



CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board

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

This is to certify that

Transcat - Rochester

35 Vantage Point Drive

Rochester, NY 14624

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

ISO/IEC 17025:2005

and national standard

ANSI/NCSL Z540-1-1994

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-2489

Certificate Number


ANAB Approval

Certificate Valid: 05/04/2018-09/07/2019

Version No. 002 Issued: 05/04/18



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).



ANSI-ASQ National Accreditation Board

**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005 AND
ANSI/NCSL Z540-1-1994 (R2002)**

Transcat - Rochester

35 Vantage Point Drive
Rochester, NY 14624
Dusty Tank
585-352-9720

CALIBRATION

Valid to: **September 7, 2019**

Certificate Number: **AC-2489**

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
AC Flatness ¹	Up to 3 V		Thermal
	10 Hz	0.2%	
	10 Hz to 1 MHz	0.11 %	Converter/HP3458A
	1 MHz to 10 MHz	0.21 %	
	10 MHz to 30 MHz	0.32 %	
	30 MHz to 50 MHz	0.36 %	
	50 MHz to 80 MHz	0.48 %	
AC Current - Measuring Equipment ¹	80 MHz to 100 MHz	0.53 %	
	0 µA to 220 µA		Fluke 5720A
	10 Hz to 20 Hz	0.031 % + 16 nA	
	20 Hz to 40 Hz	0.019 % + 10 nA	
	40 Hz to 1 kHz	0.015 % + 8 nA	
	1 kHz to 5 kHz	0.03 % + 12 nA	
	5 kHz to 10 kHz	0.11 % + 65 nA	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
AC Current - Measuring Equipment ¹	220 μ A to 2.2 mA 10 Hz to 20 Hz	0.00 % + 40 nA	Fluke 5720A
	20 Hz to 40 Hz	0.018 % + 35 nA	
	40 Hz to 1 kHz	0.014 % + 35 nA	
	1 kHz to 5 kHz	0.021 % + 0.11 μ A	
	5 kHz to 10 kHz	0.11 % + 0.65 μ A	
	2.2 mA to 22 mA 10 Hz to 20 Hz	0.039 % + 0.40 μ A	
	20 Hz to 40 Hz	0.019 % + 0.35 μ A	
	40 Hz to 1 kHz	0.014 % + 0.35 μ A	
	1 kHz to 5 kHz	0.021 % + 0.55 μ A	
	5 kHz to 10 kHz	0.11 % + 5.0 μ A	
	22 mA to 220 mA 10 Hz to 20 Hz	0.033 % + 4.0 μ A	
	20 Hz to 40 Hz	0.018 % + 3.5 μ A	
	40 Hz to 1 kHz	0.014 % + 2.5 μ A	
	1 kHz to 5 kHz	0.021 % + 3.5 μ A	
	5 kHz to 10 kHz	0.11 % + 10 μ A	
	220 mA to 2.2 A 0.01 kHz to 1 kHz	0.027 % + 35 μ A	
	1 kHz to 5 kHz	0.046 % + 80 μ A	
	5 kHz to 10 kHz	0.7 % + 0.16 mA	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
AC Current - Measuring Equipment ¹	2.2 A to 11 A 0.04 kHz to 1 kHz	0.048 % + 0.17 mA	Fluke 5720A w/5725A
	1 kHz to 5 kHz	0.096 % + 0.38 mA	
	5 kHz to 10 kHz	0.36 % + 0.75 mA	
	11 A to 20.5 A 10 Hz to 100 Hz	0.097 % + 3.9 mA	
AC Current - Measuring Equipment ¹	100 Hz to 1 kHz	0.12 % + 3.9 mA	Fluke 5520A
	1 kHz to 5 kHz	2.3 % + 3.9 mA	
	20.5 A to 40 A 10 Hz to 100 Hz	0.14 % + 11mA	
	100 Hz to 1 kHz	0.17 % + 11mA	
AC Current - Measuring Equipment ¹	1 kHz to 5 kHz	3.3 % + 11 mA	2 Fluke 5520As in Parallel
	29 µA to 330 µA 10 kHz to 30 kHz	1.2 % + 0.31 µA	
	330 µA to 3.3 mA 10 kHz to 30 kHz	0.78 % + 0.47 µA	
	3.3 mA to 33 mA 10 kHz to 30 kHz	0.31 % + 3.1 µA	
AC Current - Measuring Equipment ¹	33 mA to 330 mA 10 kHz to 30 kHz	0.31 % + 0.16 mA	Fluke 5520A
	20 A to 150 A 45 Hz to 65 Hz	0.30 % + 0.026 A	
	65 Hz to 440 Hz	0.83 % + 0.047 A	
	150 A to 1 000 A 45 Hz to 65 Hz	0.35 % + 0.12 A	
AC Current - Measuring Equipment Clamp-on Ammeter Toroidal Type ¹ Transformer Type	65 Hz to 440 Hz	1.1 % + 0.22 A	Fluke 5520A w/5500A/Coil
	20 A to 150 A 45 Hz to 65 Hz	0.57 % + 0.25 A	
	65 Hz to 440 Hz	1.0 % + 0.25 A	
	150 A to 1 000 A 45 Hz to 65 Hz	0.60 % + 0.9 A	
AC Current - Measuring Equipment Clamp-on Ammeter Non-Toroidal Type ¹ Hall Effect Sensor	65 Hz to 440 Hz	1.3 % + 0.92 A	Fluke 5520A w/5500A/Coil



