



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

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CALIBRATION

Valid until: December 31, 2012

Certificate Number: 1570.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1</sup>:

I. Dimensional

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Gage Blocks	(0.01 to 4) in (4 to 20) in	(1.2 + 1.3L) μin (0.12 + 1.7L) μin	Federal comparator and gage blocks
Micrometers <sup>3</sup>	(1 to 12) in (12 to 24) in (24 to 36) in	(130 + 0.6L) μin (28 + 9L) μin (240 + 5L) μin	GageMaker Mic-Trac gage blocks
Calipers <sup>3</sup>	(2 to 12) in (12 to 24) in (24 to 36) in (36 to 80) in	(300 + 1.1L) μin (270 + 4L) μin (260 + 5L) μin (210 + 3L) μin	GageMaker Mic-Trac gage blocks Renishaw laser
2D Height Gages <sup>3</sup>	(0 to 36) in	(98 + 1.5L) μin	Surface plate and reference bar
Bore Gages <sup>3</sup>	Up to 2.0 in	(22 + 0.6R) μin	Ring gage and Indi-Check
Ring Gage – ID	(0.035 to 0.350) in (0.350 to 3) in (3 to 20) in	(14 + 38L) μin (8.1 + 1.1L) μin (4.2 + 2.4L) μin	Zeiss ULM and setting masters

*Peter Abney*  
 Page 1 of 15

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Thread Plugs	Up to 3.6 in	55 µin	Super Mic, thread wires and gage blocks
Pitch Diameter	(3.6 to 12) in	(51 + 1.5L) µin	Zeiss ULM, thread wires and gage blocks
Optical Comparator <sup>3</sup> – Linear Scale Squareness of Scales	(0 to 30) in N/A	140 µin 110 µin	J & L glass master scale Scale and square
Cylindrical Plug/Disc	(0.05 to 20) in	(8.4 + 1.8L) µin	Zeiss ULM and gage blocks
Thread Wires	(0.003 to 0.25) in	5 µin	Zeiss ULM and gage blocks
Bench Micrometer <sup>3</sup>	(0 to 1) in	15 µin	Gage blocks
Dial Indicators <sup>3</sup>	(0.001 to 1) in (1 to 4) in	82 µin 330 µin	Indi-Check Mic-Trac
Digital Indicators <sup>3</sup>	(0 to 0.5) in (0.5 to 1) in (1 to 4) in	47 µin 290 µin 330 µin	Indi-Check Mic-Trac
Test Indicators <sup>3</sup>	(0 to 0.03) in (0.03 to 0.06) in	66 µin 220 µin	Indi-Check
Pin Gages <sup>3</sup>	Up to 2 in	(41 + 5L) µin	Laser micrometer and master disks
Indicator Calibrator	(0 to 2) in	10 µin	Renishaw laser
Mic-Trac <sup>3</sup>	(0 to 12) in (0 to 24) in (0 to 36) in	50 µin 76 µin 110 µin	Renishaw laser
Datum Balls	Up to 2 in	12 µin	Zeiss ULM & gage blocks

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Universal Measuring Machine <sup>3</sup>	Up to 20 in	(2.4 + 1.3L) μin	Gage blocks
Linear Rule	(0 to 80) in	120 μin	Renishaw laser
Micrometer Standard <sup>3</sup>	(1 to 72) in	(40 + 5L) μin	Renishaw laser and gage blocks
Surface Plate Flatness <sup>3</sup>	(0 to 120) in	(18 + 0.9D) μin	Federal leveling system
Precision Squares <sup>3</sup>	Up to 18 in	120 μin	Amplifier, granite surface plate
Micro Hite STD – Block Size and Parallelism Base Parallelism	Up to 1 in	12 μin 70 μin	Zeiss ULM, ring gage, amplifier and granite surface plate
Sine Plate <sup>3</sup>	Up to 5 in	160 μin	Gage blocks, amplifier and surface plate
Federal Levels <sup>3</sup>	± 1000 arc sec	3.8 arc sec	Gage blocks, sine plate, and granite surface plate

