



**THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION**

ACCREDITED LABORATORY

A2LA has accredited

MTS METROLOGY LABORATORY
Eden Prairie, MN

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 also demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 18 June 2005*).

Presented this 6th day of July 2006



A handwritten signature in black ink, reading 'Peter Meyer'.

President
For the Accreditation Council
Certificate Number 1044.01
Valid to May 31, 2008

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



American Association for Laboratory Accreditation

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

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CALIBRATION

Valid To: May 31, 2008

Certificate Number: 1044.01

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

Calibration of multimeters, signal sources, generators, process calibrators, signal conditioners, strain gage instrumentation, recorders, bridge simulators, thermocouple and RTD instruments and other general purpose electrical M&TE.

Parameter/Equipment	Range	Best Uncertainty ^{2,4,5} (±)	Comments
DC Voltage – Generate	(10 to 220) mV	6 μV/V + 0.4 μV	Fluke 5720A
	(220 mV to 2.2) V	4 μV/V + 0.7 μV	
	(2.2 to 22) V	3 μV/V + 2.5 μV	
	(22 to 220) V	4 μV/V + 40 μV	
	(220 to 1100) V	5 μV/V + 400 μV	
Fixed Point	10 V	4 μV/V	Fluke 732B
Measure	(1 to 120) mV	4 μV/V + 1 μV	HP 3458A (option 002)
	120 mV to 1.2 V	3 μV/V + 1 μV	
	(1.2 to 12) V	3 μV/V + 2 μV	
	(12 to 120) V	5 μV/V + 30 μV	
	(120 to 1000) V	6 μV/V + 100 μV	
Fixed Point	10V	5 μV/V	10V (ratiometric)



Parameter/Equipment	Range	Best Uncertainty ^{2,4,5} (\pm)	Comments
DC Current –			
Generate	(10 to 220) μ A 220 μ A to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A	35 μ A/A + 6 nA 30 μ A/A + 7 nA 30 μ A/A + 40 nA 40 μ A/A + 0.7 μ A 60 μ A/A + 12 μ A 0.06 % + 330 μ A	Fluke 5720A Fluke 5500A
Measure	120 nA to 1.2 μ A (1.2 to 12) μ A (12 to 120) μ A 120 μ A to 12 mA (1.2 to 12) mA (12 to 120) mA 120 mA to 1.0 A	25 μ A/A + 0.04 nA 25 μ A/A + 0.01 nA 25 μ A/A + 0.08 nA 25 μ A/A + 5 nA 25 μ A/A + 50 nA 35 μ A/A + 500 nA 0.011 % + 10 μ A	HP 3458A
Resistance –			
Generate Fixed Points	1 Ω 10 k Ω 1 Ω , 1.9 Ω 10 Ω , 19 Ω 100 Ω , 190 Ω 1 k Ω , 1.9 k Ω 10 k Ω , 19 k Ω 100 k Ω , 190 k Ω 1 M Ω , 1.9 M Ω 10 M Ω , 19 M Ω 100 M Ω	6 parts in 10 ⁶ 3 parts in 10 ⁶ 80 parts in 10 ⁶ 21 parts in 10 ⁶ 9 parts in 10 ⁶ 8 parts in 10 ⁶ 8 parts in 10 ⁶ 9 parts in 10 ⁶ 15 parts in 10 ⁶ 30 parts in 10 ⁶ 95 parts in 10 ⁶	Fluke 742A Fluke 742A Fluke 5720A
Measure	(1 to 12) Ω (12 to 120) Ω 120 Ω to 1.2 k Ω (1.2 to 12) k Ω (12 to 120) k Ω 120 k Ω to 1.2 M Ω (1.2 to 12) M Ω (12 to 120) M Ω 120 M Ω to 1 G Ω	15 $\mu\Omega/\Omega$ + 0.05 m Ω 12 $\mu\Omega/\Omega$ + 0.5 m Ω 10 $\mu\Omega/\Omega$ + 0.5 m Ω 10 $\mu\Omega/\Omega$ + 5 m Ω 10 $\mu\Omega/\Omega$ + 50 m Ω 15 $\mu\Omega/\Omega$ + 2 Ω 50 $\mu\Omega/\Omega$ + 100 Ω 0.05 % + 1 k Ω 0.5 % + 10 k Ω	HP 3458A

