



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1-1994

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CALIBRATION

Valid To: March 31, 2015

Certificate Number: 1877.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Dimensional

Parameter/Equipment	Range	CMC ² (±)	Comments
Calipers ³	(1 to 6) in	380 μin + 7.8 μin/in	Gage blocks
	(6 to 12) in	370 μin + 19 μin/in	
	(12 to 24) in	450 μin + 24 μin/in	
Indicators ³ (Digital and Dial)	(0.1 to 2) in	690 μin + 1.4 μin/in	Gage blocks
Height Gages ³	(4 to 24) in	570 μin + 18 μin/in	Gage blocks
Micrometers ³ (OD and ID)	(0.1 to 4.1) in	22 μin + 34 μin/in	Gage blocks; parallelism and linearity only
	(4.1 to 12) in	24 μin + 28 μin/in	
Depth Micrometers ³	(0.1 to 6) in	270 μin + 9 μin/in	Gage blocks and surface plates

Parameter/Equipment	Range	CMC ^{2,4,5} (\pm)	Comments
Tape Measure and Steel Ruler ³	(1 to 12) in (12 to 36) in (3 to 24) ft	0.008 in + 0.002 in/in 0.0034 in + 0.002 in/in 0.0026 in + 0.05 in/ft	Rigid ruler and gage blocks; no tension applied

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,4,5,7} (\pm)	Comments
DC Voltage – Generate ³	Up to 330 mV 330 mV to 3.3 V (3.3 to 30) V (30 to 330) V (330 to 1000) V	22 μ V/V + 1.7 μ V 9.6 μ V/V + 2.5 μ V 14 μ V/V + 26 μ V 26 μ V/V + 240 μ V 21 μ V/V + 1.9 mV	Fluke 5520A SC 1100
DC Voltage – Measure ³	Up to 200 mV 200 mV to 2 V (2 to 20) V (20 to 200) V (200 to 1000) V (1 to 60) kV	5.6 μ V/V + 0.23 μ V 4.0 μ V/V + 0.4 μ V 4.1 μ V/V + 0.7 μ V 6.4 μ V/V + 0.64 μ V 7.1 μ V/V + 0.01 mV 1.2 V/kV	Fluke 8508A/01 HP 34401A, Ross Engineering VD60-6.2Y-A-LB-AL
DC Current – Generate ³	Up to 330 μ A 330 μ A to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 10) A (10 to 20) A (1 to 15) A (15 to 150) A (150 to 1000)A	0.017 % + 24 nA 0.012 % + 64 nA 51 μ A/A + 390 nA 0.012 % + 3.7 μ A 0.071 % + 52 μ A 0.058 % + 630 μ A 0.12 % + 1.0 mA 0.12 % + 3.7 μ A 0.9 % + 0.16 A 0.3 % + 0.58 A	Fluke 5520A SC 1100 Fluke 5520A SC 1100 with Fluke 5500 50 turn coil
DC Current – Measure ³	Up to 200 μ A 200 μ A to 2 mA (2 to 20) mA (20 to 200) mA 200 mA to 2 A (2 to 20) A	3 μ A/A + 2.9 nA 2 μ A/A + 2.9 nA 2.1 μ A/A + 47 nA 8.4 μ A/A + 9 μ A 0.21 mA/A 0.47 mA/A + 0.5 μ A	Fluke 8508A/01