## II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,6,7</sup> (±)	Comments
DC Voltage – Measure <sup>3</sup>	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V	7 μV/V + 1 μV 6 μV/V + 3 μV 6 μV/V + 5 μV 8 μV/V + 30 μV 8 μV/V + 0.1 mV	HP 3458A with opt. 002

Parameter/Equipment	Range	CMC <sup>2, 5, 6, 8</sup> ( $\pm$ )	Comments
DC Voltage – Generate <sup>3</sup>	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (330 to 1000) V	20 $\mu$ V/V + 1 $\mu$ V 11 $\mu$ V/V + 2 $\mu$ V 12 $\mu$ V/V + 20 $\mu$ V 18 $\mu$ V/V + 0.15 mV 18 $\mu$ V/V + 1.5 mV	Fluke 5520A
DC Current – Measure <sup>3</sup>	(10 to 100) $\mu$ A 100 $\mu$ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	25 $\mu$ A/A + 8 parts in 10 <sup>6</sup> 25 $\mu$ A/A + 5 parts in 10 <sup>6</sup> 25 $\mu$ A/A + 5 parts in 10 <sup>6</sup> 40 $\mu$ A/A + 5 parts in 10 <sup>6</sup> 0.012 % + 10 parts in 10 <sup>6</sup>	HP 3458A
DC Current – Generate <sup>3</sup>	(0 to 330) $\mu$ A 330 $\mu$ A 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) A	0.015 % + 0.02 $\mu$ A 0.01 % + 0.05 $\mu$ A 0.01 % + 0.25 $\mu$ A 0.01 % + 2.5 $\mu$ A 0.02 % + 40 $\mu$ A 0.038 % + 40 $\mu$ A 0.05 % + 0.50 mA 0.1 % + 0.75 mA	Fluke 5520A
DC Current <sup>3</sup> – Clamp-On	(20 to 150) A (150 to 550) A (550 to 1000) A	0.26 % + 0.05 A 0.26 % + 0.06 A 0.27 % + 0.06 A	Fluke 5520A with 50 turn coil
Resistance – Measure <sup>3</sup>	Up to 10 $\Omega$ (10 to 100) $\Omega$ 100 $\Omega$ to 1 k $\Omega$ (1 to 10) k $\Omega$ (10 to 100) k $\Omega$ 100 k $\Omega$ to 1 M $\Omega$ (1 to 10) M $\Omega$ (10 to 100) M $\Omega$ 100 M $\Omega$ to 1 G $\Omega$	18 $\mu\Omega/\Omega$ + 50 $\mu\Omega$ 15 $\mu\Omega/\Omega$ + 0.50 m $\Omega$ 13 $\mu\Omega/\Omega$ + 0.50 m $\Omega$ 13 $\mu\Omega/\Omega$ + 5 m $\Omega$ 13 $\mu\Omega/\Omega$ + 50 m $\Omega$ 18 $\mu\Omega/\Omega$ + 2 $\Omega$ 53 $\mu\Omega/\Omega$ + 0.10 k $\Omega$ 0.051 % + 1 k $\Omega$ 0.5 % + 10 k $\Omega$	HP 3458A

Parameter/Equipment	Range	CMC <sup>2, 5, 8</sup> (±)	Comments
Resistance – Generate <sup>3</sup>	(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 30 μΩ/Ω + 1.5 mΩ 28 μΩ/Ω + 1.4 mΩ 28 μΩ/Ω + 2 mΩ 28 μΩ/Ω + 2 mΩ 28 μΩ/Ω + 20 mΩ 28 μΩ/Ω + 20 mΩ 28 μΩ/Ω + 0.2 Ω 28 μΩ/Ω + 0.2 Ω 32 μΩ/Ω + 2 Ω 32 μΩ/Ω + 2 Ω 60 μΩ/Ω + 30 Ω 0.013 % + 50 Ω 0.025 % + 2.5 kΩ 0.05 % + 3 kΩ 0.3 % + 0.10 MΩ 1.5 % + 0.50 MΩ	Fluke 5520A