Parameter/Range	Frequency	Best Uncertainty ^{2,4} (±)	Comments
AC Voltage – Generate			
(1 to 2.2) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.022 % + 4 μV 85 μV/V + 4 μV 75 μV/V + 4 μV 0.018 % + 4 μV 0.046 % + 5 μV 0.09 % + 10 μV 0.12 % + 20 μV 0.25 % + 20 μV	Fluke 5720A
(2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.022 % + 4 μV 85 μV/V + 4 μV 75 μV/V + 4 μV 0.018 % + 4 μV 0.046 % + 5 μV 0.09 % + 10 μV 0.12 % + 20 μV 0.25 % + 20 μV	
(22 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.022 % + 12 μV 85 μV/V + 7 μV 75 μV/V + 7 μV 0.018 % + 7 μV 0.042 % + 17 μV 0.075 % + 20 μV 0.12 % + 25 μV 0.25 % + 45 μV	
220 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.022 % + 40 μV 80 μV/V + 15 μV 40 μV/V + 8 μV 70 μV/V + 10 μV 0.011 % + 30 μV 0.034 % + 80 μV 0.09 % + 200 μV 0.15 % + 300 μV	
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.022 % + 0.4 mV 80 μV/V + 0.15 mV 40 μV/V + 0.05 mV 70 μV/V + 0.1 mV 95 μV/V + 0.2 mV 0.026 % + 0.6 mV 0.09 % + 2 mV 0.13 % + 3.2 mV	

Parameter/Range	Frequency	Best Uncertainty ^{2,4,5} (\pm)	Comments
AC Voltage – Generate (cont.)			
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.022 % + 4 mV 80 μ V/V + 1.5 mV 47 μ V/V + 0.6 mV 75 μ V/V + 1 mV 0.013 % + 3 mV 0.08 % + 16 mV 0.4 % + 40 mV 0.7 % + 80 mV	Fluke 5720A
(220 to 1100) V	50 Hz to 1 kHz	60 μ V/V + 4 mV	
AC Voltage – Measure			
(1 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 μ V 0.02 % + 1 μ V 0.03 % + 1 μ V 0.1 % + 1 μ V 0.5 % + 1 μ V 4 % + 2 μ V	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	70 μ V/V + 4 μ V 70 μ V/V + 2 μ V 0.014 % + 2 μ V 0.03 % + 2 μ V 0.08 % + 2 μ V 0.3 % + 10 μ V 1 % + 10 μ V 1.5 % + 10 μ V	
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	70 μ V/V + 40 μ V 70 μ V/V + 20 μ V 0.014 % + 20 μ V 0.03 % + 20 μ V 0.08 % + 20 μ V 0.3 % + 100 μ V 1 % + 100 μ V 1.5 % + 100 μ V	

Parameter/Range	Frequency	Best Uncertainty ^{2, 4, 5} (\pm)	Comments
AC Voltage – Measure (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	70 μ V/V + 0.4 mV 70 μ V/V + 0.2 mV 0.014 % + 0.2 mV 0.03 % + 0.2 mV 0.08 % + 0.2 mV 0.3 % + 1 mV 1 % + 1 mV 1.5 % + 1 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 % + 20 mV 0.02 % + 20 mV 0.035 % + 20 mV 0.1 % + 20 mV 0.4 % + 100 mV 1.5 % + 100 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 0.1 % + 20 mV 0.3 % + 20 mV	
AC Current – Generate			
(10 to 220) μ A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.023 % + 16 nA 0.014 % + 10 nA 0.011 % + 8 nA 0.025 % + 12 nA 0.09 % + 65 nA	Fluke 5720A
220 μ A to 2.2 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.023 % + 40 nA 0.014 % + 35 nA 0.011 % + 35 nA 0.018 % + 110 nA 0.09 % + 650 nA	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.023 % + 0.4 μ A 0.014 % + 0.35 μ A 0.011 % + 0.35 μ A 0.018 % + 0.55 μ A 0.09 % + 5 μ A	

