.3 μV 0.18 V/V + 12 mV	
	(10 to 100) 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	0.32 mV/V + 5.9 mV 0.32 mV/V + 3.9 mV 0.32 mV/V + 3.9 mV 0.46 mV/V + 3.9 mV 1.4 mV/V + 3.9 mV 4.6 mV/V + 12 mV 18 mV/V + 12 mV	
	100 V to 1 kV (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.55 mV/V + 40 mV 0.55 mV/V + 29 mV 0.76 mV/V + 29 mV 1.4 mV/V + 2.8 mV 3.5 mV/V + 32 mV	
	(1 to 30) kV 20 Hz to 60 kHz	5.8 mV/V + 31 mV	Ross VD30 High Voltage Divider HP34401A Multimeter



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current - Source ¹	Up to 220 μ A 220 μ A to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A	46 μ A/A + 1.9 μ A 35 μ A/A + 9 nA 35 μ A/A + 0.4 μ A 52 μ A/A + 1.9 μ A 97 μ A/A + 35 μ A	Fluke 5720A Multifunction Calibrator
	(2.2 to 11) A	0.38 mA/A + 6.8 mA	Fluke 5720A Multifunction Calibrator with Fluke 5725A Amplifier
	(11 to 20) A	170 mA/A + 170 mA	Fluke 5522 Multifunction Calibrator
DC Current - Measure ¹	(10 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 + 0.47 nA 24 μ A/A + 6.4 nA 24 μ A/A + 58 nA 41 μ A/A + 0.58 μ A 0.13 mA/A + 13 μ A	HP 3458A Precision Multimeter
	(1 to 3) A	4.4 mA/A + 0.62 mA	HP 34401A Precision Multimeter
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 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 (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	0.3 mA/A + 16 nA 0.2 mA/A + 12 nA 0.16 mA/A + 9 nA 0.33 mA/A + 14 nA 1.3 mA/A + 75 nA 0.29 mA/A + 46 nA 0.19 mA/A + 41 nA 0.14 mA/A + 41 nA 0.23 mA/A + 0.13 μ A 1.3 mA/A + 0.75 μ A 0.25 mA/A + 0.46 μ A 0.19 mA/A + 0.41 μ A 0.14 mA/A + 0.41 μ A 0.23 mA/A + 0.64 μ A 1.3 mA/A + 5.8 μ A	Fluke 5720A Multifunction Calibrator



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current - Source ¹	(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 (2.2 to 11) A 40 Hz to 1kHz (1 to 5) kHz (5 to 10) kHz	0.25 mA/A + 4.6 μA 0.19 mA/A + 4 μA 0.14 mA/A + 2.9 μA 0.23 mA/A + 4 μA 1.3 mA/A + 12 μA 0.33 mA/A + 41 μA 0.54 mA/A + 92 μA 8.1 mA/A + 0.19 mA 0.57 mA/A + 0.2 mA 1.1 mA/A + 0.44 mA 4.2 mA/A + 0.87 mA	Fluke 5720A Multifunction Calibrator
	(11 to 20) A (45 to 100) Hz 100 Hz to 1kHz (1 to 5) kHz	0.17 A/A + 0.17 A 0.17 A/A + 0.17 A 0.17 A/A + 0.2 A	Fluke 5522A Multifunction Calibrator
AC Current - Measure ¹	(5 to 100) μA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz 100 μA to 1 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 (1 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	4.6 mA/A + 35 nA 1.7 mA/A + 35 nA 0.69 mA/A + 35 nA 0.69 mA/A + 35 nA 4.6 mA/A + 0.23 μA 1.7 mA/A + 0.23 μA 0.7 mA/A + 0.23 μA 0.35 mA/A + 0.23 μA 0.7 mA/A + 0.23 μA 4.6 mA/A + 0.46 μA 6.3 mA/A + 1.7 μA 4.6 mA/A + 2.3 nA 1.7 mA/A + 2.3 nA 0.7 mA/A + 2.3 nA 0.35 mA/A + 2.3 nA 0.7 mA/A + 2.3 nA 4.6 mA/A + 4.6 nA 6.3 mA/A + 1.7 μA	HP 3458A Precision Multimeter



