



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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CALIBRATION

Valid To: May 31, 2023

Certificate Number: 1741.04

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory at the location listed above as well as the satellite laboratory location listed below to perform the following calibrations^{1,9}:

I. Chemical

Parameter/Equipment	Range	CMC ² (±)	Comments
pH Meters ³ – Fixed Points	4 pH 7 pH 10 pH	0.03 pH 0.04 pH 0.07 pH	Standard pH solutions
Conductivity Meters ³ – Fixed Points	10 µS/cm 100 µS/cm 1000 µS/cm	0.63 µS/cm 2.2 µS/cm 5.2 µS/cm	Standard conductivity solutions

II. Dimensional

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Thickness and Snap Gages ³	Up to 2 in	$(1.7 + 9.3L) \mu\text{in} + 0.6R$	Master gage blocks
Calipers ³	Up to 12 in (12 to 24) in (24 to 40) in	$(1.7 + 9.3L) \mu\text{in} + 0.6R$ $(53 + 8L) \mu\text{in} + 0.6R$ $(220 + 6.8L) \mu\text{in} + 0.6R$	Master gage blocks 24 in check master 40 in check master

Parameter/Equipment	Range	CMC ^{2, 4} ($\pm$)	Comments
Linear Indicators ³ (Dial and Test)	Up to 2 in	$(1.7 + 9.3L) \mu\text{in} + 0.6R$	Master gage blocks; indicator calibrators
Micrometers ³ – (Inside and Outside)	Up to 12 in (12 to 24) in (24 to 40) in	$(1.7 + 9.3L) \mu\text{in} + 0.6R$ $(53 + 8L) \mu\text{in} + 0.6R$ $(220 + 6.8L) \mu\text{in} + 0.6R$	Master gage blocks 24 in check master 40 in check master
Height Gages ³	Up to 12 in (12 to 24) in (24 to 40) in	$(1.7 + 9.3L) \mu\text{in} + 0.6R$ $(53 + 8L) \mu\text{in} + 0.6R$ $(220 + 6.8L) \mu\text{in} + 0.6R$	Master gage blocks 24 in check master 40 in check master
Pin Gages ³	Up to 1 in	80 μin	Digimatic micrometer
Feeler Gages ³	Up to 0.2 in	80 μin	Digimatic micrometer
Metal Tape Measures and Steel Rules ³	(0.1 to 25) ft Up to 12 in	$(5.2 + 69L) \mu\text{in} + 0.6R$ 0.0027 in + 0.6R	Gage blocks Caliper
Angle Indicators and Protractors ³	30°, 45°, 60°, 75°, 90°	0.05°	Angle block set
Optical Comparators ³ – X-Y Linearity Magnification Angle	Up to 12 in 10X to 250X (0 to 90)°	150 μin 0.014 in 0.1°	Glass master and scales Angle block set
Vision systems ³ – X-Y Linearity Z Axis	Up to 18 in Up to 4 in	$(52 + 2.9L) \mu\text{in}$ 60 μin	Grid plate Gage blocks

Parameter/Equipment	Range	CMC ^{2, 4} ($\pm$)	Comments
Surface Plates ³ – Grades AA, A, and B –			
Repeatability	---	38 μ in	Repeat-o-meter
Flatness	Up to 60DL in (>60 to 120) DL in	(31 + 0.2DL) μ in (30 + 0.3DL) μ in	Federal level systems
Surface Finish Specimens – Waviness, Texture and Roughness –			
Ra	(2 to 500) μ in	3.6 μ in	Surface analyzer
Surface Roughness Meters and Profilometers ³ –			
Ra	15.3 μ in 117.3 μ in	1.1 μ in	Precision roughness standard
X Axis Straightness	Up to 150 mm	0.7 μ m/100 mm	Optical flat
Formtesters ³ –			
Gage Head Displacement	(0.05 to 2) mm	0.1 μ m	Gage blocks
Spindle Verification	0.15 μ m to 2mm	0.04 μ m	Roundness sphere
Axis to Spindle Alignment	(25 to 250) mm	2.1 μ m/m	Cylindrical square
Z-Axis Straightness	Up to 150 mm	0.7 μ m/100 mm	Optical flat
Contour Systems ³ –			
Vertical Displacement	(2.5 to 60) mm	0.6 μ m	Gage blocks
Horizontal Displacement	(5 to 100) mm	1.3 μ m	Spheres
Radius Compensation	(2.56 to 10) mm	2.1 μ m	Spheres
X-Axis Straightness	Up to 150 mm	0.7 μ m/100 mm	Optical flat