Parameter/Range	Frequency	Best Uncertainty ^{2,4,5} (±)	Comments
AC Current – Generate (cont.)			
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.023 % + 4 μA 0.014 % + 4 μA 0.011 % + 3 μA 0.018 % + 4 μA 0.09 % + 10 μA	Fluke 5720A
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.024 % + 35 μA 0.039 % + 80 μA 0.6 % + 160 μA	
(2.2 to 11) A	(45 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz	0.06 % + 2 mA 0.1 % + 2 mA 0.33 % + 2 mA	Fluke 5500A
AC Current – Measure			
(1 to 120) μA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.4 % + 20 nA 0.15 % + 20 nA 0.06 % + 20 nA 0.06 % + 20 nA	HP 3458A
120 μA to 1.2 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 % + 0.2 μA 0.15 % + 0.2 μA 0.06 % + 0.2 μA 0.03 % + 0.2 μA 0.06 % + 0.2 μA 0.4 % + 0.4 μA 0.55 % + 1.5 μA	
(1.2 to 12) 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	
(12 to 120) 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 % + 150 μA	

Parameter/Range	Frequency	Best Uncertainty ² (±)	Comments
AC Current – Measure (cont.)			
120 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 % + 0.2 mA 0.16 % + 0.2 mA 0.08 % + 0.2 mA 0.1 % + 0.2 mA 0.3 % + 0.2 mA 1 % + 0.4 mA	HP 3458A

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Thermocouple Simulation and Measure ³ –			
Type B	600 °C to 1800 °C	0.3 °C	Fluke 5500A(“Measure” refers to measurement of thermocouple simulators / sources)
Type C	0 °C to 2300 °C	0.3 °C	
Type E	-250 °C to 1000 °C	0.2 °C	
Type J	-200 °C to 1200 °C	0.2 °C	
Type K	-200 °C to 1350 °C	0.2 °C	
Type L	-200 °C to 900 °C	0.2 °C	
Type N	-200 °C to 1300 °C	0.2 °C	
Type R, Type S	0 °C to 1750 °C	0.4 °C	
Type T	-250 °C to 400 °C	0.2 °C	
Type U	-200 °C to 600 °C	0.2 °C	
RTD Simulation ³ –			
Pt 385, 100 Ω	-200 °C to 800 °C	0.05 °C	Fluke 5500A
Pt 3926, 100 Ω	-200 °C to 630 °C	0.05 °C	
Pt 3916, 100 Ω	-190 °C to 600 °C	0.04 °C	

II. Dimensional

(Calibration of digital linear gages, calipers, dial indicators, laser extensometers, extensometer calibrators, protractors, micrometers, length standards, and other general purpose dimensional M&TE.)

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Laser Extensometer	Up to 3 in >3 to 5 in >5 to 15 in	200 μin 300 μin 0.001 in	Laser interferometer
Extensometer Calibrator	(0.001 to 2) in	5 μin	Laser interferometer
Vee Length Standard	(0.5 to 2) in	200 μin	Gage blocks, optical comparator
Dial Test Indicator	Up to 0.030 in	400 μin	Gage blocks, height master
Micrometer	Up to 1 in Up to 6 in	100 μin 500 μin	Gage blocks
Digital Protractor	0° to 360°	0.1°	Gage blocks, sine bar
Digital Indicator	Up to 4 in Up to 18 in	100 μin 200 μin or 0.005% of reading (whichever is greater)	Gage blocks, height master
Digital Caliper	Up to 6 in	500 μin	Gage blocks, ring gages
Dial Indicator	Up to 6 in	0.001 in	Gage blocks, height master
MTS Temposonics	Up to 48 in	300 μin	Laser interferometer, linear table

III. Mechanical

(Calibration of force transducers, force gages, torque transducers, rotary encoders, pressure transducers, pressure gages, vacuum transducers, vacuum gages, weight sets, balances, scales, and other general purpose mechanical M&TE.)

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Force – Measuring Equipment	(1 to 1140) lbf	0.005 % reading	MTS force calibration systems per ASTM E74 and ISO 376
Measuring Equipment and Measure	(1 to 1140) lbf (2000 to 240 000) lbf	0.01 % reading 0.05 % reading	
Torque – Measuring Equipment and Measure	(5 to 2000) in·lb (200 to 12 000) in·lb	0.06 % reading 0.04 % reading	MTS torque calibration system
Angle – Rotary Source	0° to 360°	0.002°	Rotary table system
Pressure – Measuring Equipment			
Pneumatic Hydraulic	(5 to 400) psi (10 to 10 000) psi	0.015 % reading 0.02 % reading	Pressurements T3400 Pressurements M2200
Pressure ³ – Measuring Equipment and Measure	(10 to 10 000) psi	0.1 % reading	Portable pressure calibration system
Vacuum – Measuring Equipment	(3 to 29) in Hg	0.015 % reading	Pressurements T3400

