



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

ALPHA CONTROLS AND INSTRUMENTATION
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CALIBRATION

Valid To: January 31, 2019

Certificate Number: 2260.01

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

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
DC Voltage – Measure	Up to 200 mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1000) V	5.3 μV/V + 0.9 μV 3.1 μV/V + 0.6 μV 3.7 μV/V + 0.2 μV 4.8 μV/V + 0.7 μV 5.6 μV/V + 0.5 mV	Reference DMM
DC Voltage – Generate	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (330 to 1000) V	19 μV/V + 2.1 μV 14 μV/V + 2.6 μV 12 μV/V + 20 μV 18 μV/V + 150 μV 18 μV/V + 1.5 mV	Multifunction calibrator
DC Current – Measure	Up to 200 μA 200 μA to 2 mA (2 to 20) mA (20 to 200) mA 200 mA to 2 A (2 to 20) A	13 μA/A + 2.1 μA 13 μA/A + 2.1 μA 15 μA/A + 2.1 μA 49 μA/A + 4.1 μA 0.018 % + 8 μA 0.04 % + 20 μA	Reference DMM

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
DC Current – Generate	Up to 330 µA 330 µA to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	0.016 % + 0.02 µA 0.01 % + 0.05 µA 0.01 % + 0.28 µA 0.01 % + 2.8 µA 0.02 % + 41 µA 0.039 % + 36 µA 0.066 % + 510 µA 0.1 % + 720 µA	Multifunction calibrator
Clamp-On Only	(0 to 1000) A	0.27 % + 0.062 A	DC standard/coil
Resistance – Measure ⁵	Up to 2 Ω (2 to 20) Ω (20 to 200) Ω 200 Ω to 2 kΩ (2 to 20) kΩ (20 to 200) kΩ 200 kΩ to 2 MΩ (2 to 20) MΩ (20 to 200) MΩ 200 MΩ to 2 GΩ	20 µΩ/Ω + 1.9 µΩ 11 µΩ/Ω + 0.67 µΩ 8.3 µΩ/Ω + 0.25 µΩ 8.3 µΩ/Ω + 0.25 µΩ 8.3 µΩ/Ω + 0.25 mΩ 8.6 µΩ/Ω + 0.24 mΩ 11 µΩ/Ω + 0.46 Ω 23 µΩ/Ω + 4.9 Ω 0.015 % + 50 kΩ 1.6 mΩ/Ω + 0.50 MΩ	Reference DMM
Resistance – Generate ⁵	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω to 1.1 kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 330 kΩ 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 MΩ to 1.1 GΩ	40 µΩ/Ω + 0.001 Ω 33 µΩ/Ω + 0.0015 Ω 34 µΩ/Ω + 0.0013 Ω 31 µΩ/Ω + 0.002 Ω 28 µΩ/Ω + 0.003 Ω 30 µΩ/Ω + 0.02 Ω 29 µΩ/Ω + 0.02 Ω 29 µΩ/Ω + 0.02 Ω 30 µΩ/Ω + 0.2 Ω 32 µΩ/Ω + 2.3 Ω 33 µΩ/Ω + 2.3 Ω 61 µΩ/Ω + 29 Ω 0.013 % + 260 Ω 0.026 % + 2.4 kΩ 0.052 % + 2.6 kΩ 0.3 % + 88 kΩ 1.5 % + 500 kΩ	Multifunction calibrator
Fixed Points	25 Ω 100 Ω 200 Ω 400 Ω 10 GΩ 100 GΩ 10 TΩ	6 µΩ/Ω 6 µΩ/Ω 6 µΩ/Ω 6 µΩ/Ω 0.18 % 0.86 % 2.9 %	Resistance decade box



Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Measure			
Up to 200 mV	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.017 % + 69 µV 0.014 % + 20 µV 0.012 % + 20 µV 0.012 % + 11 µV 0.014 % + 20 µV 0.035 % + 40 µV 0.077 % + 110 µV	Reference DMM
200 mV to 2 V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.015 % + 120 µV 0.012 % + 20 µV 90 µV/V + 20 µV 75 µV/V + 20 µV 0.011 % + 20 µV 0.022 % + 40 µV 0.057 % + 200 µV 0.3 % + 2 mV 1 % + 20 mV	
(2 to 20) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.015 % + 1.2 mV 0.011 % + 200 µV 90 µV/V + 200 µV 78 µV/V + 200 µV 0.011 % + 200 µV 0.023 % + 400 µV 0.059 % + 2 mV 0.3 % + 20 mV 1 % + 200 mV	
(20 to 200) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.015 % + 12 mV 0.012 % + 2 mV 90 µV/V + 2 mV 75 µV/V + 2 mV 0.011 % + 2 mV 0.022 % + 4 mV 0.057 % + 20 mV 0.3 % + 20 mV 1 % + 200 mV	



Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Measure (cont)			
(200 to 300) V	(1 to 10) Hz (10 to 40) Hz 40 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.015 % + 21 mV 0.012 % + 6 mV 0.012 % + 6 mV 0.023 % + 12 mV 0.058 % + 60 mV	Reference DMM
(300 to 1050) V	(1 to 10) Hz (10 to 40) Hz 40 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.017 % + 63 mV 0.015 % + 11 mV 0.011 % + 20 mV 0.028 % + 34 mV 0.062 % + 190 mV	
AC Voltage – Generate			
(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	0.08 % + 6 μV 0.019 % + 6 μV 0.023 % + 7 μV 0.1 % + 6 μV 0.35 % + 12 μV 0.8 % + 50 μV	Multifunction calibrator
(33 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	0.03 % + 9 μV 0.015 % + 9 μV 0.016 % + 10 μV 0.036 % + 10 μV 0.08 % + 33 μV 0.25 % + 58 μV	
(0.33 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	0.03 % + 51 μV 0.015 % + 61 μV 0.019 % + 62 μV 0.031 % + 50 μV 0.08 % + 89 μV 0.3 % + 490 μV	
(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	0.03 % + 620 μV 0.015 % + 600 μV 0.024 % + 600 μV 0.035 % + 640 μV 0.09 % + 1.9 mV	



Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Generate (cont)			
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.019 % + 1.8 µV 0.021 % + 5.6 µV 0.025 % + 5.8 µV 0.032 % + 5.6 µV 0.22 % + 42 µV	Multifunction calibrator
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.03 % + 10 mV 0.025 % + 10 mV 0.03 % + 10 mV	
AC Current – Measure			
Up to 200 µA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.031 % + 20 nA 0.03 % + 20 nA 0.071 % + 20 nA 0.4 % + 20 nA	Reference DMM
200 µA to 2 mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.031 % + 200 nA 0.03 % + 200 nA 0.071 % + 200 nA 0.4 % + 200 nA	
(2 to 20) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.031 % + 2 µA 0.03 % + 2 µA 0.071 % + 2 µA 0.4 % + 2 µA	
(20 to 200) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.031 % + 100 µA 0.029 % + 100 µA 0.063 % + 100 µA	
200 mA to 2 A	10 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.062 % + 100 µA 0.073 % + 100 µA 0.3 % + 100 µA	
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	0.082 % + 100 µA 0.25 % + 100 µA	



Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments	
AC Current – Generate				
(29 to 330) μA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.2 % + 0.1 μA 0.15 % + 0.1 μA 0.13 % + 0.1 μA 0.3 % + 0.15 μA 0.8 % + 0.2 μA 1.8 % + 0.4 μA	Multifunction calibrator	
(0.33 to 3.3) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.2 % + 0.15 μA 0.13 % + 0.15 μA 0.1 % + 0.15 μA 0.2 % + 0.2 μA 0.5 % + 0.3 μA 1 % + 0.6 μA		
(3.3 to 33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.18 % + 2 μA 0.09 % + 2 μA 0.04 % + 2 μA 0.08 % + 2 μA 0.2 % + 3 μA 0.4 % + 4 μA		
(33 to 330) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.18 % + 20 μA 0.09 % + 20 μA 0.04 % + 20 μA 0.1 % + 50 μA 0.2 % + 100 μA 0.4 % + 200 μA		
(0.33 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.18 % + 100 μA 0.06 % + 100 μA 0.6 % + 1000 μA 2.7 % + 5000 μA		
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.06 % + 2 mA 0.1 % + 2 mA 3 % + 2 mA		
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.12 % + 5 mA 0.15 % + 5 mA 3 % + 5 mA		
Clamp-On Only (0 to 1000) A	(45 to 65) Hz (65 to 440) Hz	0.3 % + 0.68 A 1.3 % + 0.27 A		AC standard/coil