III. Dimensional Testing/Calibration¹

Parameter/Equipment	Range	CMC ^{2, 4, 8} ($\pm$)	Comments
Surface Finish – Measure ⁷	(2 to 500) μ in	3.6 μ in	Surface analyzer
Roundness – Measure Straightness Cylindricity	(350 x 3000) mm Up to 250 mm Up to 100 mm	0.12 μ m 0.7 μ m/100 mm 2.2 μ m/m	Formtester
Roundness Calibration – Straightness Cylindricity	(350 x 3000) mm Up to 250 mm Up to 100 mm	0.12 μ m 0.7 μ m/100 mm 2.2 μ m/m	Formtester
Length ⁷ – X-Axis Y-Axis Z-Axis Volumetric	 Up to 39 in (1000 mm) Up to 59 in (1500 mm) Up to 27 in (700 mm) Up to 70 in (1700 mm)	 (160 + 8.3L) μ in (160 + 8.7L) μ in (160 + 7.9L) μ in (160 + 8.9L) μ in	 Wenzel CMM
Length ⁷ – X-Y Measurements Contact Laser Z-Axis	 (18 x 18) in (18 x 18) in (18 x 18) in 6 in	 (140 + 8.5L) μ in (150 + 8.4L) μ in (150 + 8.2L) μ in (160 + 12L) μ in	 Vision machine

IV. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 5, 6} ($\pm$)	Comments
DC Voltage ³ – Measure	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V (1 to 6) kV (6 to 20) kV (20 to 35) kV (35 to 40) kV	11 μ V/V + 3 μ V 10 μ V/V + 0.3 μ V 10 μ V/V + 0.05 μ V 12 μ V/V + 0.3 μ V 27 μ V/V + 0.1 μ V 1.2 % 2.4 % 1.2 % 2.4 %	Agilent/HP 3458A Fluke 80K-6 and DMM Fluke 80K-40 and DMM
DC Voltage ³ – Generate	(0 to 330) mV (0 to 3.3) V (0 to 33) V (30 to 330) V (100 to 1020) V	25 μ V/V + 1 μ V 14 μ V/V + 2 μ V 15 μ V/V + 15 μ V 22 μ V/V + 150 μ V 22 μ V/V + 1.5 mV	Fluke 5522A
DC Power ³ – Generate 33 mV to 1020 V (0.33 to 329.99) mA (0.33 to 2.9999) A (3 to 20.5) A	(0.01 to 330) W (0.33 to 3.3) kW (3.3 to 20.5) kW	0.03 % 0.03 % 0.09 %	Fluke 5522A
DC Current ³ – Measure	(0 to 100) nA 100 nA to 1 μ A (1 to 10) μ A (10 to 100) μ A 100 μ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 300) A	32 μ A/A + 0.04 nA 23 μ A/A + 0.04 nA 23 μ A/A + 0.1 nA 23 μ A/A + 0.8 nA 23 μ A/A + 5 nA 23 μ A/A + 50 nA 37 μ A/A + 0.5 μ A 0.012 % + 10 μ A 0.25 %	Agilent/HP 3458A Empro shunt /DMM
DC Clamp-On Meters ³ – Non-Toroidal	Up to 1000 A	0.65 % + 0.5 A	Fluke 5522A w/5500 coil