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
AC Current - Measuring Equipment Clamp-on Ammeter Non-Toroidal Type ¹ Hall Effect Sensor	1000 A to 6 000 A 10 Hz to 300 Hz	0.77 %	Fluke 52120A, w/ 5520A, 3kA, 6kA coil
	1 000 A to 6 000 A 300 Hz to 440 Hz	0.77 %	
AC Current Measure	0 µA to 100 mA 10 Hz to 20 Hz	0.46 % + 35 nA	3458A opt 002
	20 Hz to 45 Hz	0.18 % + 35 nA	
	45 Hz to 100 Hz	0.072 % + 35 nA	
	100 Hz to 1 kHz	0.072 % + 35 nA	
	100 µA to 1 mA 10 Hz to 20 Hz	0.46 % + 0.23 µA	
	20 Hz to 45 Hz	0.17 % + 0.23 µA	
	45 Hz to 100 Hz	0.071 % + 0.23 µA	
	0.1 kHz to 5 kHz	0.038 % + 0.23 µA	
	1 mA to 10 mA 10 Hz to 20 Hz	0.46 % + 2.3 µA	
	20 Hz to 45 Hz	0.17 % + 2.3 µA	
	45 Hz to 100 Hz	0.071 % + 2.3 µA	
	100 Hz to 5 kHz	0.038 % + 2.3 µA	
	10 mA to 100 mA 10 Hz to 20 Hz	0.46 % + 23 µA	
	20 Hz to 45 Hz	0.17 % + 23 µA	
	45 Hz to 100 Hz	0.07 % + 23 µA	
	100 Hz to 5 kHz	0.037 % + 23 µA	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
AC Current Measure	100 mA to 1 A 10 Hz to 20 Hz	0.46 % + 0.23 mA	3458A opt 002
	20 Hz to 45 Hz	0.19 % + 0.23 mA	
	45 Hz to 100 Hz	0.097 % + 0.23 mA	
	100 Hz to 5 kHz	0.12 % + 0.23 mA	
	1 A to 3 A 3 Hz to 5 Hz	1.3 % + 2 mA	Fluke 8846A
	5 Hz to 10 Hz	0.41 % + 2 mA	
	10 Hz to 5 kHz	0.18 % + 2 mA	
	5 kHz to 10 kHz	0.41 % + 24 mA	
	3 A to 10 A 3 Hz to 5 Hz	1.1 % + 13 mA	
	5 Hz to 10 Hz	0.41 % + 7 mA	
Impedance Measure ³	10 Hz to 5 kHz	0.18 % + 7 mA	Valhalla 2575A
	5 kHz to 10 kHz	0.42 % + 81 mA	
	1 A to 20 A 0.05 kHz to 5 kHz	0.10 % + 0.02 A	
	20 A to 100 A 0.05 kHz to 5 kHz	0.11 % + 0.1 A	
Impedance Measure ³	0.1 Ω		Agilent E4980AL LCR Meter
	1 kHz	2 %	
	10 kHz	1.2 %	
	100 kHz	1.1%	
	1 MHz	1.2 %	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Impedance Measure ³	1 Ω		Agilent E4980AL LCR Meter
	20 Hz	0.67 %	
	100 Hz	0.45 %	
	1 kHz	0.36 %	
	10 kHz	0.33 %	
	100 kHz	0.31 %	
	1 MHz	0.38 %	
	10 Ω		
	20 Hz	0.29 %	
	100 Hz	0.2 %	
	1 kHz	0.17 %	
	10 kHz	0.18 %	
	100 kHz	0.18 %	
	1 MHz	0.31 %	
	100 Ω		
	20 Hz	0.16 %	
	100 Hz	0.1 %	
	1 kHz	0.1 %	
	10 kHz	0.12 %	
	100 kHz	0.12 %	
	1 MHz	0.2 %	
	1 k Ω		
	20 Hz	0.15 %	
	100 Hz	0.1 %	
	1 kHz	0.1 %	
	10 kHz	0.1 %	
	100 kHz	0.1 %	
	1 MHz	0.14 %	
	10 k Ω		
	20 Hz	0.15 %	
	100 Hz	0.1 %	
	1 kHz	0.1 %	
	10 kHz	0.1 %	
	100 kHz	0.1 %	
	1 MHz	0.29 %	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Impedance Measure ³	100 k Ω		Agilent E4980AL LCR Meter
	20 Hz	0.17 %	
	100 Hz	0.1 %	
	1 kHz	0.1 %	
	10 kHz	0.17 %	
	100 kHz	0.28 %	
	1 MHz	0.38 %	
Resistance Measuring Equipment and Measure ¹	0 Ω to 10 Ω	18 $\mu\Omega/\Omega$ + 58 $\mu\Omega$	HP3458A w/Decade Resistor
	10 Ω to 100 Ω	15 $\mu\Omega/\Omega$ + 0.58 m Ω	
	100 Ω to 1 k Ω	12 $\mu\Omega/\Omega$ + 0.58 m Ω	
	1 k Ω to 10 k Ω	12 $\mu\Omega/\Omega$ + 5.8 m Ω	
	10 k Ω to 100 k Ω	12 $\mu\Omega/\Omega$ + 58 m Ω	
	100 k Ω to 1 M Ω	19 $\mu\Omega/\Omega$ + 2.3 Ω	
	1 M Ω to 10 M Ω	62 $\mu\Omega/\Omega$ + 0.12 k Ω	
	10 M Ω to 100 M Ω	0.059 % + 1.2 k Ω	
	100 M Ω to 1 G Ω	0.58 % + 12 k Ω	
Resistance Measuring Equipment ¹	1 m Ω	0.05 %	L & N Shunt
	10 m Ω	0.01 %	Guildline 9200
	100 m Ω	0.01 %	
	1 G Ω	0.58 %	Biddle Megadek
	10 G Ω	1.2 %	
500 V to 5 kV	100 G Ω	1.8 %	IET Standard Resistor
	1 T Ω	0.6 %	
5 kV	10 T Ω	1.2 %	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Resistance - Measuring Equipment ¹ 2.5 kV	10 TΩ	1 %	IET Standard Resistor
1 kV	10 TΩ	1.5 %	
500 V	10 TΩ	0.86 %	
DC Current – Measuring Equipment ¹	0 mA to 0.22 mA	36 μA/A + 6 nA	Fluke 5720A
	0.22 mA to 2.2 mA	36 μA/A + 7 nA	
	2.2 mA to 22 mA	35 μA/A + 40 nA	
	22 mA to 220 mA	48 μA/A + 0.7 μA	
	220 mA to 2.2 A	0.02 % + 12 μA	
	2.2 A to 11 A	0.04 % + 0.48 mA	Fluke 5720A w/5725A
	11 A to 100 A	0.047 %	L&N 4360 Shunt w/source
DC Current – Measure ¹	0 to 100 μA	26 μA/A + 0.9 nA	Agilent 3458A Opt 002
	100 μA to 1 mA	26 μA/A + 5.8 nA	
	1 mA to 10 mA	26 μA/A + 58 nA	
	10 mA to 100 mA	43 μA/A + 0.58 μA	
	100 mA to 1 A	0.013 % + 10 μA	
	1 A to 3 A	0.14 %	Fluke 8846A
	3 A to 10 A	0.18 % + 0.8 mA	
	1 A to 10 A	0.047 %	L&N 4361 Shunt
	10 A to 100 A	0.047 %	L&N 4360 Shunt