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
Capacitance – Generate			
(0.19 to 0.4) nF	10 Hz to 10 kHz	0.06 % + 0.01 nF	Multifunction calibrator
(0.4 to 1.1) nF	10 Hz to 10 kHz	0.05 % + 0.01 nF	
(1.1 to 3.3) nF	10 Hz to 3 kHz	0.05 % + 0.01 nF	
(3.3 to 11) nF	10 Hz to 1 kHz	0.25 % + 0.01 nF	
(11 to 33) nF	10 Hz to 1 kHz	0.25 % + 0.1 nF	
(33 to 110) nF	10 Hz to 1 kHz	0.27 % + 0.1 nF	
(110 to 330) nF	10 Hz to 1 kHz	0.25 % + 0.3 nF	
(0.33 to 1.1) µF	(10 to 600) Hz	0.28 % + 1 nF	
(1.1 to 3.3) µF	(10 to 300) Hz	0.27 % + 3 nF	
(3.3 to 11) µF	(10 to 150) Hz	0.28 % + 9 nF	
(11 to 33) µF	(10 to 120) Hz	0.41 % + 29 nF	
(33 to 110) µF	(10 to 80) Hz	0.46 % + 99 nF	
(110 to 330) µF	Up to 50 Hz	0.52 % + 220 nF	
(0.33 to 1.1) mF	Up to 20 Hz	0.45 % + 1.1 µF	
(1.1 to 3.3) mF	Up to 6 Hz	0.45 % + 3 µF	
(3.3 to 11) mF	Up to 2 Hz	0.45 % + 9.9 µF	
(11 to 33) mF	Up to 0.6 Hz	0.75 % + 30 µF	
(33 to 110) mF	Up to 0.2 Hz	1.1 % + 100 µF	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouples and Thermocouple Indicating Devices – Measure and Generate			
Type E	(-250 to -100) °C	0.58 °C	Multifunction calibrator
	(-100 to -25) °C	0.20 °C	
	(-25 to 350) °C	0.17 °C	
	(350 to 650) °C	0.20 °C	
	(650 to 1000) °C	0.25 °C	
Type J	(-210 to -100) °C	0.32 °C	
	(-100 to -30) °C	0.20 °C	
	(-30 to 150) °C	0.18 °C	
	(150 to 760) °C	0.21 °C	
	(760 to 1200) °C	0.28 °C	
Type K	(-200 to -100) °C	0.39 °C	
	(-100 to -25) °C	0.23 °C	
	(-25 to 120) °C	0.20 °C	
	(120 to 1000) °C	0.31 °C	
	(1000 to 1372) °C	0.47 °C	



Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouples and Thermocouple Indicating Devices – Measure and Generate (cont)			
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.48 °C 0.28 °C 0.25 °C 0.24 °C 0.34 °C	Multifunction calibrator
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.86 °C 0.67 °C 0.65 °C 0.70 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.78 °C 0.68 °C 0.68 °C 0.75 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.73 °C 0.29 °C 0.20 °C 0.18 °C	
Electrical Calibration of RTD Indicating Devices – Generate ⁵			
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	0.06 °C 0.06 °C 0.08 °C 0.10 °C 0.12 °C 0.14 °C 0.27 °C	Multifunction calibrator
Pt 3926, 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	0.06 °C 0.06 °C 0.08 °C 0.10 °C 0.12 °C 0.14 °C	



Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of RTD Indicating Devices – Generate ⁵ (cont)			
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.29 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.10 °C 0.12 °C 0.27 °C	Multifunction calibrator
Pt 385, 200 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.05 °C 0.05 °C 0.05 °C 0.06 °C 0.14 °C 0.15 °C 0.16 °C 0.19 °C	
Oscilloscopes			
DC Signal 50 Ω Load 1 MΩ Load	(-6.6 to 6.6) V (-130 to 130) V	0.5 % + 44 μV 0.05 % + 46 μV	Fluke 5522A-SC600
Square Wave 50 Ω Load 1 MΩ Load	±1 mV to 6.6 Vpp ±1 mV to 130 Vpp	0.25 % + 45 μV 0.10 % + 45 μV	
Leveled SineWave 50 Ω Load	5 mV to 5 V (50 kHz)	2% + 350 μV	
Flatness (@ 50kHz reference)	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	3.3 % + 280 μV 4.1 % + 300 μV 6.1% + 300 μV	
Time Markers 50 Ω Load	2 ns to 20 ms 50 ms to 5 s	2.5 μs/s (30 + 1000t) μs/s	



II. Fluid Quantities

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
Gas Flow – Measure	(0 to 100) SCCM	0.51 % + 0.24 SCCM	Transfer standard
	(0 to 2) SLM	0.25 % + 0.0002 SLM	Molbloc - L
	(2 to 10) SLM	0.29 % + 0.0008 SLM	
	(10 to 50) SLM	0.30 % + 0.00047 SLM	
	(50 to 100) SLM	0.35 % + 0.0082 SLM	
	(100 to 250) SLM	0.63 % + 0.57 SLM	Transfer standard

