



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

E.S.R SERVICES INC
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CALIBRATION

Valid To: April 30, 2019

Certificate Number: 2523.01

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	(0 to 19.9999) mV (20 to 199.999) mV (0.2 to 1.99999) V (2 to 19.9999) V (20 to 199.999) V (200 to 1100) V	0.012 % + 10 µV 0.0093 % + 14 µV 0.0098 % + 50 µV 0.01 % + 0.41 mV 0.0095 % + 4.0 mV 0.0099 % + 20 mV	Fluke 5100B calibrator
DC Voltage – Measure	(0 to 19.9999) mV (20 to 199.999) mV (0.2 to 1.99999) V (2 to 19.9999) V (20 to 199.999) V (200 to 1000) V	0.014 % + 3.0 µV 0.0082 % + 3.0 µV 0.0049 % + 20 µV 0.0058 % + 0.2 mV 0.0046 % + 2.0 mV 0.0065 % + 20 mV	Fluke 8842A DMM
DC Current – Generate	(10 to 199.999) µA (0.2 to 1.99999) mA (2 to 19.9999) mA (20 to 199.999) mA (0.2 to 1.99999) A	0.59 % + 48 nA 0.069 % + 0.12 µA 0.035 % + 0.84 µA 0.035 % + 8.0 µA 0.035 % + 80 µA	Fluke 5100B calibrator
DC Current – Measure	1 mA to 1 A (> 1 to 1.99999) A	0.058 % + 40 µA 0.12 % + 40 µA	Fluke 8842A DMM

Parameter/Equipment	Range	CMC ^{2,3,4} (±)	Comments
Resistance – Generate Fixed Points	1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ	0.039 % 0.024 % 0.0092 % 0.0091 % 0.0091 % 0.0091 % 0.024 % 0.07 %	Fluke 5100B calibrator
Resistance – Measure	(1 to 19.9999) Ω (20 to 199.999) Ω (0.2 to 1.99999) kΩ (2 to 19.9999) kΩ (20 to 199.999) kΩ (0.2 to 1.99999) MΩ (2 to 19.9999) MΩ	0.017 % + 4.0 mΩ 0.013 % + 4.0 mΩ 0.011 % + 30 mΩ 0.011 % + 0.30 Ω 0.013 % + 3.0 Ω 0.032 % + 30 Ω 0.049 % + 0.40 kΩ	Fluke 8842A DMM

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
AC Voltage – Generate (1 to 19.9999) mV	(50 to 100) Hz in increments of 10 Hz (0.1 to 1) kHz in increments of 100 Hz (1 to 10) kHz in increments of 1 kHz	0.084 % + 0.1 mV 0.084 % + 0.1 mV 0.084 % + 0.1 mV	Fluke 5100B calibrator
(20 to 199.999) mV	(10 to 50) kHz in increments of 10 kHz (50 to 100) Hz in increments of 10 Hz (0.1 to 1) kHz in increments of 100 Hz (1 to 10) kHz in increments of 1 kHz (10 to 50) kHz in increments of 10 kHz	0.14 % + 0.1 mV 0.081 % + 0.12 mV 0.081 % + 0.12 mV 0.081 % + 0.12 mV 0.14 % + 0.13 mV	

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
AC Voltage – Generate (cont)			
(0.2 to 1.99999) V	(50 to 100) Hz in increments of 10 Hz	0.083 % + 0.3 mV	Fluke 5100B calibrator
	(0.1 to 1) kHz in increments of 100 Hz	0.083 % + 0.3 mV	
	(1 to 10) kHz in increments of 1 kHz	0.083 % + 0.3 mV	
	(10 to 50) kHz in increments of 10 kHz	0.14 % + 0.42 mV	
(2 to 19.9999) V	(50 to 100) Hz in increments of 10 Hz	0.081 % + 2.1 mV	
	(0.1 to 1) kHz in increments of 100 Hz	0.081 % + 2.1 mV	
	(1 to 10) kHz in increments of 1 kHz	0.081 % + 2.1 mV	
	(10 to 50) kHz in increments of 10 kHz	0.14 % + 3.3 mV	
(20 to 110) V	(50 to 100) Hz in increments of 10 Hz	0.081 % + 20 mV	
	(0.1 to 1) kHz in increments of 100 Hz	0.081 % + 20 mV	
	(1 to 10) kHz in increments of 1 kHz	0.081 % + 20 mV	
	20 kHz	0.14 % + 32 mV	
(>110 to 199.999) V	(50 to 100) Hz in increments of 10 Hz	0.081 % + 20 mV	
	(0.1 to 1) kHz in increments of 100 Hz	0.081 % + 20 mV	
(200 to 1100) V	(50 to 100) Hz in increments of 10 Hz	0.081 % + 0.11 V	
	(0.1 to 1) kHz in increments of 100 Hz	0.081 % + 0.11 V	