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
DC Current – Measuring Equipment Clamp-on Ammeter Non-Toroidal Type ¹ Hall Sensor	20 A to 150 A	0.51 % + 0.14 A	Fluke 5520A w/ 5500A/Coil
	150 A to 1 000 A	0.52 % + 0.5 A	
DC Current – Measuring Equipment Clamp-on Ammeter Non-Toroidal Type ¹ Hall Sensor	1 000 A to 5 000 A	0.58 %	Fluke 52120A, w/ 5520A, 3kA or 6 kA coil
DC Voltage - Measure	0 mV to 100 mV	7.1 μ V/V + 0.58 μ V	3458A Opt 002
	100 mV to 1 V	5 μ V/V + 0.58 μ V	
	1 V to 10 V	5.1 μ V/V + 0.58 μ V	
	10 V to 100 V	7.6 μ V/V + 35 μ V	
	100 V to 500 V	11 μ V/V + 0.12 mV	
	500 V to 800 V	16 μ V/V + 0.12 mV	
	800 V to 1 kV	21 μ V/V + 0.12 mV	
	1 kV to 10 kV	0.049 % + 0.62 V	Vitretek 4700A
	10 kV to 20 kV	0.08 % + 0.35 V	4700A w/HVP-35
	20 kV to 35 kV	0.14 % + 1 V	
	15 kV to 30 kV	0.065 % + 1 V	4700A w/HVL-70
	30 kV to 45 kV	0.09 % + 3 V	
	45 kV to 70 kV	0.17 % + 1 V	4700A w/HVL-100
	25 kV to 100 kV	0.11 % + 0.5 V	
DC Voltage - Measuring Equipment ¹	0 V to 0.22 V	8.5 μ V/V + 0.4 μ V	Fluke 5720A
	0.22 V to 2.2 V	5.1 μ V/V + 0.7 μ V	
	2.2 V to 11 V	4.0 μ V/V + 2.5 μ V	
	11 V to 22 V	3.9 μ V/V + 4 μ V	
	22 V to 220 V	6.2 μ V/V + 40 μ V	
	220 V to 1 100 V	7.6 μ V/V + 0.4 mV	Fluke 5720A w/5725A