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current - Measure ¹	(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 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	4.6 mA/A + 23 nA 1.7 mA/A + 23 nA 0.7 mA/A + 23 nA 0.35 mA/A + 23 nA 0.7 mA/A + 23 nA 4.6 mA/A + 46 nA 6.3 mA/A + 1.7 μA 4.6 mA/A + 0.2 mA 1.8 mA/A + 0.2 mA 0.9 mA/A + 0.2 mA 1.2 mA/A + 0.2 mA 3.5 mA/A + 0.2 mA 12 mA/A + 0.4 mA	HP 3458A Precision Multimeter
Electrical Simulation of Thermocouple indicating devices 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	0.54 °C 0.43 °C 0.38 °C 0.41 °C 0.37 °C 0.37 °C 0.39 °C 0.64 °C 0.75 °C 0.6 °C 0.22 °C 0.2 °C 0.22 °C 0.27 °C 0.34 °C 0.22 °C 0.2 °C 0.23 °C 0.3 °C	Fluke 5522A Multifunction Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple indicating devices ¹	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 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	0.41 °C 0.24 °C 0.22 °C 0.33 °C 0.48 °C 0.48 °C 0.29 °C 0.26 °C 0.25 °C 0.34 °C 0.69 °C 0.45 °C 0.41 °C 0.49 °C 0.58 °C 0.44 °C 0.45 °C 0.56 °C 0.75 °C 0.25 °C 0.19 °C 0.2 °C	Fluke 5522A Multifunction Calibrator
Electrical Simulation of RTD indicating devices ¹	Pt 385, 100 Ω (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.12 °C 0.12 °C 0.13 °C 0.15 °C 0.15 °C 0.17 °C 0.29 °C	Fluke 5522A Multifunction Calibrator



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD indicating devices ¹	Pt 3926, 100 Ω		Fluke 5522A Multifunction Calibrator
	(-200 to -190) °C	0.31 °C	
	(-190 to -80) °C	0.11 °C	
	(-80 to 0) °C	0.12 °C	
	(0 to 100) °C	0.12 °C	
	(100 to 260) °C	0.13 °C	
	(260 to 300) °C	0.14 °C	
	(300 to 400) °C	0.15 °C	
	(400 to 600) °C	0.15 °C	
	(600 to 630) °C	0.29 °C	
	Pt 3916, 100 Ω		
	(-200 to -80) °C	0.11 °C	
	(-80 to 0) °C	0.11 °C	
	(0 to 100) °C	0.11 °C	
	(100 to 260) °C	0.12 °C	
	(260 to 300) °C	0.17 °C	
	(300 to 400) °C	0.18 °C	
	(400 to 600) °C	0.19 °C	
	(600 to 630) °C	0.2 °C	
	Pt 385, 200 Ω		
	(-200 to -80) °C	0.11 °C	
	(-80 to 0) °C	0.12 °C	
	(0 to 100) °C	0.12 °C	
	(100 to 260) °C	0.12 °C	
	(260 to 300) °C	0.14 °C	
	(300 to 400) °C	0.14 °C	
	(400 to 600) °C	0.15 °C	
	(600 to 630) °C	0.16 °C	
Pt 385, 500 Ω			
(-200 to -80) °C	0.11 °C		
(-80 to 0) °C	0.11 °C		
(0 to 100) °C	0.11 °C		
(100 to 260) °C	0.12 °C		
(260 to 300) °C	0.12 °C		
(300 to 400) °C	0.13 °C		
(400 to 600) °C	0.13 °C		
(600 to 630) °C	0.29 °C		