Parameter/Equipment	Range	CMC ^{2, 5, 6} ($\pm$)	Comments
DC Current ³ – Generate	(0 to 330) μ A (0 to 3.3) mA (0 to 33) mA (0 to 330) mA (0 to 1.1) A (1.1 to 3) A (0 to 11) A (11 to 21) A	0.018 % + 0.02 μ A 0.012 % + 0.05 μ A 0.012 % + 0.25 μ A 0.012 % + 2.5 μ A 0.024 % + 40 μ A 0.046 % + 40 μ A 0.06 % + 500 μ A 0.12 % + 750 μ A	Fluke 5522A
	1 mA to 100 A	0.055 % of setting	Valhalla 2555A
Resistance ³ – Measure	(0 to 10) Ω (10 to 100) Ω 100 Ω to 1 k Ω (1 to 10) k Ω (10 to 100) k Ω 100 k Ω to 1 M Ω (1 to 10) M Ω (10 to 100) M Ω 100 M Ω to 1 G Ω	18 $\mu\Omega/\Omega$ + 50 $\mu\Omega$ 15 $\mu\Omega/\Omega$ + 0.5 m Ω 14 $\mu\Omega/\Omega$ + 0.5 m Ω 14 $\mu\Omega/\Omega$ + 5 m Ω 12 $\mu\Omega/\Omega$ + 50 m Ω 17 $\mu\Omega/\Omega$ + 2 Ω 52 $\mu\Omega/\Omega$ + 100 Ω 0.05 % + 1 k Ω 0.5 % + 10 k Ω	Agilent/HP 3458A
Resistance ³ – Generate	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω 110 Ω to 1.1 k Ω (1.1 to 11) k Ω (11 to 110) k Ω 110 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 to 1100) M Ω	49 $\mu\Omega/\Omega$ + 0.001 Ω 37 $\mu\Omega/\Omega$ + 0.0015 Ω 34 $\mu\Omega/\Omega$ + 0.0014 Ω 34 $\mu\Omega/\Omega$ + 0.002 Ω 34 $\mu\Omega/\Omega$ + 0.02 Ω 34 $\mu\Omega/\Omega$ + 0.2 Ω 39 $\mu\Omega/\Omega$ + 2 Ω 73 $\mu\Omega/\Omega$ + 30 Ω 0.016 % + 50 Ω 0.03 % + 2.5 k Ω 0.06 % + 3 k Ω 0.36 % + 100 k Ω 1.8 % + 500 k Ω	Fluke 5522A
Fixed Points ³	10 M Ω 100 M Ω 1 G Ω 10 G Ω 100 G Ω	1.2 % 1.2 % 1.2 % 1.2 % 1.2 %	Set of resistors

Parameter/Range	Frequency	CMC ^{2, 5, 6} ($\pm$)	Comments
Capacitance ³ – Generate			
40 pF to 1.2 μ F	--	0.5 % + 3 pF	Agilent/HP 4440B
(220.0 to 399.9) pF	(10 to 10 000) Hz	0.6 % + 10 pF	Fluke 5522A
(0.4 to 1.0999) nF	(10 to 10 000) Hz	0.6 % + 0.01 nF	
(1.1 to 3.2999) nF	(10 to 3000) Hz	0.6 % + 0.01 nF	
(3.3 to 10.9999) nF	(10 to 1000) Hz	0.3 % + 0.1 nF	
(11 to 109.999) nF	(10 to 1000) Hz	0.3 % + 0.1 nF	
(110 to 329.999) nF	(10 to 1000) Hz	0.3 % + 0.3 nF	
(0.33 to 1.099 99) μ F	(10 to 600) Hz	0.3 % + 1 nF	
(1.1 to 3.299 99) μ F	(10 to 300) Hz	0.3 % + 3 nF	
(3.3 to 10.9999) μ F	(10 to 150) Hz	0.3 % + 10 nF	
(11 to 32.9999) μ F	(10 to 120) Hz	0.49 % + 30 nF	
(33 to 109.999) μ F	(10 to 80) Hz	0.55 % + 100 nF	
(110 to 329.999) μ F	(0 to 50) Hz	0.54 % + 300 nF	
(.33 to 1.099 99) mF	(0 to 20) Hz	0.55 % + 1 μ F	
(1.1 to 3.299 99) mF	(0 to 6) Hz	0.55 % + 3 μ F	
(3.3 to 10.9999) mF	(0 to 2) Hz	0.56 % + 10 μ F	
(11 to 32.9999) mF	(0 to 0.6) Hz	0.91 % + 30 μ F	
(33 to 110) mF	(0 to 0.2) Hz	1.4 % + 100 μ F	
AC Voltage ³ – Generate			
(1 to 33) mV	(10 to 45) Hz	0.096 % + 6 μ V	Fluke 5522A
	45 Hz to 10 kHz	0.019 % + 6 μ V	
	(10 to 20) kHz	0.025 % + 6 μ V	
	(20 to 50) kHz	0.12 % + 6 μ V	
	(50 to 100) kHz	0.42 % + 12 μ V	
	(100 to 500) kHz	0.96 % + 50 μ V	
(33 to 330) mV	(10 to 45) Hz	0.036 % + 8 μ V	
	45 Hz to 10 kHz	0.018 % + 8 μ V	
	(10 to 20) kHz	0.02 % + 8 μ V	
	(20 to 50) kHz	0.042 % + 8 μ V	
	(50 to 100) kHz	0.096 % + 32 μ V	
	(100 to 500) kHz	0.24 % + 70 μ V	
(0.33 to 3.3) V	(10 to 45) Hz	0.036 % + 50 μ V	
	45 Hz to 10 kHz	0.019 % + 60 μ V	
	(10 to 20) kHz	0.023 % + 60 μ V	
	(20 to 50) kHz	0.036 % + 50 μ V	
	(50 to 100) kHz	0.084 % + 130 μ V	
	(100 to 500) kHz	0.29 % + 600 μ V	
(3.3 to 33) V	(10 to 45) Hz	0.036 % + 650 μ V	
	45 Hz to 10 kHz	0.019 % + 600 μ V	
	(10 to 20) kHz	0.029 % + 600 μ V	