Parameter/Equipment	Range	CMC ^{2, 4, 5, 7} (\pm)	Comments
DC Power ³	(0.01 to 330) W (0.33 to 11) kW (11 to 20.5) kW	0.021 % 0.073 % 0.12 %	Fluke 5520A SC1100
Resistance – Generate ³	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω to 1.1 k Ω (1.1 to 3.3) k Ω (3.3 to 11) k Ω (11 to 33) k Ω (33 to 110) k Ω (110 to 330) k Ω 330 k Ω to 1.1 M Ω (1.1 to 3.3) M Ω (3.3 to 11) M Ω (11 to 33) M Ω (33 to 110) M Ω (110 to 330) M Ω 330 M Ω to 1.1 G Ω	7.6 $\mu\Omega/\Omega$ + 1.3 m Ω 7.2 $\mu\Omega/\Omega$ + 1.8 m Ω 15 $\mu\Omega/\Omega$ + 2.2 m Ω 25 $\mu\Omega/\Omega$ + 2.3 m Ω 34 $\mu\Omega/\Omega$ + 21 m Ω 39 $\mu\Omega/\Omega$ + 61 m Ω 40 $\mu\Omega/\Omega$ + 210 m Ω 40 $\mu\Omega/\Omega$ + 1.4 m Ω 41 $\mu\Omega/\Omega$ + 2.4 m Ω 44 $\mu\Omega/\Omega$ + 7 Ω 38 $\mu\Omega/\Omega$ + 4 Ω 72 $\mu\Omega/\Omega$ + 38 Ω 150 $\mu\Omega/\Omega$ + 0.1 k Ω 320 $\mu\Omega/\Omega$ + 3.6 k Ω 590 $\mu\Omega/\Omega$ + 4.9 k Ω 1.1 m Ω/Ω + 0.1 M Ω 17 m Ω/Ω + 1.1 M Ω	Fluke 5520A SC1100,
Resistance – Measure ³	Up to 2 Ω (2 to 20) Ω (20 to 200) Ω 200 Ω to 2 k Ω (2 to 20) k Ω (20 to 200) k Ω 200 k Ω to 2 M Ω (2 to 20) M Ω (20 to 200) M Ω 200 M Ω to 2 G Ω	52 $\mu\Omega/\Omega$ + 6 $\mu\Omega$ 12 $\mu\Omega/\Omega$ + 17 $\mu\Omega$ 10 $\mu\Omega/\Omega$ + 58 $\mu\Omega$ 9.5 $\mu\Omega/\Omega$ + 0.58 m Ω 21 $\mu\Omega/\Omega$ + 5.8 m Ω 10 $\mu\Omega/\Omega$ + 58 m Ω 11 $\mu\Omega/\Omega$ + 1.2 Ω 0.034 % + 120 Ω 2.6 % + 12 k Ω 8.6 % + 120 k Ω	Fluke 8508A/01
Capacitance – Generate	(0 to 0.4) nF (0.4 to 33) nF (33 to 330) nF 330 nF to 3.3 μ F (3.3 to 33) μ F (33 to 110) μ F 110 μ F to 3.3 mF (3.3 to 33) mF (33 to 110) mF	5.9 % + 1.2 pF 0.11 % + 1.2 pF 0.4 % + 1.2 pF 0.43 % + 1.2 pF 0.58 % + 1.2 pF 0.64 % + 1.2 pF 0.60 % + 1.2 pF 0.98 % + 1.2 pF 1.3 % + 1.2 pF	Fluke 5520A SC 1100

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Electrical Calibration of Thermocouple Indicators –			
Type J	-200 °C to -100 °C -100 °C to 800 °C 800 °C to 1210 °C	0.32 °C 0.22 °C 0.27 °C	Fluke 5520A SC 1100
Type K	-200 °C to -100 °C -100 °C to 800 °C 800 °C to 1375 °C	0.40 °C 0.31 °C 0.36 °C	
Type T	-200 °C to 0 °C 0 °C to 200 °C 200 °C to 400 °C	0.73 °C 0.29 °C 0.19 °C	
Type S	0 °C to 250 °C 200 °C to 1400 °C 1400 °C to 1765 °C	0.58 °C 0.44 °C 0.54 °C	
Type E	-100 °C to 25 °C -25 °C to 120 °C 120 °C to 1000 °C	0.44 °C 0.19 °C 0.24 °C	
Type R	0 °C to 250 °C 250 °C to 1400 °C 1400 °C to 1765 °C	0.58 °C 0.42 °C 0.47 °C	
Type N	-200 °C to 0 °C 0 °C to 200 °C 200 °C to 400 °C	0.47 °C 0.26 °C 0.33 °C	
Electrical Simulation of RTD Indicators ³ –			
Pt 395, 100 Ω	-200 °C to 0 °C 0 °C to 100 °C 100 °C to 300 °C 300 °C to 400 °C 400 °C to 630 °C	0.1 °C 0.1 °C 0.2 °C 0.2 °C 0.2 °C	Fluke 5520A SC 1100
Pt 385, 200 Ω	-200 °C to 0 °C 0 °C to 100 °C 100 °C to 300 °C 300 °C to 400 °C	0.1 °C 0.1 °C 0.4 °C 0.6 °C	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Electrical Simulation of RTD Indicators ³ – (cont)			
Cu 427, 10 Ω	-100 °C to 0 °C 0 °C to 100 °C 100 °C to 260 °C	0.35 °C 0.35 °C 0.35 °C	Fluke 5520A SC 1100