III. Mechanical

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
Pressure –	Differential (-1.6 to 1.6) inH ₂ O (-60 to 60) inH ₂ O	0.00015 inH ₂ O	Ruska 7250LP pressure calibrator
		0.01 %	
Pneumatic	(0 to 5) psig	0.0005 psig	Pressure calibrator see footnote 6
	(5 to 15) psig	0.010 % + 0.00004 psig	
	(15 to 30) psig	0.0027 psig	
	(30 to 300) psig	0.009 % + 0.00026 psig	
	(0 to 9) psia	0.0011 psia	
	(9 to 30) psia	0.008 % + 0.0011 psia	
	(30 to 300) psia	0.009 % + 0.0011 psia	
Hydraulic	(200 to 2000) psi	0.02 % + 0.005 psi	Deadweight tester
	(2000 to 20 000) psi	0.02 % + 0.05 psi	
Barometric	(750 to 1150) mbar	0.11 mbar	Reference pressure monitor
Vacuum	(0 to -14.5) psig	0.0015 psig	Pressure calibrator ⁶

IV. Thermodynamic

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Temperature – Measure	(-200 to 660) °C (660 to 1200) °C	0.01 °C 0.14 % + 0.7 °C	SPRT and Superthermometer TC-S
Temperature – Measuring Equipment	(-95 to -80) °C (-80 to 100) °C (100 to 300) °C (300 to 660) °C (660 to 1200) °C -196 °C -38.83 °C 0.01 °C 231.928 °C 419.527 °C 660.323 °C (-15 to 35) °C (35 to 200) °C (200 to 500) °C	0.064 °C 0.011 °C 0.01 % + 0.003 °C 0.05 % + 0.27 °C 0.13 % + 1.1 °C 7 mK (0.007 °C) 6 mK (0.006 °C) 3 mK (0.003 °C) 4 mK (0.004 °C) 6 mK (0.006 °C) 9 mK (0.009 °C) 0.71 °C 0.24 % + 0.59 °C 0.38 % + 0.31 °C	Temperature baths, temperature chamber, dry well calibrator Liquid nitrogen & fixed points Infrared calibrator
Relative Humidity – Measuring Equipment Dew Point Temperature	(0 to 10) % RH (10 to 95) % RH (-90 to -80) °C (-80 to -70) °C (-70 to 30) °C (30 to 70) °C	0.10 % RH 0.6 % + 0.18 % RH 0.75 °C 0.30 °C 0.15 °C 0.25 °C	Humidity generator

V. Time & Frequency

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Frequency – Measure	DC to 225 MHz	0.006 %	Frequency counter



Field Calibration Services:

VI. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
DC Voltage – Measure ³	(0 to 110) mV 110 mV to 1.1 V (1.1 to 11) V (11 to 110) V (110 to 300) V	0.029 % + 0.019 % FS 0.026 % + 0.007 % FS 0.026 % + 0.005 % FS 0.058 % + 0.006 % FS 0.056 % + 0.025 % FS	Process calibrator
DC Voltage – Generate ³	(0 to 110) mV 110 mV to 1.1 V (1.1 to 15) V	0.011 % + 0.005 % FS 0.010 % + 0.005 % FS 0.011 % + 0.005 % FS	Process calibrator
DC Current – Measure ³	(0 to 30) mA (30 to 110) mA	0.012 % + 0.15 % FS 0.012 % + 0.15 % FS	Process calibrator
DC Current – Generate ³ Tx Simulator	(0 to 22) mA	0.013 % + 0.015 % FS	Process calibrator
Resistance – Measure ⁵	(0 to 11) Ω (11 to 110) Ω 110 Ω to 1.1 kΩ (1.1 to 11) kΩ	0.056 % + 0.06 Ω 0.059 % + 0.06 Ω 0.057 % + 0.6 Ω 0.12 % + 12 Ω	Process calibrator
Resistance – Generate ⁵	(0 to 11) Ω (11 to 110) Ω 110 Ω to 1.1 kΩ (1.1 to 11) kΩ	0.023 Ω 0.011 % + 0.048 Ω 0.023 % + 0.6 Ω 0.034 % + 6 Ω	Process calibrator



Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Frequency – Measure ³	(1 to 109.99) Hz (110 to 1099.9) Hz (1.1 to 10.999) kHz (11 to 50) kHz	0.06 Hz 0.64 Hz 0.006 kHz 0.06 kHz	Process calibrator
AC Frequency – Generate ³	(1 to 10.99) Hz (11 to 109.9) Hz (110 to 1099.9) Hz (1.1 to 21.99) kHz (22 to 50) kHz	0.02 Hz 0.02 Hz 0.02 Hz 0.003 kHz 0.006 kHz	Process calibrator
AC Voltage – Measure ³ (0 to 300) V	(40 to 500) Hz	0.57 % + 6 counts	Process calibrator