Parameter/Range	Frequency	CMC ^{2, 5, 6} ($\pm$)	Comments
AC Voltage ³ – Generate (cont)			
(3.3 to 33) V	(20 to 50) kHz (50 to 100) kHz	0.042 % + 600 μ V 0.11 % + 1.6 mV	Fluke 5522A
(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	0.023 % + 2 mV 0.025 % + 6 mV 0.03 % + 6 mV 0.036 % + 6 mV 0.24 % + 50 mV	
(330 to 1020) V	45 Hz to 10 kHz	0.036 % + 10 mV	
AC Voltage ³ – Measure			
Up to 10 mV	(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	0.03 % + 0.03 % of rng 0.02 % + 0.01 % of rng 0.03 % + 0.01 % of rng 0.1 % + 0.01 % of rng 0.5 % + 0.01 % of rng 4 % + 0.02 % of rng	HP 3458A
10 mV 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	0.008 % + 0.004 % of rng 0.008 % + 0.002 % of rng 0.014 % + 0.002 % of rng 0.03 % + 0.002 % of rng 0.08 % + 0.002 % of rng 0.3 % + 0.01 % of rng	
(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	0.02 % + 0.004 % of rng 0.02 % + 0.002 % of rng 0.02 % + 0.002 % of rng 0.035 % + 0.002 % of rng 0.12 % + 0.002 % of rng 0.4 % + 0.01 % of rng	
(100 to 700) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.041 % + 0.004 % of rng 0.041 % + 0.002 % of rng 0.061 % + 0.002 % of rng 0.013 % + 0.002 % of rng 0.31 % + 0.002 % of rng	
700 V to 6 kV	(1 to 500) Hz	1.2 %	Fluke 80K-6 and DMM
(6 to 40) kV	(1 to 500) Hz	6 %	Fluke 80K-40 and DMM