Parameter/Range	Frequency	CMC <sup>2, 6, 7, 8</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup>			
(5 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 % + 3 μV 0.02 % + 1.1 μV 0.03 % + 1.1 μV 0.1 % + 1.1 μV 0.5 % + 1.1 μV 4 % + 2 μV	HP 3458A
(10 to 100) 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 300 kHz to 1 MHz (1 to 2) MHz	72 μV/V + 4 μV 72 μV/V + 2 μV 15 μV/V + 2 μV 0.03 % + 2 μV 0.08 % + 2 μV 0.3 % + 10 μV 1 % + 10 μV 1.5 % + 10 μV	
100 mV to 1 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz	72 μV/V + 40 μV 72 μV/V + 20 μV 15 μV/V + 20 μV 0.03 % + 20 μV 0.08 % + 20 μV 0.3 % + 0.10 mV 1 % + 0.10 mV 1.5 % + 0.10 mV	

Parameter/Range	Frequency	CMC <sup>2, 5, 6, 7, 8</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup> (cont)			
(1 to 10) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz	72 µV/V + 0.40 mV 72 µV/V + 0.20 mV 15 µV/V + 0.20 mV 0.03 % + 0.20 mV 0.08 % + 0.20 mV 0.3 % + 1.0 mV 1 % + 1.0 mV 1.5 % + 1.0 mV	HP 3458A
(10 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.02 % + 4 mV 0.02 % + 2 mV 0.02 % + 2 mV 0.036 % + 2 mV 0.12 % + 2 mV 0.4 % + 10 mV 1.5 % + 10 mV	
(100 to 1000) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.04 % + 40 mV 0.04 % + 20 mV 0.06 % + 20 mV 0.12 % + 20 mV 0.3 % + 20 mV	
AC Voltage – Generate <sup>3</sup>			
(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 0.015 % + 6 µV 0.02 % + 6 µV 0.1 % + 6 µV 0.35 % + 12 µV 0.8 % + 50 µV	Fluke 5520A
(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	0.05 % + 8 µV 0.015 % + 8 µV 0.016 % + 8 µV 0.035 % + 8 µV 0.08 % + 32 µV 0.2 % + 70 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 % + 50 µV 0.015 % + 60 µV 0.019 % + 60 µV 0.03 % + 50 µV 0.07 % + 0.13 mV 0.24 % + 0.60 mV	

Parameter/Range	Frequency	CMC <sup>2, 5, 6, 7, 8</sup> (±)	Comments
AC Voltage – Generate <sup>3</sup> (cont)			
(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 % + 0.65 mV 0.015 % + 0.60 mV 0.024 % + 0.60 mV 0.035 % + 0.60 mV 0.09 % + 1.6 mV	Fluke 5520A
(33 to 330) V	45 Hz to 1 kHz 1 kHz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.019 % + 2 mV 0.02 % + 6 mV 0.025 % + 6 mV 0.03 % + 6 mV 0.2 % + 50 mV	
(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 <sup>3</sup>			
(5 to 100) μA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz	0.4 % + 30 nA 0.15 % + 30 nA 0.06 % + 30 nA 0.06 % + 30 nA	HP 3458A
100 μA to 1 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.4 % + 0.20 μA 0.15 % + 0.20 μA 0.06 % + 0.20 μA 0.03 % + 0.20 μA 0.06 % + 0.20 μA 0.4 % + 0.40 μA 0.55 % + 1.5 μA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.4 % + 2 μA 0.15 % + 2 μA 0.06 % + 2 μA 0.03 % + 2 μA 0.06 % + 2 μA 0.4 % + 4 μA 0.55 % + 15 μA	