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
AC Voltage – Measure ¹	0 mV to 10 mV 1 Hz to 40 Hz	0.039 % + 3.5 μ V	Agilent 3458A/002
	40 Hz to 1 kHz	0.028 % + 1.2 μ V	
	1 kHz to 20 kHz	0.038 % + 1.2 μ V	
	20 kHz to 50 kHz	0.15 % + 1.2 μ V	
	50 kHz to 100 kHz	0.59 % + 1.2 μ V	
	100 kHz to 300 kHz	4.6 % + 2.3 μ V	
	10 mV to 100 mV 1 Hz to 40 Hz	0.013 % + 4.6 μ V	
	40 Hz to 1 kHz	0.009 5 % + 2.3 μ V	
	1 kHz to 20 kHz	0.017 % + 2.3 μ V	
	20 kHz to 50 kHz	0.037 % + 2.3 μ V	
	50 kHz to 100 kHz	0.093 % + 2.3 μ V	
	100 kHz to 300 kHz	0.36 % + 12 μ V	
	300 kHz to 1 MHz	1.2 % + 12 μ V	
	100 mV to 1 V 1 Hz to 40 Hz	0.009 8 % + 46 μ V	
	40 Hz to 1 kHz	0.009 5 % + 23 μ V	
	1 kHz to 20 kHz	0.017 % + 23 μ V	
	20 kHz to 50 kHz	0.036 % + 23 μ V	
	50 kHz to 100 kHz	0.093 % + 23 μ V	
	100 kHz to 300 kHz	0.35 % + 0.12 mV	
	300 kHz to 1 MHz	1.2 % + 0.12 mV	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
AC Voltage – Measure ¹	1 V to 10 V 1 Hz to 40 Hz	0.009 5 % + 0.46 mV	Agilent 3458A/002
	40 Hz to 1 kHz	0.009 5 % + 0.23 mV	
	1 kHz to 20 kHz	0.017 % + 0.23 mV	
	20 kHz to 50 kHz	0.036 % + 0.23 mV	
	50 kHz to 100 kHz	0.093 % + 0.23 mV	
	100 kHz to 300 kHz	0.35 % + 1.2 mV	
	300 kHz to 1 MHz	1.2 % + 1.2 mV	
	10 V to 100 V 1 Hz to 40 Hz	0.024 % + 4.6 mV	
	40 Hz to 1 kHz	0.024 % + 2.3 mV	
	1 kHz to 20 kHz	0.024 % + 2.3 mV	
	20 kHz to 50 kHz	0.041 % + 2.3 mV	
	50 kHz to 100 kHz	0.14 % + 2.3 mV	
	100 kHz to 300 kHz	0.46 % + 12 mV	
	300 kHz to 1 MHz	1.7 % + 12 mV	
	100 V to 700 V 1 Hz to 40 Hz	0.047 % + 46 mV	
	40 Hz to 1 kHz	0.047 % + 23 mV	
	1 kHz to 20 kHz	0.071 % + 23 mV	
	20 kHz to 50 kHz	0.14 % + 23 mV	
	50 kHz to 100 kHz	0.35% + 23 mV	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
AC Voltage – Measure ¹	700 V to 10 kV 60 Hz	0.17 % + 0.16 V	Vitretek 4700A
	10 kV to 20 kV 60 Hz	0.17 % + 0.6 V	4700A w/HVP-35
	20 kV to 35 kV 60 Hz	0.23 % + 3.5 V	
	12.5 kV to 25 kV 60 Hz	0.15 % + 1.4 V	4700A w/HVL-70
	25 kV to 37.5 kV 60 Hz	0.16 % + 2.8 V	
	37.5 kV to 50 kV 60 Hz	0.2 % + 0.2 V	
	25 kV to 75 kV 60 Hz	0.19 % + 3.5 V	4700A w/ HVL-100
	0 mV to 1 mV 100 kHz to 1 MHz 1 MHz to 3 MHz 3 MHz to 10 MHz 10 MHz to 20 MHz	2 % + 2.4 μV 3.8 % + 2.4 μV 10 % + 2.4 μV 25 % + 2.4 μV	R&S URE3
	1 mV to 3 mV 100 kHz to 1 MHz 1 MHz to 3 MHz 3 MHz to 10 MHz 10 MHz to 20 MHz	1 % + 2 μV 3.8 % + 2 μV 11 % + 2 μV 25 % + 2 μV	
	3 mV to 100 mV 100 kHz to 1 MHz 1 MHz to 3 MHz 3 MHz to 10 MHz 10 MHz to 20 MHz 20 MHz to 30 MHz	0.98 % + 3 μV 1.9 % + 3 μV 3.2 % + 3 μV 7.6 % + 3 μV 16 % + 3 μV	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
AC Voltage Measuring Equipment ¹	0 mV to 2.2 mV 10 Hz to 20 Hz	0.16 % + 4 μ V	5720A
	20 Hz to 40 Hz	0.10 % + 4 μ V	
	40 Hz to 20 kHz	0.077 % + 4 μ V	
	20 kHz to 50 kHz	0.13 % + 4 μ V	
	50 kHz to 100 kHz	0.17 % + 5 μ V	
	100 kHz to 300 kHz	0.33 % + 10 μ V	
	300 kHz to 500 kHz	0.47 % + 20 μ V	
	500 kHz to 1 MHz	0.58 % + 20 μ V	
	2.2 mV to 22 mV 10 Hz to 20 Hz	0.042 % + 4 μ V	5720A
	20 Hz to 40 Hz	0.030 % + 4 μ V	
	40 Hz to 20 kHz	0.014 % + 4 μ V	
	20 kHz to 50 kHz	0.03 % + 4 μ V	
	2.2 mV to 22 mV 50 kHz to 100 kHz	0.058 % + 5.0 μ V	
	100 kHz to 300 kHz	0.12 % + 10 μ V	
	300 kHz to 500 kHz	0.16 % + 20 μ V	
	500 kHz to 1 MHz	0.27 % + 20 μ V	
	22 mV to 220 mV 10 Hz to 20 Hz	0.028 % + 12 μ V	
	20 Hz to 40 Hz	0.011 % + 7.0 μ V	
	40 Hz to 20 kHz	0.008 5 % + 7.0 μ V	
	20 kHz to 50 kHz	0.021 % + 7.0 μ V	
	50 kHz to 100 kHz	0.047 % + 17 μ V	
	100 kHz to 300 kHz	0.091 % + 20 μ V	
	300 kHz to 500 kHz	0.14 % + 25 μ V	
	500 kHz to 1 MHz	0.28 % + 45 μ V	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
AC Voltage Measuring Equipment ¹	220 mV to 2.2 V	0.027 % + 40 µV	5720A
	10 Hz to 20 Hz		
	20 Hz to 40 Hz	0.01 % + 15 µV	
	40 Hz to 20 kHz	0.004 8 % + 8 µV	
	20 kHz to 50 kHz	0.008 % + 10 µV	
	50 kHz to 100 kHz	0.012 % + 30 µV	
	100 kHz to 300 kHz	0.043 % + 80 µV	
	300 kHz to 500 kHz	0.10 % + 0.2 mV	
	500 kHz to 1 MHz	0.18 % + 0.3 mV	
	2.2 V to 22 V		
	10 Hz to 20 Hz	0.028 % + 0.4 mV	
	20 Hz to 40 Hz	0.01 % + 0.15 mV	
	40 Hz to 20 kHz	0.004 9 % + 50 µV	
	2.2 V to 22 V	0.0083 % + 0.1 mV	
	20 kHz to 50 kHz	0.011 % + 0.2 mV	
	50 kHz to 100 kHz	0.030 % + 0.6 mV	
	100 kHz to 300 kHz	0.10 % + 2 mV	
	300 kHz to 500 kHz		
	500 kHz to 1 MHz	0.17 % + 3.2 mV	
	22 V to 220 V		
	10 Hz to 20 Hz	0.028 % + 4 mV	
	20 Hz to 40 Hz	0.01 % + 1.5 mV	
	40 Hz to 20 kHz	0.005 6 % + 0.6 mV	
	20 kHz to 50 kHz	0.0093 % + 1 mV	
	50 kHz to 100 kHz	0.016 % + 2.5 mV	
	100 kHz to 300 kHz	0.090 % + 16 mV	
	300 kHz to 500 kHz	0.44 % + 40 mV	
	500 kHz to 1 MHz	0.8 % + 80 mV	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
AC Voltage Measuring Equipment ¹	220 V to 750 V	0.061 % + 11 mV	5720A w/ 5725A
	30 kHz to 50 kHz	0.23 % + 45 mV	
	50 kHz to 100 kHz		
	220 V to 1100 V	0.011 % + 4 mV	
	40 Hz to 1 kHz	0.017 % + 6 mV	
	1 kHz to 20 kHz	0.061 % + 11 mV	
	20 kHz to 30 kHz		
DC Power – Measuring Equipment 0.33 mA to 330 mA	11 µW to 1.1 mW	0.024 %	Fluke 5520A
	1.1 mW to 0.11 W	0.027 %	
	0.11W to 110 W	0.024 %	
	110 W to 330 W	0.018 %	
0.33 A to 3 A	11 mW to 110 mW	0.044 %	
	0.11 W to 990 W	0.053 %	
	1 W to 3 kW	0.009 6 %	
3 A to 20.5 A	99 mW to 0.99 W	0.088 %	
	0.99 W to 6.8 kW	0.07 %	
	6.8 W to 20.5 kW	0.04 %	
AC Power – Measuring Equipment (PF = 1) 3.3 mA to 9 mA	0.11 mW to 3 mW 10 Hz to 65 Hz	0.13 %	Fluke 5520A
	3 mW to 9 W 10 Hz to 65 Hz	0.077 %	
9 mA to 33 mA	0.3 mW to 10 mW 10 Hz to 65 Hz	0.089 %	
	10 mW to 33 W 10 Hz to 65 Hz	0.077 %	
33 mA to 90 mA	1 mW to 30 mW 10 Hz to 65 Hz	0.071 %	
	30 mW to 90 W 10 Hz to 65 Hz	0.057 %	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
AC Power – Measuring Equipment (PF = 1) 90 mA to 330 mA	3.0 mW to 100 mW 10 Hz to 65 Hz	0.089 %	Fluke 5520A
	100 mW to 300 W 10 Hz to 65 Hz	0.078 %	
0.33 A to 0.9 A	11 mW to 0.3 W 10 Hz to 65 Hz	0.071 %	
	0.3 W to 900 W 10 Hz to 65 Hz	0.081 %	
0.9 A to 2.2 A	30 mW to 0.72 W 10 Hz to 65 Hz	0.089 %	
	0.72 W to 2 kW 10 Hz to 65 Hz	0.079 %	
2.2 A to 4.5 A	80 mW to 1.4 W 10 Hz to 65 Hz	0.088 %	
	1.4 W to 4.5 kW 10 Hz to 65 Hz	0.18 %	
4.5 A to 20.5 A	150 mW to 6.7 W 10 Hz to 65 Hz	0.17 %	
	6.7 W to 20 kW 10 Hz to 65 Hz	0.17 %	
Phase Meters	0° to 90° 10 Hz to 65 Hz	0.11°	
	65 Hz to 500 Hz	0.2°	
	500 Hz to 1 kHz	0.39°	
	1 kHz to 5 kHz	1.9°	
	5 kHz to 10 kHz	3.9°	
	10 kHz to 30 kHz	7.8°	
Distortion ¹ (0 dB to -80 dB)	20 Hz to 100 kHz	1 dB	Agilent 8903
Distortion (5 Hz to 600 kHz) Voltage Range < 30 V 100 % to 0.3 %	(Harmonic Range) 10 Hz to 1 MHz 1 MHz to 3 MHz	3.5 % 6.9 %	Agilent 334A