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouples and Thermocouple Indicating Devices – Measure ³			
Type J	(-210 to -100) °C (-100 to 800) °C (800 to 1200) °C	0.72 °C 0.40 °C 0.61 °C	Process calibrator
Type K	(-210 to -100) °C (-100 to 400) °C (400 to 1200) °C (1200 to 1372) °C	0.84 °C 0.40 °C 0.61 °C 0.84 °C	
Type T	(-250 to -200) °C (-200 to 0) °C (0 to 400) °C	1.2 °C 0.72 °C 0.40 °C	



Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouples and Thermocouple Indicating Devices – Generate ³			
Type J	(-210 to -100) °C (-100 to 800) °C (800 to 1200) °C	0.39 °C 0.29 °C 0.29 °C	Process calibrator
Type K	(-210 to -100) °C (-100 to 400) °C (400 to 1200) °C (1200 to 1372) °C	0.50 °C 0.39 °C 0.39 °C 0.39 °C	
Type T	(-250 to -200) °C (-200 to 0) °C (0 to 400) °C	1.1 °C 0.50 °C 0.39 °C	
Electrical Calibration of RTD Indicating Devices – Generate ^{3, 5}			
Pt 385, 100 Ω	(-200 to 0) °C (0 to 400) °C (400 to 800) °C	0.2 °C 0.28 °C 0.49 °C	Process calibrator
Pt 385, 1000 Ω	(-200 to 0) °C (0 to 400) °C (400 to 800) °C	0.2 °C 0.28 °C 0.49 °C	
Pt 3926, 100 Ω	(-200 to 0) °C (0 to 630) °C	0.2 °C 0.28 °C	
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to 0) °C (0 to 630) °C	0.38 °C 0.2 °C 0.28 °C	



Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of RTD Indicating Devices – Measure ^{3, 5}			
Pt 385, 100 Ω	(-200 to 0) °C (0 to 400) °C (400 to 800) °C	0.39 °C 0.61 °C 0.96 °C	Process calibrator
Pt 385, 1000 Ω	(-200 to 0) °C (0 to 400) °C (400 to 800) °C	0.39 °C 0.61 °C 0.96 °C	
Pt 3926, 100 Ω	(-200 to 0) °C (0 to 630) °C	0.38 °C 0.6 °C	
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to 0) °C (0 to 630) °C	0.38 °C 0.38 °C 0.6 °C	

VII. Fluid Quantities

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
Gas Flow – Measure	Up to 50 SLM	1 % + 0.11 SLM	Flowmeter



VIII. Mechanical

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Pressure ³ – Pneumatic	(-1 to 1) inH ₂ O (-15 to 15) inH ₂ O	0.24 % + 0.001 inH ₂ O 0.25 % + 0.014 inH ₂ O	Setra 869
	(0 to 150) psia (0 to 150) psig (0 to 500) psig (0 to 1000) psig (0 to 10 000) psig	0.007 % + 0.015 psia 0.13% + 0.009 psig 0.12 % 0.12 % + 0.1 psig 0.12 % + 1 psig	Pressure standard and indicator
Barometric	(750 to 1150) mbar	0.11 mbar	Pressure standard and indicator
Vacuum – Pneumatic ³	(0 to -14.5) psig	0.015 psig	Pressure standard and indicator

IX. Thermodynamics

Parameter/Equipment	Range	CMC ² (±)	Comments
Temperature – Measure ³	(-200 to 660) °C	0.01 °C	Digital thermometers and PRT
Temperature – Measuring Equipment ³	(30 to 100) °C (100 to 660) °C	0.034 °C 0.08 % + 0.026 °C	Dry well calibrator
Humidity – Measure ³	(10 to 90) % RH	0.9 % RH	Rotronic HygroClip HC2



¹ This laboratory offers commercial and field calibration services, where noted.

² Calibration and Measurement Capability Uncertainty (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. CMCs 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 In the statement of CMC, percentages are percentages of reading/output, unless otherwise noted. FS denotes a percentage of the full scale.

⁵ The method used for the CMC is a 4 wire method.

⁶ Auto zero function performed referenced to a standard barometer.



Accredited Laboratory

A2LA has accredited

ALPHA CONTROLS & INSTRUMENTATION INC.

Markham, Ontario, CANADA

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 R205 – Specific Requirements: Calibration Laboratory Accreditation Program. 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 6th day of January 2017.

A handwritten signature in black ink, written over a horizontal line.

President and CEO
For the Accreditation Council
Certificate Number 2260.01
Valid to January 31, 2019

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