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
AC Voltage – Measure			
(1 to 199.999) mV	(20 to 45) Hz (45 to 200) Hz (0.2 to 20) kHz (20 to 50) kHz (50 to 100) kHz	1.4 % + 0.1 mV 0.47 % + 0.1 mV 0.13 % + 0.1 mV 0.25 % + 0.2 mV 0.58 % + 0.4 mV	Fluke 8842A DMM
(0.2 to 1.99999) V	(20 to 45) Hz (45 to 200) Hz (0.2 to 20) kHz (20 to 50) kHz (50 to 100) kHz	1.4 % + 1.0 mV 0.46 % + 1.0 mV 0.094 % + 0.8 mV 0.24 % + 2.0 mV 0.58 % + 4.0 mV	
(2 to 19.9999) V	(20 to 45) Hz (45 to 200) Hz (0.2 to 20) kHz (20 to 50) kHz (50 to 100) kHz	1.4 % + 10 mV 0.46 % + 10 mV 0.094 % + 8.0 mV 0.24 % + 20 mV 0.58 % + 40 mV	
(20 to 199.999) V	(20 to 45) Hz (45 to 200) Hz (0.2 to 20) kHz (20 to 50) kHz (50 to 100) kHz	1.4 % + 100 mV 0.46 % + 100 mV 0.093 % + 80 mV 0.24 % + 200 mV 0.58 % + 400 mV	
(200 to 700) V	(20 to 45) Hz (45 to 200) Hz (0.2 to 20) kHz	1.4 % + 1.0 V 0.46 % + 1.0 V 0.12 % + 1.0 V	
AC Current – Generate			
0.2 mA to < 2.0 A	50 Hz to 1 kHz	0.12 % + 0.01 % range + 0.04 µA	Fluke 5100B calibrator
AC Current – Measure			
2000 mA	(20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	2.4 % + 2.0 mA 0.58 % + 2.0 mA 0.46 % + 2.0 mA	Fluke 8842A DMM

II. Optical Quantities

Parameter/Equipment	Range	CMC ² (±)	Comments
Optical Power – Measure Multi-Mode (MM)	All to 2 dBm Max 635 nm (± 30 nm) 850 nm (± 30 nm) 1300 nm (± 30 nm)	0.59 dBm	RIFOCS / tempo OPM system
Optical Attenuation (Att.) and Insertion Loss (IL.) – Measure Multi-Mode (MM) Measurement	All to 2 dBm Max 635 nm (± 30 nm) 850 nm (± 30 nm) 1300 nm (± 30 nm)	0.59 dB	RIFOCS / tempo OPM system
Optical Power – Measure Single Mode (SM) Measurement – Laser Only	1310 nm, 1490 nm 1550 nm, 1625 nm All (± 30 nm)	0.59 dBm	RIFOCS / tempo OPM system
Optical Attenuation (Att.) and Insertion Loss (IL.) – Measure Single Mode (SM) Measurement – Laser Only	1310 nm, 1490 nm 1550 nm, 1625 nm All (± 30 nm)	0.59 dB	RIFOCS / tempo OPM system

¹ This laboratory offers commercial calibration service.

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 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.

⁴ In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.



Accredited Laboratory

A2LA has accredited

E.S.R SERVICES INC.

Pacoima, CA

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 21st day of March 2017.

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

President and CEO
For the Accreditation Council
Certificate Number 2523.01
Valid to April 30, 2019
Revised January 15, 2019

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