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Distortion (5 Hz to 600 kHz) Voltage Range < 30 V 0.1%	10 Hz to 20 Hz	14 %	Agilent 334A
	20 Hz to 30 Hz	6.9 %	
	30 Hz to 300 kHz	3.5 %	
	300 kHz to 500 kHz	6.9 %	
	500 kHz to 1.2 MHz	14 %	
Distortion Voltage Range > 30 V 100 % to 0.3 %	10 Hz to 300 kHz	3.5 %	
	300 kHz to 500 kHz	6.9 %	
	0.5 MHz to 3 MHz	14 %	
Distortion (5 Hz to 600 kHz) Voltage Range < 30 V 0.1 %	20 Hz to 30 Hz	14 %	
	30 Hz to 300 kHz	3.5 %	
	300 kHz to 500 kHz	6.9 %	
	500 kHz to 1.2 MHz	14 %	
Capacitance Measure ³	0.1 pF 100 kHz 1 MHz	1.4 % 1.8 %	Agilent E4980AL LCR Meter
	1 pF 10 kHz 100 kHz 1 MHz	1.4 % 0.37 % 0.44 %	
	10 pF 1 kHz 10 kHz 100 kHz 1 MHz	1.4 % 0.28 % 0.28 % 0.3 %	
	100 pF 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	2.1 % 0.23 % 0.18 % 0.21 % 0.23 %	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Capacitance Measure ³	1 nF		Agilent E4980AL LCR Meter
	20 Hz	1.8 %	
	100 Hz	0.3 %	
	1 kHz	0.1 %	
	10 kHz	0.1 %	
	100 kHz	0.1 %	
	1 MHz	0.14 %	
	10 nF		
	20 Hz	0.31 %	
	100 Hz	0.12 %	
	1 kHz	0.1 %	
	10 kHz	0.1 %	
	100 kHz	0.1 %	
	1 MHz	0.25 %	
	100 nF		
	20 Hz	0.16 %	
	100 Hz	0.1 %	
	1 kHz	0.1 %	
	10 kHz	0.1 %	
	100 kHz	0.18 %	
	1 MHz	0.33 %	
	1 μF		
	20 Hz	0.15 %	
	100 Hz	0.1 %	
	1 kHz	0.1 %	
	10 kHz	0.18 %	
	100 kHz	0.25 %	
	1 MHz	0.79 %	
Capacitance Measure ³	10 μF		Agilent E4980AL LCR Meter
	20 Hz	0.15 %	
	100 Hz	0.01 %	
	1 kHz	0.16 %	
	10 kHz	0.28 %	
	100 kHz	0.73 %	
	100 μF		
	20 Hz	0.16 %	
	100 Hz	0.17 %	
	1 kHz	0.29 %	
	10 kHz	0.8 %	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Capacitance Measuring Equipment ¹	0.1 nF to 0.7 nF 0.1 kHz to 1 kHz	0.1 % + 0.53 pF	Arco SS32
	0.7 nF to 600 nF 0.1 kHz to 1 kHz	0.15 % + 0.2 pF	
	600 nF to 1400 nF 0.1 kHz to 1 kHz	0.045 % + 0.5 nF	
	0.5 nF to 1400 nF 0.1 kHz to 1 kHz	0.12 % + 0.018 pF	
	0.19 nF to 1.1 nF 10 Hz to 10 kHz	0.39 % + 6.1 pF	Fluke 5520A
	1.1 nF to 3.3 nF 10 Hz to 3 kHz	0.39 % + 6.1 pF	
	3.3 nF to 11 nF 10 Hz to 1 kHz	0.21 % + 6.1 pF	
	11 nF to 110 nF 10 Hz to 1 kHz	0.21 % + 61 pF	
	110 nF to 330 nF 10 Hz to 1 kHz	0.21 % + 0.18 nF	
	0.33 μF to 1.1 μF 10 Hz to 600 Hz	0.2 % + 0.61 nF	
	1.1 μF to 3.3 μF 10 Hz to 300 Hz	0.2 % + 1.9 nF	
	3.3 μF to 11 μF 10 Hz to 150 Hz	0.2 % + 6.1 nF	
	11 μF to 33 μF 10 Hz to 120 Hz	0.32 % + 18 nF	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Capacitance Measuring Equipment ¹	33 μ F to 110 μ F 10 Hz to 80 Hz	0.35 % + 61 nF	Fluke 5520A
	110 μ F to 330 μ F DC to 50 Hz	0.35 % + 0.18 μ F	
	0.33 mF to 1.1 mF DC to 20 Hz	0.35 % + 0.61 μ F	
	1.1 mF to 3.3 mF DC to 6 Hz	0.35 % + 1.8 μ F	
	3.3 mF to 11 mF DC to 2 Hz	0.35 % + 6.1 μ F	
	11 mF to 33 mF DC to 0.6 Hz	0.58 % + 18 μ F	
	33 mF to 110 mF DC to 0.2 Hz	0.85 % + 61 μ F	
Inductance Measure ³	1 μ H 10 kHz	1.6 %	Agilent E4980AL LCR Meter
	100 kHz	0.36 %	
	1 MHz	0.27 %	
	10 μ H 10 kHz	0.37 %	
	100 kHz	0.2 %	
	1 MHz	0.2 %	
	100 μ H 1 kHz	0.41 %	
	10 kHz	0.2 %	
	100 kHz	0.12 %	
	1 MHz	0.14 %	
	1 mH 100 Hz	0.56 %	
	1 kHz	0.19 %	
	10 kHz	0.12 %	
	100 kHz	0.1 %	
	1 MHz	0.23 %	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Inductance Measure ³	10 mH		Agilent E4980AL LCR Meter
	20 Hz	0.86 %	
	100 Hz	0.22 %	
	1 kHz	0.1 %	
	10 kHz	0.1 %	
	100 kHz	0.11 %	
	1 MHz	0.35 %	
	100 mH		
	20 Hz	0.28 %	
	100 Hz	0.11 %	
	1 kHz	0.1 %	
	10 kHz	0.1 %	
	100 kHz	0.21 %	
	1 MHz	0.88 %	
	1 H		
	20 Hz	0.17 %	
	100 Hz	0.1 %	
	1 kHz	0.1 %	
	10 kHz	0.11 %	
	100 kHz	0.31 %	
	10 H		
	20 Hz	0.15 %	
	100 Hz	0.1 %	
	1 kHz	0.11 %	
	10 kHz	0.21 %	
	100 kHz	0.69 %	
	100 H		
	20 Hz	0.15 %	
	100 Hz	0.11 %	
	1 kHz	0.15 %	
	10 kHz	0.62 %	
Inductance Measuring Equipment ¹	100 mH 1 kHz	0.14 %	Standard Inductor