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Generate ³			
(1 to 33) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	18 μV/V + 7.1 μV 18 μV/V + 7.1 μV 24 μV/V + 7.1 μV 0.017 % + 7.1 μV 0.045 % + 7.1 μV 0.11 %+ 7.1 μV	Fluke 5520A SC 1100
33 mV to 330 mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.15 mV/V + 15 μV 0.15 mV/V + 15 μV 0.17 mV/V + 15 μV 0.41 mV/V + 15 μV 1.0 mV/V + 15 μV 2.5 mV/V + 15 μV	
330 mV to 3.3 V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	55 μV/V + 110 μV 55 μV/V + 110 μV 69 μV/V + 110 μV 0.11 mV/V + 110 μV 0.27 mV/V + 110 μV 0.99 mV/V + 110 μV	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 7} (\pm)	Comments
AC Voltage – Generate ³ (cont)			Fluke 5520A SC 1100
(3.3 to 33) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.34 mV/V + 2.5 mV 0.19 mV/V + 2.5 mV 0.28 mV/V + 2.5 mV 0.39 mV/V + 2.5 mV 2.5 mV/V + 2.5 mV	
(33 to 330) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.21 mV/V + 6.2 mV 0.24 mV/V + 6.2 mV 0.29 mV/V + 6.2 mV 0.36 mV/V + 6.2 mV 2.5 mV/V + 6.2 mV	
(330 to 1000) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.35 mV/V + 14 mV 0.29 mV/V + 14 mV 0.35 mV/V + 14 mV	
AC Voltage – Measure ³			Fluke 8508A/01
Up to 200 mV	(1 to 10) Hz (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.012 % + 4.6 μ V 91 μ V/V + 4.6 μ V 0.011 % + 4.6 μ V 0.028 % + 4.6 μ V 0.064 % + 4.6 μ V 0.066 % + 4.6 μ V	
200 mV to 2 V	(1 to 10) Hz (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.02 % + 23 μ V 0.011 % + 23 μ V 0.013 % + 23 μ V 0.027 % + 23 μ V 0.077 % + 23 μ V 0.077 % + 23 μ V 0.46 % + 23 μ V	
(2 to 20) V	(1 to 10) Hz (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.026 % + 240 μ V 0.011 % + 240 μ V 0.013 % + 240 μ V 0.027 % + 240 μ V 0.076 % + 240 μ V 0.077 % + 240 μ V 0.46 % + 240 μ V	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 7} (±)	Comments
AC Voltage– Measure ³ (cont)			
(20 to 200) V	(1 to 10) Hz (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.019 % + 4.2 mV 0.010 % + 4.2 mV 0.012 % + 4.2 mV 0.026 % + 4.2 mV 0.075 % + 4.2 mV 0.076 % + 4.2 mV 0.46 % + 4.2 mV	Fluke 8508A/01
(200 to 1050) V	(1 to 10) Hz (10 to 45) Hz 45 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.023 % + 23 mV 0.014 % + 23 mV 0.013 % + 23 mV 0.033 % + 23 mV 0.033 % + 23 mV	
(1 to 42) kV	60 Hz	0.58 %	HP 34401A; Ross Engineering VD60-6.2Y-A-LB-AL
AC Current – Generate ³			
(0 to 330) µA	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.18 % + 120 nA 0.15 % + 120 nA 0.32 % + 170 nA 0.93 % + 230 nA 1.8 % + 460 nA	Fluke 5520A SC 1100
330 µA to 3.3 mA	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	1.7 mA/A + 0.44 µA 1.2 mA/A + 0.17 µA 2.0 mA/A + 0.53 µA 5.6 mA/A + 0.96 µA 1 mA/A + 2.9 µA	
(3.3 to 33) mA	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.083 % + 4.5 µA 0.042 % + 2 µA 0.065 % + 5.1 µA 0.062 % + 8.9 µA 0.35 % + 21 µA	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 7} (±)	Comments
AC Current – Generate ³ (cont)			
(33 to 330) mA	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.097 % + 48 µA 0.048 % + 23 µA 0.14 % + 75 µA 0.22 % + 150 µA 0.43 % + 0.36 mA	Fluke 5520A SC 1100
(0.33 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.19 % + 0.89 mA 0.069 % 0.63 % + 1.2 mA 2.9 % + 6.1 mA	
(3 to 11) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	0.061 % + 3.5 mA 0.073 % 3.5 % + 4.3 mA	
(11 to 20.5) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	0.14 % + 7.4 mA 0.071 % + 7.4 mA 3.3 % + 8.6 mA	Fluke 5500 50 turn coil
(1 to 15) A	(45 to 65) Hz (65 to 440) Hz	1.2 % 1.2 %	
(15 to 150) A	(45 to 65) Hz (65 to 440) Hz	2.3 % 2.3 %	
(150 to 1000) A	(45 to 65) Hz (65 to 440) Hz	1.3 % 0.81 %	
AC Current – Measure ³			
Up to 200 µA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.040 % + 23 nA 0.039 % + 23 nA 0.084 % + 23 nA	Fluke 8508A/01
200 µA to 2 mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.036 % + 230 nA 0.033 % + 0.29 µA 0.082 % + 230 nA	
(2 to 20) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.038 % + 2.0 µA 0.031 % + 2.0 µA 0.072 % + 2.0 µA	