Parameter/Range	Frequency	CMC ^{2, 5} ($\pm$)	Comments
AC Current ³ – Generate			
(0 to 0.33) 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	0.24 % + 0.1 μ A 0.18 % + 0.1 μ A 0.15 % + 0.1 μ A 0.36 % + 0.15 μ A 0.96 % + 0.2 μ A 2 % + 0.4 μ A	Fluke 5522A
(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	0.25 % + 0.15 μ A 0.16 % + 0.15 μ A 0.13 % + 0.15 μ A 0.25 % + 0.2 μ A 0.6 % + 0.3 μ A 1.2 % + 0.6 μ A	
(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	0.22 % + 2 μ A 0.11 % + 2 μ A 0.05 % + 2 μ A 0.096 % + 2 μ A 0.24 % + 3 μ A 0.48 % + 4 μ A	
(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	0.22 % + 20 μ A 0.11 % + 20 μ A 0.05 % + 20 μ A 0.12 % + 50 μ A 0.24 % + 100 μ A 0.48 % + 200 μ A	
(0.33 to 1.1) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.22 % + 100 μ A 0.06 % + 100 μ A 0.72 % + 1 mA 3 % + 5 mA	
(1.1 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.22 % + 100 μ A 0.072 % + 100 μ A 0.72 % + 1 mA 3 % + 5 mA	
(3 to 11) A	45 Hz to 1 kHz (1 to 5) kHz	0.12 % + 2 mA 3.6 % + 2 mA	
(11 to 20.5) A	45 Hz to 1 kHz (1 to 5) kHz	0.18 % + 5 mA 3.6 % + 5 mA	
1 mA to 100 A	100 Hz 400 Hz 1 kHz	0.23 % of setting 0.35 % of setting 0.52 % of setting	Valhalla 2555A

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
AC Clamp-On Meters ³ – (Up to 150) A			
Toroidal	(45 to 65) Hz (65 to 440) Hz	0.49 % + 0.025 A 1 % + 0.027 A	Fluke 5522A w/ 5500 coil
Non-Toroidal	(45 to 65) Hz (65 to 440) Hz	0.76 % + 0.25 A 1.3 % + 0.25 A	
(150 to 1025) A			
Toroidal	(45 to 65) Hz (65 to 440) Hz	0.49 % + 0.09 A 1 % + 0.1 A	
Non-Toroidal	(45 to 65) Hz (65 to 440) Hz	0.76 % + 0.9 A 1.3 % + 0.9 A	
AC Current – Measure ³			
(0 to 100) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz 100 Hz to 5 kHz	0.4 % + 0.03 % of rng 0.15 % + 0.03 % of rng 0.06 % + 0.03 % of rng 0.06 % + 0.03 % of rng	Agilent/HP 3458A
(0.1 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	0.4 % + 0.02 % of rng 0.15 % + 0.02 % of rng 0.06 % + 0.02 % of rng 0.03 % + 0.02 % of rng 0.06 % + 0.02 % of rng 0.4 % + 0.04 % of rng 0.55 % + 0.15 % of rng	
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	0.4 % + 0.02 % of rng 0.16 % + 0.02 % of rng 0.08 % + 0.02 % of rng 0.1 % + 0.02 % of rng 0.3 % + 0.02 % of rng 1 % + 0.04 % of rng	

Parameter/Range	Frequency	CMC ^{2, 5, 6} ($\pm$)	Comments
AC Power – Generate ³ (45 to 65) Hz; PF=1 (33 to 330) mV Range (3.3 to 8.99) mA (9 to 32.99) mA (33 to 89.99) mA (90 to 329.99) mA (0.33 to 0.8999) A (0.9 to 2.1999) A (2.2 to 4.4999) A (4.5 to 20.5) A 330 mV to 1020 V Range (3.3 to 8.99) mA (9 to 32.99) mA (33 to 89.99) mA (90 to 329.99) mA (0.33 to 0.8999) A (0.9 to 2.1999) A (2.2 to 4.4999) A (4.5 to 20.5) A	110 μ W to 3 mW (3 to 11) mW (1.1 to 30) mW (3 to 110) mW (11 to 300) mW (30 to 730) mW 73 mW to 1.5 W 150 mW to 6.8 W 1.1 mW to 9 W 3 mW to 33 W 11 mW to 90 W 30 mW to 330 W 110 mW to 900 W 300 mW to 2200 W 730 mW to 4500 W (1.5 to 20.9) kW	0.17 % 0.12 % 0.17 % 0.12 % 0.16 % 0.14 % 0.16 % 0.14 % 0.15 % 0.1 % 0.15 % 0.1 % 0.14 % 0.11 % 0.15 % 0.12 %	Fluke 5522A
Oscilloscopes ³ – Square Wave Signal: 50 Ω Load @ 1 kHz 1 M Ω Load @ 1 kHz DC Volt Amplitude: 50 Ω Load 1 M Ω Load	1 mV to 6.6 V _{pk - pk} 1 mV to 130 V _{pk - pk} (0 to 6.6) V (0 to 130) V (0 to 330) mV (0 to 3.3) V (0 to 33) V (30 to 330) V (100 to 1020) V	0.31 % + 40 μ V 0.14 % + 40 μ V 0.3 % + 40 μ V 0.06 % + 40 μ V 25 μ V/V + 1 μ V 14 μ V/V + 2 μ V 15 μ V/V + 15 μ V 22 μ V/V + 150 μ V 22 μ V/V + 1.5 mV	Fluke 5522A w/ SC1100 Fluke 5522A