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Electrical Calibration of Thermocouple Devices ¹ Type B	250 °C to 350 °C	1 °C	Ectron 1140A
	350 °C to 445 °C	0.77 °C	
	445 °C to 580 °C	0.61 °C	
	580 °C to 750 °C	0.47 °C	
	750 °C to 1 000 °C	0.39 °C	
	1 000 °C to 1 820 °C	0.31 °C	
Type C	0 °C to 250 °C	0.21 °C	
	250 °C to 1 000 °C	0.17 °C	
	1 000 °C to 1 500 °C	0.19 °C	
	1 500 °C to 1 800 °C	0.22 °C	
	1 800 °C to 2 000 °C	0.24 °C	
	2 000 °C to 2 250 °C	0.3 °C	
	2 250 °C to 2 315 °C	0.33 °C	
Type E	-270 °C to -245 °C	2.1 °C	
	-245 °C to -195 °C	0.2 °C	
	-195 °C to -155 °C	0.11 °C	
	-155 °C to -90 °C	0.09 °C	
	-90 °C to 0 °C	0.08 °C	
	0 °C to 15 °C	0.08 °C	
	15 °C to 890 °C	0.07 °C	
	890 °C to 1 000 °C	0.08 °C	
Type J	-210 °C to -180 °C	0.13 °C	
	-180 °C to -120 °C	0.11 °C	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Electrical Calibration of Thermocouple Devices ¹ Type J	-120 °C to -50 °C	0.09 °C	Ectron 1140A
	-50 °C to 990 °C	0.08 °C	
	990 °C to 1 200 °C	0.08 °C	
Type K	-270 °C to -255 °C	2.3 °C	
	-255 °C to -195 °C	0.73 °C	
	-195 °C to -115 °C	0.14 °C	
	-115 °C to -55 °C	0.1 °C	
	-55 °C to 1 000 °C	0.08 °C	
	1 000 °C to 1 372 °C	0.09 °C	
Type N	-270 °C to -260 °C	5.1 °C	
	-260 °C to -200 °C	1.1 °C	
	-200 °C to -140 °C	0.25 °C	
	-140 °C to -70 °C	0.16 °C	
	-70 °C to 25 °C	0.13 °C	
	25 °C to 160 °C	0.11 °C	
	160 °C to 1 300 °C	0.1 °C	
Type R	-50 °C to -30 °C	0.68 °C	
	-30 °C to -45 °C	0.58 °C	
	-45 °C to 160 °C	0.42 °C	
	160 °C to 380 °C	0.31 °C	
	380 °C to 775 °C	0.28 °C	
	775 °C to 1 768 °C	0.23 °C	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Electrical Calibration of Thermocouple Devices ¹ Type S	-50 °C to -30 °C	0.65 °C	Ectron 1140A
	-30 °C to 45 °C	0.59 °C	
	45 °C to 105 °C	0.42 °C	
	105 °C to 310 °C	0.35 °C	
	310 °C to 615 °C	0.31 °C	
	615 °C to 1 768 °C	0.27 °C	
Type T	-270 °C to -255 °C	1.8 °C	
	-255 °C to -240 °C	0.52 °C	
	-240 °C to -210 °C	0.32 °C	
	-210 °C to -150 °C	0.19 °C	
	-150 °C to -40 °C	0.13 °C	
	-40 °C to 100 °C	0.09 °C	
	100 °C to 400 °C	0.08 °C	
Type B	600 °C to 800 °C	0.34 °C	Fluke 5520
	800 °C to 1 000 °C	0.26 °C	
	1 000 °C to 1 550 °C	0.23 °C	
	1 550 °C to 1 820 °C	0.26 °C	

Electrical - RF/Microwave

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Relative RF Power	100 kHz to 4.2 GHz 0 dB to -10 dB	1.1 %	Agilent 438A/8482A
	-10 dB to -20 dB	1.4 %	

Electrical - RF/Microwave

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Relative RF Power	-20 dB to -30 dB	1.4 %	Agilent 438A/8482A
	-30 dB to -40 dB	1.5 %	
	-40 dB to -50 dB	4.3 %	