Parameter/Range	Frequency	CMC <sup>2, 5, 6, 8</sup> (±)	Comments
AC Current – Measure <sup>3</sup> (cont)			
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.4 % + 20 µA 0.15 % + 20 µA 0.06 % + 20 µA 0.03 % + 20 µA 0.06 % + 20 µA 0.4 % + 40 µA 0.55 % + 0.15 mA	HP 3458A
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 % + 0.20 mA 0.16 % + 0.20 mA 0.08 % + 0.20 mA 0.1 % + 0.20 mA 0.3 % + 0.20 mA 1 % + 0.40 mA	
AC Current – Generate <sup>3</sup>			
(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 1.6 % + 0.4 µA	Fluke 5520A
330 µA 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 % + 0.10 mA 0.4 % + 0.20 mA	

Parameter/Range	Frequency	CMC <sup>2, 5, 8</sup> (±)	Comments
AC Current – Generate <sup>3</sup> (cont)			
33 mA to 3 A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.18 % + 0.10 mA 0.06 % + 0.10 mA 0.6 % + 1 mA 2.5 % + 5 mA	Fluke 5520A
(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 21) 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 (20 to 1000) A	(45 to 440) Hz	0.28 % + 50 mA	Fluke 5520 with 50 turn coil
Capacitance – Generate <sup>3</sup>			
(0.19 to 0.4) nF (0.4 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF	10 Hz to 10 kHz 10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz	0.5 % + 0.01 nF 0.5 % + 0.01 nF 0.5 % + 0.01 nF 0.25 % + 0.01 nF 0.25 % + 0.1 nF 0.25 % + 0.1 nF 0.25 % + 0.3 nF	Fluke 5520A
(0.33 to 1.1) µF (1.1 to 3.3) µF (3.3 to 11) µF (11 to 33) µF (33 to 110) µF (110 to 330) µF	(10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz Up to 80 Hz Up to 50 Hz	0.25 % + 1 nF 0.25 % + 3 nF 0.25 % + 10 nF 0.4 % + 30 nF 0.45 % + 0.10 µF 0.45 % + 0.30 µF	
330 µF to 1.1 mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	Up to 20 Hz Up to 6 Hz Up to 2 Hz Up to 0.6 Hz Up to 0.2 Hz	0.45 % + 1 µF 0.45 % + 3 µF 0.45 % + 10 µF 0.75 % + 30 µF 1.1 % + 0.10 mF	

Parameter/Range	Frequency	CMC <sup>2,5,8</sup> (±)	Comments
Leveled Sine Wave <sup>3</sup> –			
5 mV to 5.5 V	50 kHz reference	2 % + 0.30 mV	Fluke 5520A with SC600 option
Absolute	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	3.5 % + 0.30 mV 4 % + 0.30 mV 6 % + 0.30 mV	
Flatness	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	1.5 % + 0.10 mV 2 % + 0.10 mV 4 % + 0.10 mV	

Parameter/Equipment	Range	CMC <sup>2,5,8</sup> (±)	Comments
AC Power <sup>3</sup> –			
Frequency (45 to 65) Hz			Fluke 5520A
w/ PF=1			
Volt Range	Current Range		
(33 to 330) mV	(3.3 to 9) mA	0.14 %	
	(9 to 33) mA	0.1 %	
	(33 to 90) mA	0.14 %	
	(90 to 330) mA	0.1 %	
	(330 to 900) mA	0.13 %	
	900 mA to 3 A	0.11 %	
	(3 to 11) A	0.13 %	
	(11 to 20) A	0.16 %	
330 mV to 1020 V	(3.3 to 9) mA	0.12 %	
	(9 to 33) mA	0.08 %	
	(33 to 90) mA	0.12 %	
	(90 to 330) mA	0.08 %	
	(330 to 900) mA	0.11 %	
	900 mA to 3 A	0.09 %	
	(3 to 11) A	0.12 %	
	(11 to 20) A	0.19 %	