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
AC Current – Measure ³ (cont)			
(20 to 200) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.042 % + 23 μA 0.034 % + 23 μA 0.072 % + 23 μA	Fluke 8508A/01
200 mA to 2 A	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.072 % + 23 mA 0.086 % + 23 mA 0.35 % + 23 mA	
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	0.036 % + 23 mA 0.29 % + 23 mA	
AC Power ³ – (45 to 65) Hz; PF=1			
330 mV Range 330 mA Range 3.3 A Range 10.5 A Range 20.5 A Range	(0.01 to 0.99) W (0.99 to 1.1) W (1.1 to 3.5) W (3.5 to 6.8) W	0.12 % 0.21 % 0.11 % 0.16 %	Fluke 5520A SC 1100
1020 V Range 33 mA Range 330 mA Range 1.1 A Range 3.3 A Range 10.5 A Range 20.5 A Range	(6.8 to 34) W (34 to 337) W 337 W to 1.1 kW (1.1 to 3.3) kW (3.3 to 11) kW (11 to 20.9) kW	0.11 % 0.11 % 0.22 % 0.21 % 0.09 % 0.17 %	
Phase Generate ³ –			
0 to 360°	(1 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz	0.13° 0.30° 0.58° 2.9°	Fluke 5520A SC 1100

Parameter/Range	Frequency	CMC ^{2,4,5} (±)	Comments
Oscilloscopes ³ – Line Sine Wave			Fluke 5520A SC1100
Amplitude	50 kHz ref 50 K to 100 MHz (300 to 600) MHz (600 to 1100) MHz	2.3 % + 0.35 mV 5 % + 0.36 mV 6.5 % + 0.57 mV 7.5 % + 400 mV	
Rise Time Tunnel Diode Pulse 5520 into 50 Ω	125 ps 2 ns	15 ps/ns 33 %	
Time Markers	5 s to 50 ms 50 ms to 20 ns (20 to 1) ns	0.6 % + 3 ns 0.006 % + 50 ps 50 ps	