Parameter/Range	Frequency	CMC ^{2, 5, 6} ($\pm$)	Comments
Oscilloscopes ³ – (cont)			
Level Sine Wave:			
Frequency	(0 to 1100) MHz	3.3 μ Hz/Hz	Fluke 5522A
Amplitude			
50 kHz Reference	5 mV to 5.5 V	2.4 % + 300 μ V	
50 kHz to 100 MHz	5 mV to 5.5 V	4.2 % + 300 μ V	
(100 to 300) MHz	5 mV to 5.5 V	4.8 % + 300 μ V	
(300 to 600) MHz	5 mV to 5.5 V	7.2 % + 300 μ V	
(600 to 1100) MHz	4 mV to 3.5 V	8.4 % + 300 μ V	
Flatness (Bandwidth)			
0 kHz to 100 MHz	5 mV to 5.5 V	1.8 % + 100 μ V	
(100 to 300) MHz	5 mV to 5.5 V	2.4 % + 100 μ V	
(300 to 600) MHz	5 mV to 5.5 V	4.8 % + 100 μ V	
(600 to 1100) MHz	4 mV to 3.5 V	6 % + 100 μ V	
Time Markers:			
Into a 50 Ω Load	5 s to 50 ms 20 ms to 1 ns	(30 + 1000t) μ s/s 3.5 μ s/s	t = time in seconds
Rise Time:			
1 kHz to 2 MHz	$\leq$ 300 ps	130 ps	
(2 to 10) MHz	$\leq$ 350 ps	130 ps	
Electrical Simulation of RTDs ³			
Pt 385, 100 Ω	(-200 to 0) $^{\circ}$ C (0 to 100) $^{\circ}$ C (100 to 300) $^{\circ}$ C (300 to 400) $^{\circ}$ C (400 to 630) $^{\circ}$ C (630 to 800) $^{\circ}$ C	0.08 $^{\circ}$ C 0.10 $^{\circ}$ C 0.11 $^{\circ}$ C 0.13 $^{\circ}$ C 0.15 $^{\circ}$ C 0.28 $^{\circ}$ C	Fluke 5522A

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Thermocouple Simulation ³ –			
Type B	(600 to 800) °C (800 to 1820) °C	0.54 °C 0.42 °C	Fluke 5522A
Type E	(-250 to -100) °C (-100 to 650) °C (650 to 1000) °C	0.61 °C 0.22 °C 0.28 °C	
Type J	(-210 to -100) °C (-100 to 760) °C (760 to 1200) °C	0.34 °C 0.23 °C 0.30 °C	
Type K	(-200 to -100) °C (-100 to 1000) °C (1000 to 1372) °C	0.41 °C 0.33 °C 0.49 °C	
Type N	(-200 to -100) °C (-100 to 410) °C (410 to 1300) °C	0.49 °C 0.29 °C 0.34 °C	
Type R	(0 to 250) °C (250 to 1000) °C (1000 to 1767) °C	0.70 °C 0.41 °C 0.49 °C	
Type S	(0 to 250) °C (250 to 1400) °C (1400 to 1767) °C	0.58 °C 0.46 °C 0.57 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 400) °C	0.76 °C 0.31 °C 0.22 °C	