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Mass, Fixed Points –			
Measuring Equipment	(1, 2, 5, 10, 20) g (50, 100) g (200, 500) g 1 kg (2, 5) kg (10, 20) kg (0.1, 0.2, 0.25) lb (0.5, 1, 2) lb (5, 10) lb 20 lb 50 lb (100 to 500) lb	0.02 mg 0.04 mg 0.2 mg 0.2 mg 2 mg 30 mg 0.0000002 lb 0.000002 lb 0.00002 lb 0.0002 lb 0.0003 lb 0.01 %	Reference weight sets Secondary weight set
Measure	(1, 2, 5, 10, 20) g (50, 100) g (200, 500, 1000) g (2, 5) kg (10, 20) kg (0.1, 0.2) lb (0.25, 0.5, 1, 2) lb (5, 10) lb (20, 50) lb	0.3 mg 0.3 mg 3 mg 0.02 g 0.2 g 0.0000006 lb 0.00001 lb 0.0001 lb 0.001 lb	Single substitution, reference weights and precision balances

IV. Thermodynamic

Calibration of temperature probes, thermometers, temperature meters, humidity meters, thermocouple and RTD instruments, recorders, and other general purpose temperature M&TE.

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Relative Humidity ³ –			
Measure	10 % to 90 % RH	2 % RH	Humidity meter
Measuring Equipment	11 % RH 33 % RH 75 % RH	1.4 % RH 1.3 % RH 1.5 % RH	Humidity calibrator

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Temperature ³ – Measure	-100 °C to 400 °C	0.04 °C	Thermometer w/ PRT
Measuring Equipment	0 °C 30 °C to 150 °C 50 °C to 400 °C	0.01 °C 0.1 °C 1 °C	Ice bath reference PRT and bath Dry well
Simulation ³ – Thermocouple and RTD	Various	See Electrical	See Electrical

V. Time and Frequency

Calibration of counters, generators, oscillators, process calibrators, and general purpose time and frequency M&TE.

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Frequency – Measuring Equipment	(5, 10) MHz 1 Hz to 15 MHz	1 part in 10 ¹¹ 1 part in 10 ⁷	GPS reference standard Agilent 53131A
Measure	1 Hz to 225 MHz	1 part in 10 ¹⁰	Agilent 53131A

VI. Acoustics and Vibration

Calibration of accelerometers, vibration transducers, velocity transducers, vibration instrumentation, portable shakers, vibration tables, vibration controllers and related systems, sound level meters, and other general purpose vibration and acoustic M&TE.

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Vibration ³ – Measuring Equipment and Measure	(5 to 100) Hz ≥ 100 Hz to 2.5 kHz (> 2.5 to 10) kHz	1.5 % 1.2 % 2.5 %	Accelerometer calibration system
	10 Hz to 2.5 kHz (> 2.5 to 10) kHz	2 % 3 %	Portable calibration system (site work)

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Acoustics – Measuring Equipment	94 dB, 114 dB (1 kHz)	0.2 dB (re 20 µPa)	Bruel & Kjaer 4231

¹ This laboratory offers commercial and on-site calibration service.

² “Best Uncertainty” 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 of nearly ideal measuring equipment. Best uncertainties represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The best uncertainty of a specific calibration performed by the laboratory may be greater than the best uncertainty due to the behavior of the customer’s device and to influences from the circumstances of the specific calibration.

³ On-site calibration service is available for this calibration. The uncertainties achievable on a customer's site can normally be expected to be larger than the Best Measurement Capabilities (BMC) that the accredited laboratory has been assigned as Best Uncertainty 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 uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the calibration uncertainty being larger than the BMC.

⁴ The measurands stated are generated with the Fluke 732B, Fluke 5720A, Fluke 5500A series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. Best measurement uncertainties are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.

⁵ The measurands stated are measured with the HP 3458A series of instruments. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. Best measurement uncertainties are expressed as either a specific value that covers the full range or as a combination of the fraction of the reading/output plus a range specification.