III. Mechanical

Parameter/Equipment	Range	CMC ^{2,7,8} (±)	Comments
Balances ³	(0.001 to 5) g Up to 10 g Up to 30 g Up to 50 g Up to 100 g Up to 200 g Up to 300 g Up to 500 g Up to 1000 g (1 to 15) kg	0.04 mg + 0.6R 0.06 mg + 0.6R 0.09 mg + 0.6R 0.14 mg + 0.6R 0.3 mg + 0.6R 0.6 mg + 0.6R 0.9 mg + 0.6R 1.4 mg + 0.6R 3 mg + 0.6R 3 mg/kg + 0.6R	ASTM Class 1 weights
Scales ³	(1 to 2000) lbs	0.017 % + 0.6R	ASTM Class 6 weights
Pressure – Precision Measuring Equipment	(-14 to 25) psia (0 to 25) psi	9.5 ppm 9.8 ppm	Ruska 2465
Pneumatic	(2 to 1000) psia (2 to 1000) psi	10 ppm 10 ppm	

Parameter/Equipment	Range	CMC ^{2,7,8} (±)	Comments
Pressure – Measuring Equipment ³ Pneumatic	15 psia (0 to 15) psi vacuum (0.1 to 10) inH ₂ O (0.14 to 31) psi (10 to 1000) psi	0.0081 psia 0.013 psi 0.03 inH ₂ O 0.01 % 0.01 %	Pressure transducer Fluke 700P01 Pneumatic DWT
Pressure – Measuring Equipment ³ Hydraulic	(50 to 500) psi (500 to 7500) psi (7500 to 15 000) psi	0.017 % 0.018 % 0.024 %	Hydraulic DWT
Force – Measuring Equipment ³ Tension and Compression	(0 to 500) lbf	0.06 %	Verification by Class F weights
Torque Wrenches and Dials ³	(20 to 400) ozf·in (24 to 50) lbf·in (50 to 400) lbf·in (400 to 1000) lbf·in (83 to 125) lbf·ft (125 to 250) lbf·in (250 to 600) lbf·in (600 to 1000) lbf·in (1000 to 2000) lbf·in	0.63 ozf·in + 0.003 ozf·in/ozf·in 0.069 lbf·in 0.42 lbf·in 0.2 lbf·in 0.14 lbf·ft 0.094 lbf·ft 0.5 lbf·ft 1.1 lbf·ft 1.3 lbf·ft	Torque transducers and loader
Power Torque Tools ³	(20 to 400) ozf·in (24 to 50) lbf·in (50 to 400) lbf·in (400 to 1000) lbf·in (80 to 125) lbf·ft (125 to 250) lbf·ft	0.056 ozf·in + 0.0015 ozf·in/ozf·in 0.0013 lbf·in + 0.001 lbf·in/lbf·in 0.045 lbf·in + 0.001 lbf·in/lbf·in 0.029 lbf·in + 0.001 lbf·in/lbf·in 0.055 lbf·ft + 0.0008 lbf·ft/lbf·ft 0.0062 lbf·ft + 0.001 lbf·ft/lbf·ft	Torque transducers loader and joint rate simulators

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Accelerometers	(20 to 99) Hz 100 Hz (101 to 500) Hz 501 Hz to 3 kHz (3 to 10) kHz	2.2 % 2 % 2.1 % 2.3 % 2.7%	VR9500 and Dytran accelerometers
Torque Transducers ³	(10 to 400) ozf·in (24 to 50) lbf·in (50 to 400) lbf·in (400 to 1000) lbf·in (83 to 125) lbf·ft (125 to 250) lbf·ft (250 to 600) lbf·ft (600 to 1000) lbf·ft (1000 to 2000) lbf·ft	0.055 ozf·in + 0.00078 ozf·in/ozf·in 0.0027 lbf·in + 0.000076 lbf·in/lbf·in 0.058 lbf·in + 0.000031 lbf·in/lbf·in 0.058 lbf·in + 0.000031 lbf·in lbf·in 0.014 lbf·ft + 0.000062 lbf·ft/lbf·ft 0.0075 lbf·ft + 0.00025 lbf·ft/lbf·ft 0.011 lbf·ft + 0.00015 lbf·ft/lbf·ft 0.1 lbf·ft + 0.000092 lbf·ft/lbf·ft 0.081 lbf·ft + 0.00014 lbf·ft/lbf·ft	Dead weights and torque arms