V. Mechanical

Parameter/Equipment	Range	CMC ^{2, 4, 6, 8} ($\pm$)	Comments
Scales and Balances ³	(1 to 500) mg (1 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 g to 20 kg (20 to 900) kg Up to 1000 lb	0.013 mg + 0.6R 0.041 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 1.5 mg + 0.6R 3 mg + 0.6R 0.017 % + 0.6R 0.017 % per 20 kg + 0.6R 0.017 % + 0.6R	ASTM Class 1 weights (applied load) Class F weights (applied load)
Force Gages ³	1 g to 20 kgf (20 to 900) kgf Up to 500 lbf	0.017 % + 0.6R 0.017 % per 20 kgf + 0.6R 0.017 % + 0.6R	Class F weights (applied load)
Torque Wrenches ³	4 in·lbf to 600 ft·lbf	0.65 %	CDI suretest 5000-ST
Torque Testers ³	4 in·lbf to 600 ft·lbf	0.065 %	Class F weights and torque arms
Speed/RPM/Rate ³ – Simulation	(2.5 to 100 000) RPM	0.004 %	Agilent 33250A
Speed/RPM/Rate ³ – Non-Contact	(6 to 60 000) RPM	0.02 %	Monarch tachometer
Totalize Meters ³ – (Length Counters and Totalizers)			
Distance – Measure	Up to 500 yards	0.51 %	Shimpo tach w/ encoder wheel

Parameter/Equipment	Range	CMC ^{2, 4, 6, 8} (±)	Comments
Pressure ³ – Measuring Equipment			
Differential	(0.025 to 0.25) inH ₂ O	0.000 24 inH ₂ O	Heise HM2
	(0.25 to 0.5) inH ₂ O	0.000 59 inH ₂ O	
	(0.5 to 1) inH ₂ O	0.000 95 inH ₂ O	
	(1 to 10) inH ₂ O	0.0075 inH ₂ O	
	(10 to 25) inH ₂ O	0.019 inH ₂ O	
Absolute	Up to 16 psia	Greater of 0.015 % or 0.006 % FS	Fluke 6270 w/PM500 modules
Pneumatic	Up to 15 psi	Greater of 0.015 % or 0.006 % FS	
	(-15 to 300) psi	Greater of 0.015 % or 0.006 % FS	
	(300 to 1000) psi	Greater of 0.015 % or 0.006 % FS	
	(1000 to 3000) psi	Greater of 0.015 % or 0.006 % FS	
	(0.2 to 1000) psi	0.0084 %	Ruska 2465-753
Hydraulic	(5 to 20 000) psi	0.021 %	Fluke 3116
Barometric Pressure ³ – Measuring Equipment	(17 to 34) inHg	0.02 %	Mensor CPG2300
Vacuum ³	(0 to 30) inHg	0.04 % FS	Mensor CPG2500

VI. Thermodynamics

Parameter/Equipment	Range	CMC ^{2, 8} ($\pm$)	Comments
Humidity ³ – Measure	(10 to 95) % RH	1.5 % RH	Vaisala HMP-233
Humidity ³ – Measuring Devices	(20 to 75) % RH	1.6 % RH	Vaisala HMP-233
Temperature ³ – Measuring Devices	(-15 to 110) °C (50 to 350) °C	0.3 °C 0.75 °C	Fluke 9009
	(-15 to 350) °C	0.15 °C	Fluke 9009 w/ PRT
Temperature ³ – Measure	(0 to 100) °C	0.04 °C	Fluke 1524 w/ thermistor probe
	(-200 to 300) °C	0.06 °C	Fluke 1524 w/ PRT probe
	(300 to 420) °C	0.082 °C	Fluke 1524 w/5615 PRT probe
Infrared Measuring Devices ³	(-15 to 0) °C (0 to 120) °C	0.61 °C 0.73 °C	Fluke 4180
	35 °C	0.84 °C	Fluke 4181
	(35 to 100) °C	0.95 °C	
	(100 to 200) °C	1.2 °C	
	(200 to 350) °C (350 to 500) °C	1.7 °C 2.3 °C	$\epsilon = 0.95$ $\lambda = (8 \text{ to } 14) \mu\text{m}$