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments	
Electrical Calibration of RTD Indicators and Indicating Systems <sup>3</sup> –				
Pt 385, 100 Ω	-200 °C to 0 °C 0 °C to 100 °C 100 °C to 400 °C 400 °C to 630 °C 630 °C to 800 °C	0.05 °C 0.07 °C 0.1 °C 0.12 °C 0.23 °C	Fluke 5520A	
Pt 3926, 100 Ω	-200 °C to 0 °C 0 °C to 100 °C 100 °C to 400 °C 400 °C to 630 °C	0.05 °C 0.07 °C 0.1 °C 0.12 °C		
Pt 3916, 100 Ω	-200 °C to -190 °C -190 °C to 100 °C 100 °C to 400 °C 400 °C to 600 °C 600 °C to 630 °C	0.25 °C 0.06 °C 0.09 °C 0.1 °C 0.23 °C		
Pt 385, 200Ω	-200 °C to 260 °C 260 °C to 600 °C 600 °C to 630 °C	0.05 °C 0.14 °C 0.16 °C		
Pt 385, 500 Ω	-200 °C to 260 °C 260 °C to 600 °C 600 °C to 630 °C	0.06 °C 0.09 °C 0.11 °C		
Pt 385, 1000 Ω	-200 °C to 0 °C 0 °C to 300 °C 300 °C to 600 °C 600 °C to 630 °C	0.03 °C 0.06 °C 0.07 °C 0.23 °C		
Ni 120, 120 Ω	-80 °C to 100 °C 100 °C to 260 °C	0.08 °C 0.14 °C		
Cu 427, 10 Ω	-100 °C to 260 °C	0.3 °C		
Electrical Calibration of Thermocouple Indicators and Indicating Systems <sup>3</sup> –				
Type B	600 °C to 800 °C 800 °C to 1000 °C 1000 °C to 1550 °C 1550 °C to 1820 °C	0.44 °C 0.34 °C 0.3 °C 0.33 °C		Fluke 5520A

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Electrical Calibration of Thermocouple Indicators and Indicating Systems <sup>3</sup> – (cont)			
Type L	-200 °C to -100 °C -100 °C to 800 °C 800 °C to 900 °C	0.37 °C 0.26 °C 0.17 °C	Fluke 5520A
Type N	-200 °C to -100 °C -100 °C to -25 °C -25 °C to 410 °C 410 °C to 1300 °C	0.4 °C 0.22 °C 0.19 °C 0.27 °C	
Type R	0 °C to 250 °C 250 °C to 400 °C 400 °C to 1000 °C 1000 °C to 1767 °C	0.57 °C 0.35 °C 0.33 °C 0.4 °C	
Type S	0 °C to 250 °C 250 °C to 1400 °C 1400 °C to 1767 °C	0.47 °C 0.37 °C 0.46 °C	
Type T	-250 °C to -150 °C -150 °C to 0 °C 0 °C to 120 °C 120 °C to 400 °C	0.63 °C 0.2 °C 0.16 °C 0.14 °C	
Type U	-200 °C to 0 °C 0 °C to 600 °C	0.56 °C 0.27 °C	
Type C	0 °C to 150 °C 150 °C to 650 °C 650 °C to 1000 °C 1000 °C to 1800 °C 1800 °C to 2316 °C	0.3 °C 0.26 °C 0.31 °C 0.5 °C 0.84 °C	
Type E	-250 °C to -100 °C -100 °C to 650 °C 650 °C to 1000 °C	0.5 °C 0.16 °C 0.21 °C	
Type J	-210 °C to -100 °C -100 °C to 760 °C 760 °C to 1200 °C	0.27 °C 0.17 °C 0.23 °C	
Type K	-200 °C to -100 °C -100 °C to 120 °C 120 °C to 1000 °C 1000 °C to 1372 °C	0.33 °C 0.18 °C 0.26 °C 0.4 °C	