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD indicating devices ¹	Pt 385, 1 000 Ω		Fluke 5522A Multifunction Calibrator
	(-200 to -80) °C	0.11 °C	
	(-80 to 0) °C	0.11 °C	
	(0 to 100) °C	0.11 °C	
	(100 to 260) °C	0.12 °C	
	(260 to 300) °C	0.12 °C	
	(300 to 400) °C	0.13 °C	
	(400 to 600) °C	0.13 °C	
	(600 to 630) °C	0.29 °C	
	PtNi 385, 120 Ω (Ni 120)		
	(-80 to 0) °C	0.14 °C	
	(0 to 100) °C	0.14 °C	
	(100 to 260) °C	0.19 °C	
Cu 427, 10 Ω			
(-100 to 260) °C	0.36 °C		
Resistance - Source ¹	Up to 11 Ω	40 μΩ/Ω + 1 mΩ	Fluke 5522A Multifunction Calibrator
	(11 to 33) Ω	30 μΩ/Ω + 1.5 mΩ	
	(33 to 110) Ω	28 μΩ/Ω + 1.4 mΩ	
	(110 to 330) Ω	28 μΩ/Ω + 2 mΩ	
	330 Ω to 1.1 kΩ	28 μΩ/Ω + 2 mΩ	
	(1.1 to 3.3) kΩ	28 μΩ/Ω + 20 mΩ	
	(3.3 to 11) kΩ	28 μΩ/Ω + 20 mΩ	
	(11 to 33) kΩ	28 μΩ/Ω + 0.2 Ω	
	(33 to 110) kΩ	28 μΩ/Ω + 0.2 mΩ	
	(110 to 330) kΩ	32 μΩ/Ω + 2 Ω	
	330 kΩ to 1.1 MΩ	32 μΩ/Ω + 2 Ω	
	1.1 MΩ to 3.3 MΩ	60 μΩ/Ω + 30 Ω	
	(3.3 to 11) MΩ	0.13 mΩ/Ω + 50 Ω	
	(11 to 33) MΩ	0.25 mΩ/Ω + 2.5 kΩ	
	(33 to 110) MΩ	0.5 mΩ/Ω + 3 kΩ	
	(110 to 330) MΩ	3 mΩ/Ω + 0.1 MΩ	
330 MΩ to 1.1GΩ	15 mΩ/Ω + 0.5 MΩ		



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source Fixed Points	1 Ω	0.16 mΩ	Fluke 5720A Multifunction Calibrator
	1.9 Ω	0.16 mΩ	
	10 Ω	0.3 mΩ	
	19 Ω	0.45 mΩ	
	100 Ω	0.30 mΩ	
	190 Ω	0.45 mΩ	
	1 kΩ	2.5 mΩ	
	1.9 kΩ	3.9 mΩ	
	10 kΩ	0.12 Ω	
	19 kΩ	0.13 Ω	
	100 kΩ	1.1 Ω	
	190 kΩ	2.1 Ω	
	1 MΩ	20 Ω	
	1.9 MΩ	40 Ω	
10 MΩ	0.4 kΩ		
19 MΩ	0.9 kΩ		
100 MΩ	10 kΩ		
Resistance - Measure	Up to 10 Ω	18 μΩ/Ω + 50 μΩ	HP 3458A Precision Multimeter
	(10 to 100) Ω	22 μΩ/Ω + 0.5 mΩ	
	100 Ω to 1 kΩ	15 μΩ/Ω + 0.5 mΩ	
	(1 to 10) kΩ	30 μΩ/Ω + 5 mΩ	
	(10 to 100) kΩ	30 μΩ/Ω + 50 mΩ	
	100 kΩ to 1 MΩ	45 μΩ/Ω + 1 mΩ	
	(1 to 10) MΩ	0.12 mΩ/Ω + 1 mΩ	
(10 to 100) MΩ	1.3 mΩ/Ω + 10 mΩ		
100 MΩ to 1 GΩ	12 mΩ/Ω + 12 kΩ		
Oscilloscopes ¹ Amplitude DC Signal 50 Ω @ 1 kHz 1 MΩ @ 1 kHz Leveled Sine Wave Amplitude Squarewave 50 Ω Load 1M Ω Load	(0 to 6.6) V p-p	2.5 mV/V + 40 μV	Fluke 5522A/SC1100 Multifunction Calibrator
	(0 to 130) V p-p	0.50 mV/V + 40 μV	
	50 kHz to 100 MHz	35 μV/V + 0.3 mV	
	1 mV to 6.6 V p-p 10 Hz to 10 kHz	2.5 mV/V + 40 μV	
1 mV to 130 V p-p 10 Hz to 1 kHz (1 to 10) kHz	1 mV/V + 0.4 mV 2.5 mV/V + 40 μV		