VII. Time and Frequency

Parameter/Equipment	Range	CMC ^{2, 8} ($\pm$)	Comments
Frequency – Measuring Equipment ³	(0 to 1100) MHz	3.3 $\mu\text{Hz/Hz}$	Fluke 5522A/1 GHz

Parameter/Equipment	Range	CMC ^{2, 8} ($\pm$)	Comments
Frequency – Measure ³	Up to 225 MHz	0.23 μ Hz/Hz	HP 53131A
Timers and Stop Watches ³	(2 to 3600) s	0.1 s	HP 53131A w/ Agilent 33250A

Satellite Lab

CROSS TECHNOLOGIES, INC dba CROSS (FORMERLY J.A. KING)

8 Southchase Court

Fountain Inn, SC 29644

Connie Foster Phone: 336 292 0511

CALIBRATION

I. Dimensional

Parameter/Equipment	Range	CMC ^{2, 4, 8} ($\pm$)	Comments
Cylindrical – Measure			
Plain Rings	Up to 14 in	$(6.9 + 1.8L) \mu\text{in}$	P&W Labmaster™
Pins, Plain Plugs, Discs, Spheres – External Diameter	Up to 13 in	$(6.9 + 1.8L) \mu\text{in}$	
Gage Blocks, Jo Blocks, Length Gages, Fixture Gages	Up to 12 in	$(6.9 + 1.5L) \mu\text{in}$	P&W Labmaster™
Hand Tools – Depth Gages, Snap Gages, Fixture Gages, Thickness Gages	Up to 12 in (12 to 40) in	$(4.6 + 2.8L) \mu\text{in} + 0.6R$ $(13 + 2.1L) \mu\text{in} + 0.6R$	Gage blocks
Height Gages	Up to 48 in	$(56 + 1.3L) \mu\text{in}$	Gage blocks
Calipers	Up to 12 in (12 to 24) in (24 to 40) in	$(1.7 + 9.3L) \mu\text{in} + 0.6R$ $(53 + 8L) \mu\text{in} + 0.6R$ $(220 + 6.8L) \mu\text{in} + 0.6R$	Master gage blocks 24 in check master 40 in check master
Linear Indicators, Dial and Test	(0.5 to 4) in Up to 12 in	$(4.3 + 3.3L) \mu\text{in} + 0.6R$ $(6.9 + 1.5L) \mu\text{in} + 0.6R$	Gage blocks P&W Labmaster™

Parameter/Equipment	Range	CMC ^{2, 4} ($\pm$)	Comments
Micrometers – Outside Inside	Up to 12 in (12 to 40) in	$(4.6 + 2.8L) \mu\text{in} + 0.6R$ $(13 + 2.1L) \mu\text{in} + 0.6R$	Gage blocks
Thread Plugs – Major Diameter Pitch Diameter	Up to 7 in Up to 7 in	$(6.9 + 1.8L) \mu\text{in}$ $(98 + 0.2L) \mu\text{in}$	P&W Labmaster™ w/ thread wires
NPT Plugs – Simple Pitch Diameter	Up to 7 in	$(100 + 0.2L) \mu\text{in}$	P&W Labmaster™ w/ thread wires and taper master

¹ This laboratory offers commercial and field calibration/dimensional testing services and is performed at the main laboratory and satellite laboratory listed.

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. 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, L is the numerical value of the nominal length of the device measured in inches; R is the numerical value of the resolution of the device in its respective units; DL is the diagonal length of the device in inches.

⁵ The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a fraction/percentage of the reading plus a fixed floor specification.

⁶ In the statement of CMC a percentage refers to percent of reading unless otherwise noted.

⁷ This laboratory meets R205 – *Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed above and is considered equivalent to that of a calibration.

⁸ The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.

⁹ This scope meets A2LA's *P112 Flexible Scope Policy*.



Accredited Laboratory

A2LA has accredited

CROSS TECHNOLOGIES, INC DBA CROSS (FORMERLY J.A. KING)

Greenville, SC

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of 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 April 2017).



Presented this 6th of July 2021.

A blue ink signature of a person, likely the Vice President of Accreditation Services, written over a horizontal line.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1741.04
Valid to May 31, 2023

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