



World Class Accreditation

The American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

DAVIS CALIBRATION

Timonium, MD

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 3rd day of December 2009.



A handwritten signature in black ink, reading "Peter M. Boyer".

President & CEO
For the Accreditation Council
Certificate Number 1590.01
Valid to August 31, 2011

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



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

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CALIBRATION

Valid To: August 31, 2011

Certificate Number: 1590.01

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 ^{2,3} (±)	Comments
DC Voltage –	Generate Up to 220 mV 220 mV to 2.2 V (2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	1.2×10^{-8} V 1.2×10^{-7} V 1.2×10^{-6} V 1.2×10^{-6} V 0.012 V 0.012 V	Fluke 5720A OPT 03
DC Current – Generate	Up 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	1.4×10^{-8} A 5.9×10^{-8} A 5.8×10^{-7} A 7.0×10^{-6} A 1.3×10^{-4} A 2.7×10^{-4} A	Fluke 5720A OPT 03 with Fluke 5725A

Peter Abney
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Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
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	1.2×10^{-9} A 1.2×10^{-8} A 1.2×10^{-7} A 1.2×10^{-6} A 1.2×10^{-6} A 1.2×10^{-6} A	Fluke 8508A OPT 01
Resistance – Generate, Fixed Points	1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	130 µΩ 230 µΩ 300 µΩ 560 µΩ 1.3 mΩ 2.5 mΩ 0.011 Ω 0.020 Ω 0.11 Ω 0.20 Ω 1.3 Ω 2.6 Ω 25 Ω 50 Ω 510 Ω 1.3 kΩ 8 kΩ	Fluke 5720A OPT 03
Resistance – Measure	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	1.2×10^{-4} Ω 2.1×10^{-4} Ω 0.0017 Ω 0.012 Ω 0.12 Ω 1.2 Ω 14 Ω 370 Ω 23 kΩ 220 kΩ	Fluke 8508A OPT 01
Oscilloscope – Generate Amplitude			
50 Ω load	(0 to ± 6.6) V DC	0.25 % + 40 µV	Fluke 5520A/SC1100
1 MΩ load	(0 to ± 130) V DC	0.05 % + 40 µV	

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
Oscilloscope – Generate (cont)			
Amplitude			
Square Wave			
50 Ω load	± (1 mV to ± 6.6 V _{pk - pk}) 10 Hz to 10 kHz	0.25 % + 40 μV	Fluke 5520A/SC1100
1 MΩ load	± (1 mV to ± 130 V _{pk - pk}) 10 Hz to 1 kHz (1 to 10) kHz	0.1 % + 40 μV 0.25 % + 40 μV	
Flatness			
Relative to 50 kHz	5 mV to 5.5 V 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	0.35 % + 300 μV 0.4 % + 300 μV 0.6 % + 300 μV	
	4 mV to 3.5 V (600 to 1100) MHz	0.7 % + 300 μV	
Time Marker 50 Ω load	5 s to 50 ms 20 ms to 1 ns	(25 + 1000 <i>t</i>) parts in 10 ⁶ 2.5 parts in 10 ⁶	<i>t</i> = time interval
Rise Time 50 Ω load	≤ 300 ps	+ 0 ps / - 100 ps	
AC Voltage – Generate			
Up 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	8.4 × 10 ⁻⁶ V 8.1 × 10 ⁻⁶ V 8.3 × 10 ⁻⁶ V 1.2 × 10 ⁻⁵ V 2.1 × 10 ⁻⁵ V 4.4 × 10 ⁻⁵ V 6.9 × 10 ⁻⁵ V 1.1 × 10 ⁻⁴ V	Fluke 5720A OPT 03

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
AC Voltage – Generate (cont)			
(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	3.6×10^{-5} V 3.3×10^{-5} V 3.3×10^{-5} V 6.8×10^{-5} V 1.6×10^{-4} V 2.9×10^{-4} V 4.3×10^{-4} V 8.3×10^{-4} V	Fluke 5720A OPT 03
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	2.8×10^{-4} V 1.3×10^{-4} V 1.3×10^{-4} V 2.2×10^{-4} V 3.5×10^{-4} V 0.0013 V 0.0031 V 0.0051 V	
(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	0.0029 V 0.0013 V 0.0013 V 0.0023 V 0.0031 V 0.0084 V 0.031 V 0.047 V	
(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	0.028 V 0.016 V 0.016 V 0.025 V 0.046 V 0.046 V 0.046 V 0.046 V	
(220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.10 V 0.11 V	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
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	3.5×10^{-12} V 3.5×10^{-12} V 5.9×10^{-12} V 8.7×10^{-10} V 8.7×10^{-10} V 5.4×10^{-8} V	HP 3458A OPT02
(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	2.7×10^{-11} V 2.7×10^{-11} V 1.2×10^{-12} V 2.2×10^{-9} V 2.2×10^{-9} V 3.2×10^{-8} V 3.4×10^{-7} V 3.4×10^{-7} 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	2.7×10^{-9} V 2.7×10^{-9} V 8.6×10^{-9} V 3.4×10^{-8} V 0.33 V 0.33 V 0.33 V 0.33 V	
(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	6.0×10^{-7} V 6.0×10^{-7} V 1.2×10^{-6} V 3.8×10^{-6} V 2.3×10^{-5} V 3.2×10^{-4} V 0.0034 V 0.0034 V	
(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	1.6×10^{-4} V 1.6×10^{-4} V 1.6×10^{-4} V 4.6×10^{-4} V 0.0050 V 0.0050 V 0.0050 V	
(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	0.029 V 0.029 V 0.063 V 0.063 V 0.063 V	