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes ¹ Flatness (50 kHz ref)	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	15 $\mu\text{V}/\text{V} + 0.1 \text{ mV}$ 20 $\mu\text{V}/\text{V} + 0.1 \text{ mV}$ 40 $\mu\text{V}/\text{V} + 0.1 \text{ mV}$	Fluke 5522A/SC1100 Multifunction Calibrator
Time Marker – Source ² Period @ 50 Ω	5 s to 50 ms 20 ms to 2 ns	(25 + 1 000t) $\mu\text{s}/\text{s}$ 2.5 $\mu\text{s}/\text{s}$	
Rise Time	$\leq 300 \text{ ps}$	+0 / -100 ps	
Edge Specs into 50 Ω Load Rise Time Amplitude (p-p)	$\leq 350 \text{ ps}$ 5mV to 2.5 V	0 ps/-100 ps 20 mV/V + 0.2 mV	
Wave Generator – Source Amplitude 10 Hz to 10 kHz Square, Sine, Triangle Into 1M Ω	1.8 mV to 55 V p-p	30 mV/V + 0.1 mV	
Square, Sine, Triangle Into 50 Ω	1.8 mV to 2.5 V p-p	30 mV/V + 0.1 mV	
Frequency	10 Hz to 100 kHz	25 $\mu\text{s}/\text{s} + 15 \text{ mHz}$	
Capacitance - Source ¹	(220 to 400) pF 400 pF to 1.1 nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF 330 nF to 1.1 μF (1.1 to 3.3) μF (3.3 to 11) μF (11 to 33) μF (33 to 110) μF (110 to 330) μF 330 μF to 1.1 mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	5.8 mF/F + 12 pF 5.8 mF/F + 12 pF 5.8 mF/F + 12 pF 2.9 mF/F + 1 pF 2.9 mF/F + 0.12 nF 2.9 mF/F + 0.12 nF 2.9 mF/F + 0.35 nF 2.9 mF/F + 1.2 nF 2.9 mF/F + 3.5 nF 2.9 mF/F + 12 nF 5.5 mF/F + 35 nF 5.5 mF/F + 0.12 μF 7.7 mF/F + 0.35 μF 5.5 mF/F + 1.2 μF 7.7 mF/F + 3.5 μF 5.6 mF/F + 12 μF 13 mF/F + 35 μF 18 mF/F + 0.12 mF	Fluke 5522A Multifunction Calibrator



Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks ²	Up to 12 in	$(3.4 + 1L) \mu\text{in}$	Gage Block Comparator, Gage Blocks
Gage Blocks ²	Up to 12 in	$(6.3 + 2.1L) \mu\text{in}$	LabMaster, Gage Blocks
Gage Blocks ²	(12 to 20) in	$(9.6 + 1L) \mu\text{in}$	Universal Length Measuring Machine, Gage Blocks
Plug Gages - Cylindrical ²	Up to 12 in	$(5.8 + 1.7D) \mu\text{in}$	LabMaster, Gage Blocks
Rings - Cylindrical ²	Up to 12 in	$(5.1 + 1.7D) \mu\text{in}$	LabMaster, Gage Blocks
Calipers ^{1,2}	Up to 40 in	$(350 + 13L) \mu\text{in}$	Gage Blocks
Micrometers ^{1,2}	Up to 36 in	$(40 + 5.2L) \mu\text{in}$	Gage Blocks
Indicators ^{1,2} - Test - Drop	Up to 0.06 in Up to 4 in	35 μin $(6.2 + 33L) \mu\text{in}$	Gage Blocks
Plug Gages - Cylindrical ²	Up to 12 in	$(15 + 5.4L) \mu\text{in}$	ULM, Gage Blocks
Rings - Cylindrical ²	Up to 12 in	$(22 + 4.8D) \mu\text{in}$	ULM, Gage Blocks
Height Gages ^{1,2}	Up to 40 in	$(19 + 3L) \mu\text{in}$	Gage Blocks
Surface Plates ^{1,2} Overall Flatness Local Area Flatness	Up to 200 in +/- 0.001 in	$(37 + 0.58DL) \mu\text{in}$ 27 μin	Electronic Levels, Repeat Reading Gage
ULM/ Bench Micrometer ^{1,2}	Up to 20 in (0.025 to 5) lbf	$(9.1 + 4.5L) \mu\text{in}$ 0.02 lbf	Gage Blocks, Digital Force Gage
	Up to 120 in (0.025 to 5) lbf	$(1.1 + 3.2L) \mu\text{in}$ 0.02 lbf	5529A Dynamic Laser Calibrator, Digital Force Gage
Radius Gage/Weld Fillets ²	Up to 9.0 in Diameter (4.5 Inch Radius)	$(1\ 200 + 200D) \mu\text{in}$	Optical Comparator
Electronic, Machinist, and Precision Levels ¹	(0 to 90) °	1 sec of arc	Sine Bar, Gage Blocks, Surface Plate
Length Calibration ²	Up to 7.4 in	$(730 + 19L) \mu\text{in}$	Optical Comparator

Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Length Calibration ²	Up to 12 in	(6.3 + 2.1L) μin	LabMaster
	Up to 8 in	(200 + 100L) μin	Micrometer
Length Calibration ²	Up to 24 in	(700 + 60L) μin	Digital Slide Caliper
Steel Ruler ²	Up to 24 in Up to 7.4 in	(320 + 5.4L) μin (840 + 8.1L) μin	ULM System Optical Comparator
Protractor ²	360 °	(4.4 + 0.03A) min of Arc	Optical Comparator
Optical Comparator ^{1,2}	Up to 6 in	(230 + 4.3L) μin	Glass Scale
Thread Ring Gage ²	(4 to 80) tpi	(110 + 14PD) μin	LabMaster, thread plug (thread set plug method)
Thread Plug, Thread Set Plug Pitch Diameter ²	(4 to 80) tpi	(17 + 2.3PD) μin	LabMaster, working thread wires (3 wire method)
Thread Wire, Master ²	(0.004 to 0.029) in	(8.1 + 152D) μin	LabMaster, gage blocks
Thread Wire, Working ²	(0.004 to 0.029) in	(13 + 240D) μin	LabMaster, Master thread wire

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure ^{1,2}	(1 000 to 20 000) psi	(0.59 + 0.000 2P) psi	Deadweight Tester, Fluke P3116
	(-15 to 15) in H ₂ O (-15 to -60) in H ₂ O (15 to 60) in H ₂ O	0.019 in H ₂ O (0.019 + 0.000 2p) in H ₂ O (0.019 + 0.000 2p) in H ₂ O	Pressure Controller/ Calibrator, Fluke 7250LP
	(-14.5 to 12.5) psi (12.5 to 50) psi	0.012 psi (0.012 + 0.000 12P) psi	Dual Channel Pressure Controller, Fluke 7252i
	(50 to 1 000) psi	(0.019 + 0.000 086P) psi	Pressure Controller/ Calibrator, Fluke 7250xi



Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature Uniformity Survey (TUS) – Oven Mapping - using Type K thermocouple wire ¹	(32 to 375) °F (375 to 2 500) °F	1.3 °F 1.1 °F + 0.000 55 °F/°F	Chart Recorder, Eurotherm Chessell 6100A, Pyromation Type K Thermocouple Wire (special limits)

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency Measure ¹	0.1 Hz to 3 GHz	0.001 7 μHz/Hz	HP 53131A with Datum 9390-52033 GPS 10 MHz Receiver/Discipline Oscillator

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. A = angle in degrees, D = diameter in inches, DL = diagonal length in inches, L = length ion inches, P = pressure in psi, p = pressure in inH2O, PD = pitch diameter in inches, t = time in seconds.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-1196.



 Vice President