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ⁴	Reference Standard, Method and/or Equipment
Angle Measuring Equipment	0° to 89°	4.4"	Angle Blocks
	90°	1.1"	Granite Square
Micrometers & Calipers – Outside, Inside, Depth ¹	0 in to 0.5 in	13 μin	Comparison to Gage Blocks
	0.5 in to 1 in	14 μin	
	1 in to 4 in	(10 + 3.6L) μin	
	4 in to 15 in	(11 + 4.2L) μin	
	15 in to 40 in	(11 + 4.4L) μin	
Anvil Flatness ¹	0 in to 1 in	6.2 μin	Optical Flats
Anvil Parallelism ¹	0 in to 1 in	6.6 μin	Optical Parallels
Bore Gages	0.125 in to 0.25 in	34 μin	Characterized Rings
	0.25 in to 1 in	36 μin	
	1 in to 6 in	(30 + 7L) μin	
Digital, Dial, Drop and Test Indicators ¹	0 in to 6 in	(6.3 + 3.2L) μin	Gage Blocks/ Surface Plate
Test Indicators	0 in to 0.025 in	5.6 μin	ULM

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ⁴	Reference Standard, Method and/or Equipment
Single Axis – Outside	0 in to 1 in	$(3.9 + 0.5L) \mu\text{in}$	ULM
	1 in to 2 in	$(2.9 + 1.5L) \mu\text{in}$	
	2 in to 6 in	$(1 + 2.5L) \mu\text{in}$	
	6 in to 12 in	$(4.5 + 1.9L) \mu\text{in}$	
	12 in to 24 in	$(53 + 3L) \mu\text{in}$	P & W U304393
Single Axis – Inside	0.06 in to 2 in	$(6.2 + 2L) \mu\text{in}$	P & W Labmaster
	2 in to 6 in	$(6.9 + 1.5L) \mu\text{in}$	
	6 in to 12 in	$(24 + 1.1L) \mu\text{in}$	
Height Measuring Equipment 1	0 in to 4 in	$(26 + 0.5L) \mu\text{in}$	Comparison to Gage Blocks
	4 in to 24 in	$(16 + 3L) \mu\text{in}$	
Height Measure	0 in to 12 in	$(28 + 3.2L) \mu\text{in}$	Gage Blocks & Amplifier
Squareness	0 in to 18 in	$5.9 \mu\text{in/in}$	Comparison to Master Square
Length Measuring Equipment – Linear Displacement	0 ft to 12 ft	$(1 + 2.1L) \mu\text{in}$	Laser Interferometer
Optical Comparator			
Length	0 in to 6 in	$(104 + 14L) \mu\text{in}$	Calibration Grids
Squareness	0.04 in to 1 in	$(112 + 1.5L) \mu\text{in}$	Magnification Checker Scale
Magnification	10X to 50X	$(240 + 21L) \mu\text{in}$	
Optical Reference Plane	150 mm to 300 mm	$2.1 \mu\text{m}$	Calibration Grid
Thread Wires	2 TPI to 120 TPI 0.00833 in to 0.5 in	$13 \mu\text{in}$	ULM
Plug Gage – Outer Diameter	0 in to 6 in	$(7.4 + 1.3L) \mu\text{in}$	ULM

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ⁴	Reference Standard, Method and/or Equipment
Pin Gage – Outer Diameter Non-contact	0.004 in to 1 in	33 μ in	Laser Micrometer
Ring Gage – Inner Diameter	0 in to 2 in	(6.2 + 2L) μ in	ULM
	2 in to 6 in	(6.9 + 1.5L) μ in	
	6 in to 12 in	(23 + 1.2L) μ in	
Laser Micrometers	0 in to 1 in	(7.4 + 1.3L) μ in	Characterized Master Pins
Flatness	(0 to 4) in Diameter	6.2 μ in	Optical Flat
	(0 x 0) in to (3 x 12) in	35 μ in	Indicator w/ Amp
	(3 x 12) in to (3 x 18) in	42 μ in	
	(6 x 18) in to (6 x 30) in	46 μ in	
	(0 x 0) in to (6 x 12) in	138 μ in	Vision System w/Probe
Parallelism	(0 x 0) in to (3 x 12) in	33 μ in	Indicator w/ Amp
	(3 x 12) in to (3 x 18) in	40 μ in	
	(6 x 18) in to (6 x 30) in	45 μ in	
Straightness	(0 to 12) in	35 μ in	Indicator w/ Amp
	(12 to 18) in	42 μ in	
	(18 to 30) in	46 μ in	
Tapes and Rulers	0 ft to 6 ft	(400 + 2L) μ in	Vision System
	6 ft to 12 ft	(400 + 7L) μ in	
	12 ft to 100 ft	(400 + 6L) μ in	
Thread Plug Gages Pitch Diameter 60° Thread Major Diameter	0 in to 7 in	79 μ in	ULM w/Thread Wires
	0 in to 7 in	(7.4 + 1.3L) μ in	ULM



Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ⁴	Reference Standard, Method and/or Equipment
Tapered Thread Plug Pitch Diameter	0 in to 3 in	90 μ in	ULM w/Thread Wires
Standoff	0 in to 1 in	31 μ in	Gage Blocks & Amplifier
Thread Ring Gage Inner Pitch Diameter	0 in to 7 in	79 μ in	Master Plug Uncertainty
TWO DIMENSIONAL GAGES Two Axis (X-Y)	0.000 05 in to 1 in	84 μ in	Vision System
	1 in to 2 in	90 μ in	
	2 in to 3 in	96 μ in	
	3 in to 4 in	0.000 1 in	
	4 in to 5 in	0.000 11 in	
	5 in to 6 in	0.000 12 in	
	6 in to 9 in	0.000 14 in	
	9 in to 12 in	0.000 16 in	
Z Axis	0.1 in to 2 in	0.000 15 in	Vision System
	2 in to 4 in	0.000 16 in	
	4 in to 5 in	0.000 17 in	
Angle	0° to 360°	0.005°	Vision System

Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Air Velocity	0.2 m/s to 2 m/s 2 m/s to 60 m/s	0.06 m/s 1.3 % + 0.01 m/s	Westenberg Westi-box
Force Measuring Equipment	0 lbf to 300 lbf	0.01 %	Deadweight
Torque Measure	9 lbf·in to 800 lbf·ft	1 %	Torque Calibrator
Pneumatic Torque	0.20 lbf·in to 18 lbf·in	0.55 lbf·in	Imada i-80
	18 lbf·in to 70 lbf·in	1.1 lbf·in	Imada i-80
	8 lbf·in to 130 lbf·in	0.89 lbf·in	Imada CD-150M
Balances & Scales – Metric ¹	10 kg	8.2 mg	ASTM Class 1
	2 kg	5.9 mg	
	1 kg	2.7 mg	
	500 g	1.5 mg	
	300 g	1.1 mg	
	200 g	0.63 mg	
	100 g	0.17 mg	
	50 g	0.18 mg	
	20 g	75 µg	
	10 g	47 µg	
	5 g	51 µg	
	2 g	90 µg	
	1 g	47 µg	
	500 mg	69 µg	

Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Balances & Scales – Metric ¹	200 mg	69 µg	ASTM Class 1
	100 mg	69 µg	
	50 mg	69 µg	
	20 mg	69 µg	
	10 mg	69 µg	
	5 mg	69 µg	
	2 mg	69 µg	
	1 mg	69 µg	
Avoirdupois	2.2 lb to 450 lb	0.017 %	NIST Class F
Mass	0 kg to 1.2 kg	3 g	XS1203S
Pressure Absolute Measure & Measuring Equipment	0 psia to 30 psia	0.002 4 psia	DHI PPC4 Controller
	30 psia to 1 000 psia	0.006 6 % + 0.000 48 psia	
	500 psia to 16 000 psia	0.019 %	P3125-3 DWT w/barometer
Pressure Gage Measure & Measuring Equipment – Pneumatic	0 in H ₂ O to 0.5 in H ₂ O	0.000 5 in H ₂ O	Ashcroft ASQ-1
	0.5 in H ₂ O to 1 in H ₂ O	0.000 76 in H ₂ O	Ashcroft ASQ-1
	-14.7 psig to 30 psig	0.002 1 psig	DHI PPC4 Controller
	30 psig to 1000 psig	0.006 6 % + 0.001 psig	
	-36 in H ₂ O to -22 in H ₂ O	0.009 % + 150 µin H ₂ O	DHI PPC4-ui
	-22 in H ₂ O to 22 in H ₂ O	0.002 in H ₂ O	
	22 in H ₂ O to 60 in H ₂ O	0.009 % + 150 µin H ₂ O	
	60 in H ₂ O to 72 in H ₂ O	0.006 5 in H ₂ O	
	72 in H ₂ O to 804 in H ₂ O	0.009 % + 150 µin H ₂ O	



Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method and/or Equipment
Pressure Gage Measuring Equipment ¹	-14.7 psig to -0.5 psig	0.010 % + 0.000 11 psig	Fluke P3025-PSI
	3 psig to 500 psig	0.007 1 % + 0.003 9 psig	
Pressure Gage Measuring Equipment ¹	500 psig to 16 000 psig	0.01 %	P3125-3 DWT

Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Humidity Measuring Equipment (-10 °C to 15 °C)	10 % RH to 75 % RH	0.5 % RH	Thunder Scientific 2500
	75 % RH to 95 % RH	0.65 % RH	
(15 °C to 35 °C)	10 % RH to 95 % RH	0.5 % RH	
(35 °C to 70 °C)	10 % RH to 50 % RH	0.5 % RH	
	50 % RH to 70 % RH	0.7 % RH	
	70 % RH to 95 % RH	0.85 % RH	
Humidity Measure ¹	10 % RH to 90 % RH	1.3 % RH	Vaisala MI70/HMP76B
Dew / Frost Point Measuring Equipment	40 °C to 65 °C	0.17 °C	Thunder Scientific 2500
	30 °C to 40 °C	0.16 °C	
	20 °C to 30 °C	0.15 °C	
	20 °C to -10 °C	0.13 °C	
	-10 °C to -40 °C	0.15 °C	Thunder Scientific 3900
	-40 °C to -50 °C	0.25 °C	



Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Dew / Frost Point Measuring Equipment	-50 °C to -60 °C	0.36 °C	Thunder Scientific 3900
	-60 °C to -70 °C	0.4 °C	
	-70 °C to -80 °C	0.61 °C	
	-80 °C to -85 °C	1.2 °C	
Temperature Measure ¹	-195 °C to 0 °C	0.015 °C	AccuMac AM1760 w/Black Stack
	0 °C to 420 °C	0.022 °C	
	420 °C to 660 °C	0.039 °C	
	600 °C to 800 °C	0.55 °C	Fluke 5649 w/3458A
	800 °C to 1 000 °C	0.76 °C	
	1 000 °C to 1 450 °C	2.9 °C	
Temperature Measuring Equipment ¹	-75 °C to 50 °C	0.033 °C	AccuMac AM1760 w/Hart Bath or Metrology Well & Black Stack
	50 °C to 100 °C	0.051 °C	
	100 °C to 425°C	0.074 °C	
	425 °C to 600 °C	0.092 °C	
	600 °C to 800 °C	1.2 °C	Fluke 5649 w/Furnace & 3458A
	800 °C to 1 000 °C	1.5 °C	
	1 000 °C to 1200 °C	3.6 °C	
Infrared Temperature – Measuring equipment	-15 °C to 0 °C	0.8 °C	Hart Black Body 4181 $\epsilon = (0.1 \text{ to } 1.0)$ $\lambda = (8 \text{ to } 14) \mu\text{m}$
	0 °C to 50 °C	0.65 °C	
	50 °C to 100 °C	0.70 °C	
	100 °C to 120 °C	0.76 °C	



Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Infrared Temperature – Measuring equipment	120 °C to 200 °C	0.94 °C	Hart Black Body $\epsilon = (0.1 \text{ to } 1.0)$ $\lambda = (8 \text{ to } 14) \mu\text{m}$
	200 °C to 350 °C	1.6 °C	
	350 °C to 500 °C	2.1 °C	
	500 °C to 1 000 °C	2.6 °C + 0.22 %	Mikron M300 $\epsilon = (0.999)$ $\lambda = (8 \text{ to } 14) \mu\text{m}$

Time and Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Frequency Measure and Measuring Equipment	10 MHz	$3.8 \times 10^{-12} \text{ Hz/Hz}$	Fluke 910R
Frequency Measure ¹	10 MHz	$2.1 \times 10^{-7} \text{ Hz/Hz}$	HP 53131A Counter

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. Values listed with percent (%) are percent of reading or generated value unless otherwise noted.
3. As frequency & amplitude deviate from the listed values, uncertainty may be higher than stated. If needed, contact laboratory for more information regarding uncertainties at frequency and range combinations other than the ones shown.
4. L = Length in inches.
5. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2489.

Vice President