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
AC Current – Generate			
(9 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.8×10^{-7} A 3.1×10^{-7} A 3.1×10^{-7} A 6.2×10^{-7} A 7.8×10^{-7} A	Fluke 5720A OPT 03
220 µA to 2.2 mA	(10 to 20) kHz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	3.0×10^{-7} A 2.2×10^{-7} A 2.2×10^{-7} A 4.3×10^{-6} A 2.5×10^{-6} A	
(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	3.1×10^{-6} A 2.3×10^{-6} A 2.3×10^{-6} A 4.0×10^{-6} A 2.2×10^{-4} A	
(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	2.9×10^{-5} A 2.2×10^{-5} A 2.2×10^{-5} A 3.6×10^{-5} A 1.7×10^{-4} A	
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	4.3×10^{-4} A 7.2×10^{-4} A 0.0095 A	
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	6.6×10^{-4} A 8.1×10^{-4} A 8.3×10^{-4} A	with Fluke 5725A
AC Current – Measure			
Up to 200 µA	Up to 55 Hz (55 to 300) Hz 300 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.3×10^{-7} A 1.3×10^{-7} A 1.3×10^{-7} A 7.8×10^{-7} A 4.1×10^{-7} A	Fluke 8508A OPT01

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
AC Current – Measure (cont)			
200 µA to 2 mA	Up to 55 Hz (55 to 300) Hz 300 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	6.1×10^{-8} A 6.1×10^{-8} A 5.9×10^{-8} A 1.1×10^{-7} A 1.4×10^{-7} A	Fluke 8508A OPT01
(2 to 20) mA	Up to 55 Hz (55 to 300) Hz 300 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	6.9×10^{-7} A 6.7×10^{-7} A 7.1×10^{-7} A 1.6×10^{-6} A 2.0×10^{-6} A	
(20 to 200) mA	Up to 55 Hz (55 to 300) Hz 300 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	6.9×10^{-6} A 6.9×10^{-6} A 6.9×10^{-6} A 8.9×10^{-6} A 8.7×10^{-6} A	
200 mA to 2 A	Up to 55 Hz (55 to 300) Hz 300 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.0011 A 0.0011 A 0.0011 A 0.0012 A 0.0012 A	
(2 to 20) A	Up to 55 Hz (55 to 300) Hz 300 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.0018 A 0.0019 A 0.0020 A 0.011 A 0.010 A	
Capacitance – Generate Fixed Points			
100 pF 1000 pF	1 kHz 1 kHz	6.0×10^{-16} F 4.9×10^{-15} F	Genrad 1404B, Genrad 1404A

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
Capacitance – Generate			Fluke 5520A
(0.19 to 0.4) nF	10 Hz to 10 kHz	0.0013 nF	
(0.4 to 1.1) nF	10 Hz to 10 kHz	0.016 nF	
(1.1 to 3.3) nF	10 Hz to 3 kHz	0.020 nF	
(3.3 to 11) nF	10 Hz to 1 kHz	0.036 nF	
(11 to 33) nF	10 Hz to 1 kHz	0.16 nF	
(33 to 110) nF	10 Hz to 1 kHz	0.36 μF	
(110 to 330) nF	10 Hz to 1 kHz	1.1 μF	
(0.33 to 1.1) μF	(10 to 600) Hz	0.0038 μF	
(1.1 to 3.3) μF	(10 to 300) Hz	0.010 μF	
(3.3 to 11) μF	(10 to 150) Hz	0.036 μF	
(11 to 33) μF	(10 to 120) Hz	0.14 μF	
(33 to 110) μF	(10 to 80) Hz	0.056 μF	
(110 to 330) μF	(0 to 50) Hz	2.4 μF	
(0.33 to 1.1) mF	(0 to 20) Hz	0.0055 mF	
(1.1 to 3.3) mF	(0 to 6) Hz	0.0024 mF	
(3.3 to 11) mF	(0 to 2) Hz	0.054 mF	
(11 to 33) mF	(0 to 0.6) Hz	0.28 mF	
(33 to 110) mF	(0 to 0.2) Hz	1.4 mF	

II. Mechanical

Parameter/Equipment	Range	CMC ² (±)	Comments
Pressure	(-14 to 50) psig (50 to 1000) psig	0.06 % of reading 0.12 % of reading	Ruska 7250xi digital pressure controller

III. Thermodynamics

Parameter/Equipment	Range	CMC ² (±)	Comments
Temperature – Measuring Equipment	60 °C to 420 °C	0.029 °C	Hart 6050
	35 °C to 200 °C	0.042 °C	Hart 6102
	-40 °C to 150 °C	0.016 °C	Hart 7341
	-80 °C to 100 °C	0.018 °C	Hart 7380
	-195 °C	0.008 °C	Hart 7196
			Indicated bath temperature monitored by a Hart 5680 SPRT and 1590 super thermometer

IV. Time and Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency	10 MHz	2.4 pHz	Datum 9390-6000

¹ This laboratory offers commercial 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 The measurands stated are generated with the Fluke 5200, 5500, 5700, or 8500 series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. Calibration and Measurement Capability is expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.

⁴ The measurands stated are measured with the HP 3458A. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. Calibration and Measurement Capability is 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.