### III. Mechanical

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Pressure <sup>3</sup>	(0 to 100) psi (100 to 1000) psi	0.1 psi + 0.6R 0.3 psi + 0.6R	Heise pressure calibrators and modules
Torque	(0 to 300) in•lb (0 to 1000) ft•lb	2.7 in•lb 7.3 ft•lb	AKO torque calibrator
Indirect Verification of Rockwell Hardness Testers <sup>3</sup>	HRC: Low, Middle, High  HRB: Low, Middle, High  HR15N: Low, Middle, High  HR30N: Low, Middle, High  HR45N: Low, Middle, High  HR15T: Low, Middle, High  HR30T: Low, Middle, High  HR45T: Low, Middle, High	1.4 HRC  1.4 HRB  1.4 HR15N  1.4 HR30N  1.4 HR45N  1.5 HR15T  1.5 HR30T  1.4 HR45T	Indirect verification method per ASTM E18

### IV. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Temperature – Measure	-40 °C to 250 °C 250 °C to 450 °C	0.025 °C 0.08 °C	PRT with indicator system

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Temperature – Measuring Equipment <sup>3</sup>	-40 °C to 100 °C	0.07 °C	PRT with ASL temperature indicator and fluid bath

#### V. Time and Frequency

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Frequency – Measure <sup>3</sup>	Up to 225 MHz	$(0.96 + 10f)$ Hz	HP 53131A counter  $f$ = measured frequency in MHz
Frequency – Measuring Equipment <sup>3</sup>	10 Hz to 600 MHz	2.5 $\mu$ Hz/Hz + 5 $\mu$ Hz	Fluke 5520A
Time Marker in Oscilloscope Uncertainty <sup>3</sup>  Cardinal Points at:	(2 and 5) ns (1, 2, 5, 10, 20, 50) $\mu$ s (100, 200 and 500) $\mu$ s  (1, 2, 5, 10, 20, 50) ms (100, 200, 500) ms (1, 2 and 5) s	2.5 $\mu$ s/s  $(25 + 1000t)$ $\mu$ s/s	Fluke 5520A with: SC600  $t$ = time in seconds  Add 50 $\mu$ s/s for markers not at cardinal points
Edge Rise Time Uncertainty <sup>3</sup>  Into 50 $\Omega$	$\leq 300$ ps	+ 0 ps -100 ps	Fluke 5520A / SC600

<sup>1</sup> This laboratory offers commercial calibration service and field calibration service.

<sup>2</sup> 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.

- <sup>3</sup> 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.
- <sup>4</sup> In the statement of CMC,  $L$  is the numerical value of the nominal length of the device measured in inches,  $D$  is the diagonal length of the device measured in inches, and  $R$  is the numerical value of the resolution of the device indicator.
- <sup>5</sup> Based on using the standard at the temperature the Fluke 5520A was calibrated (tcal) within  $\pm 5$  °C and assuming the instrument is zeroed at least every seven days or when the ambient temperature changes more than 5 °C. For resistance, a zero calibration is performed at least every 12 hours within  $\pm 1$  °C of use. For AC Current, best uncertainties are determined with LCOMP Off. CMC is based upon 1-year specifications and using the standard at ambient temperature that is within  $\pm 5$  °C of tcal.
- <sup>6</sup> Based on using the standard at the temperature the HP 3458A was calibrated (tcal) within  $\pm 5$  °C and an auto-calibration (ACAL) was performed within the previous 24 hours ( $\pm 1$  °C of ambient temperature). CMC is based upon 1-year specifications and using the standard at ambient temperature that is within  $\pm 5$  °C of tcal.
- <sup>7</sup> For  $V_{IN} > 100$  V add  $12 \mu\text{V/V} (V_{IN}/1000)^2$
- <sup>8</sup> In the statement of CMC, percentage (%) refers to percent of reading unless otherwise noted.



World Class Accreditation

The American Association for Laboratory Accreditation

# Accredited Laboratory

A2LA has accredited

## CINCINNATI PRECISION INSTRUMENTS

*Cincinnati, OH*

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 8th day of December 2010.



  
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Peter Meyer

President & CEO  
For the Accreditation Council  
Certificate Number 1570.01  
Valid to December 31, 2012

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