IV. Thermodynamic

Parameter/Equipment	Range	CMC ^{2,6,7} (±)	Comments
Temperature – Measuring Equipment ³	-30 °C to 661 °C	0.015 °C + 0.0036 %	Fluke 518, Hart 5628, Fluke 8508A
Temperature – Measure ³	-197 °C to 661 °C	0.009 °C + 0.0011 %	Hart 5628, Fluke 8508A
Infrared Temperature – Measuring Equipment ³	Ambient to 500 °C	0.84 °C + 0.000135 °C/°C	Hart 9132
Humidity Measuring Equipment – Calibration Humidity Probes ³	(10 to 97.4) % RH	1.8 % RH	ASTM E104 Salt Solutions

Parameter/Equipment	Range	CMC ^{2, 6, 7} (±)	Comments
Humidity – Measure ³	(10 to 80) % RH (80 to 90) % RH	1.4 % RH 2.4 % RH	Vaisala HMI
Thermocouple – Measure ³ Types E, J, K, and T Type S	-200 °C to 1250 °C -100 °C to 1450 °C	0.14 °C 0.38 °C	Hart 1560/2566

V. Time & Frequency

Parameter/Equipment	Range	CMC ^{2, 7} (±)	Comments
Sine Wave Frequency – Generate	0.01 Hz to 2 kHz 2 kHz to 0.5 MHz (0.5 to 250) MHz (250 to 500) MHz (500 to 1100) MHz	2.9 µHz/Hz 2.9 µHz/Hz 2.9 µHz/Hz 2.9 µHz/Hz 2.9 µHz/Hz	Fluke 5520A, SC 1100
Sine Wave Frequency – Measure	30 Hz to 1.0 MHz (1 to 225) MHz	0.24 µHz/Hz 0.2 µHz/Hz	HP 53132 opt 10 12 digit counter
Time Interval – A to B	10 ns to 10 ⁵ s	2.9 x 10 ⁻¹² s/s + 1.2 ns	HP 53132 opt 10 12 digit counter
Frequency – Measuring Equipment ³	0.01 Hz to 250 kHz 250 kHz to 3GHz	20 µHz/Hz + 370 pHz 3.1 x 10 ⁻¹⁰ Hz/Hz + 0.012 Hz	Agilent 33220A Agilent E4432B
Frequency – Measure ³	(DC to 300) MHz (300 to 3000) MHz	5.9 x 10 ⁻⁸ Hz 1.6 Hz	HP 53132 opt 10, 12 digit counter
Frequency – Measure ³	10 MHz	1 x 10 ⁻¹² Hz	GPS receiver/HP 53132 opt 10

Parameter/Equipment	Range	CMC ^{2,7} (\pm)	Comments
Stopwatches ³	0.1 s to 24 Hr	0.13 s	HP 53132A Agilent 33220A
Tachometers ³	(40 to 99 999) rpm	$1.4 \times 10^8 + 0.0022$ rpm	Fluke 5520A

¹ This laboratory offers commercial calibration services and field calibration services.

² Calibration and Measurement Capability (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. Calibration and Measurement Capabilities represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

³ Field calibration service is available for this calibration and this laboratory meets A2LA R104 – *General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

⁴ The measurands stated are generated with the Fluke 5520A. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. Calibration and Measurement Capability (CMC) are expressed as either a specific value that covers the full range or as output plus one year floor specification where defined.

⁵ DC Voltage is measured with a Fluke 8508A. This capability is suitable for the calibration of devices intended to generate DC Volts in the ranges indicated.

⁶ Infrared Temperature is generated with a Hart 9132. This capability is suitable for the calibration of devices intended to measure Temperature in the ranges indicated.

⁷ All percentages are percent of reading unless otherwise indicated.

⁸ In the statement of CMC, R is the numerical value of the resolution of the device.



American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

CALIBRATION SOLUTIONS, INC.

Cornelius, NC

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration. 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 8 January 2009*).

Presented this 11th day of July 2013.



A handwritten signature in black ink, appearing to read "Peter Meyer".

President & CEO
For the Accreditation Council
Certificate Number 1877.01
Valid to March 31, 2015

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.