



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

AVALON TEST EQUIPMENT  
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CALIBRATION

Valid To: July 31, 2020

Certificate Number: 4859.01

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. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,3</sup> (±)	Comments
DC Voltage – Generate	(0 to 0.33) V (0.33 to 3.3) V (3.3 to 33) V 33 V to 0.33 kV (0.33 to 1.02) kV	7.7 μV 39 μV 0.43 mV 6.2 mV 20 mV	Fluke 5522A
DC Voltage – Measure	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V  100 V to 1 kV	1.1 μV 5.2 μV 49 μV 0.8 mV  9.5 mV	Agilent 3458A, option 002  Add 12 ppm x (Vin/1000) <sup>2</sup> for V > 100
DC Current – Generate	(0 to 0.33) mA (0.33 to 3.3) mA (3.3 to 33) mA 33 mA to 0.33 A (0.33 to 1.1) A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	70 nA 0.38 μA 3.6 μA 36 μA 0.26 mA 1.2 mA 6 mA 21 mA	Fluke 5522A

Parameter/Equipment	Range	CMC <sup>2,3</sup> (±)	Comments
DC Current – Measure	(10 to 100) $\mu$ A 100 $\mu$ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	3.4 nA 30 nA 0.3 $\mu$ A 4.7 $\mu$ A 0.13 mA	Agilent 3458A, option 002
DC Resistance – Generate	(0 to 11) $\Omega$ (11 to 33) $\Omega$ (33 to 110) $\Omega$ (110 to 330) $\Omega$ 330 $\Omega$ to 1.1 k $\Omega$ (1.1 to 3.3) k $\Omega$ (3.3 to 11) k $\Omega$ (11 to 33) k $\Omega$ (33 to 110) k $\Omega$ (110 to 330) k $\Omega$ 330 k $\Omega$ to 1.1 M $\Omega$ (1.1 to 3.3) M $\Omega$ (3.3 to 11) M $\Omega$ (11 to 33) M $\Omega$ (33 to 110) M $\Omega$ (110 to 330) M $\Omega$ (330 to 1100) M $\Omega$	0.46 m $\Omega$ 1 m $\Omega$ 3.2 m $\Omega$ 9.4 m $\Omega$ 31 m $\Omega$ 96 m $\Omega$ 0.32 $\Omega$ 0.96 $\Omega$ 3.2 $\Omega$ 11 $\Omega$ 36 $\Omega$ 0.2 k $\Omega$ 1.4 k $\Omega$ 8.6 k $\Omega$ 56 k $\Omega$ 0.99 M $\Omega$ 17 M $\Omega$	Fluke 5522A
DC Resistance – Measure	(0 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 $\Omega$	0.22 m $\Omega$ 1.9 m $\Omega$ 13 m $\Omega$ 0.13 $\Omega$ 1.3 $\Omega$ 19 $\Omega$ 0.62 k $\Omega$ 51 k $\Omega$	Agilent 3458A, option 002

Parameter/Range	Frequency	CMC <sup>2,3</sup> (±)	Comments
AC Voltage – Generate  (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	32 $\mu$ V 11 $\mu$ V 13 $\mu$ V 39 $\mu$ V 0.13 mV 0.31 mV	Fluke 5522A

Parameter/Range	Frequency	CMC <sup>2,3</sup> (±)	Comments
AC Voltage – Generate (cont)			
(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	0.12 mV 57 µV 62 µV 0.12 mV 0.3 mV 0.73 mV	Fluke 5522A
(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	1.1 mV 0.56 mV 0.69 mV 1 mV 2.4 mV 8.6 mV	
(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	12 mV 5.6 mV 8.6 mV 12 mV 31 mV	
(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	66 mV 73 mV 89 mV 0.11 V 0.71 V	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.32 V 0.27 V 0.32 V	
AC Voltage – Measure			
(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	12 µV 11 µV 18 µV 33 µV 90 µV 0.32 mV	Agilent 3458A, option 002
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	0.12 mV 0.1 mV 0.17 mV 0.35 mV 0.85 mV 3.2 mV	

Parameter/Range	Frequency	CMC <sup>2,3</sup> (±)	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	1.4 mV 1 mV 1.7 mV 3.5 mV 8.4 mV 31 mV	Agilent 3458A, option 002
(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	25 mV 24 mV 25 mV 40 mV 0.13 V	
(100 to 1000) V	40 Hz to 1 kHz (1 to 20) kHz	0.44 V 0.63 V	
AC Current – Generate			
(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	0.77 µA 0.6 µA 0.52 µA 1.1 µA 2.8 µA 5.7 µA	Fluke 5522A
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	6.8 µA 4.4 µA 3.5 µA 6.8 µA 17 µA 34 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	62 µA 32 µA 16 µA 29 µA 70 µA 0.14 mA	
(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	0.62 mA 0.32 mA 0.16 mA 0.38 mA 0.77 mA 1.5 mA	

Parameter/Range	Frequency	CMC <sup>2,3</sup> (±)	Comments
AC Current – Generate (cont)			
330 mA to 1.1 A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	2.1 mA 0.66 mA 7.6 mA 33 mA	Fluke 5522A
(1.1 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	5.5 mA 1.9 mA 19 mA 80 mA	
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	8.6 mA 13 mA 0.33 A	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	30 mA 36 mA 0.62 A	
AC Current – Measure			
Up to 100 µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 1) kHz	0.43 µA 0.18 µA 96 nA 96 nA	Agilent 3458A, option 002
100 µA to 1 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 10) kHz	4.2 µA 1.7 µA 0.81 µA 0.51 µA 0.81 µA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 10) kHz	42 µA 17 µA 8.2 µA 5.4 µA 8.2 µA	
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 10) kHz	0.42 mA 0.17 mA 82 µA 54 µA 82 µA	

Parameter/Range	Frequency	CMC <sup>2,3</sup> (±)	Comments
AC Current – Measure (cont)  100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 10) kHz	4.2 mA 1.8 mA 1 mA 1.2 mA 3.2 mA	Agilent 3458A, option 002
Capacitance – Generate  (220 to 400) pF (0.04 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 (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 0.33 μF to 1.1 mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	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 (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (0 to 50) Hz (0 to 20) Hz (0 to 6) Hz (0 to 2) Hz (0 to 0.6) Hz (0 to 0.2) Hz	12 pF 16 pF 27 pF 39 pF 97 pF 0.3 nF 0.97 nF 3 nF 9 nF 30 nF 0.14 μF 0.51 μF 1.5 μF 4.4 μF 13 μF 44 μF 0.13 mF 0.44 mF	Fluke 5522A

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Stimulation of Thermocouple  Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.44 °C 0.34 °C 0.3 °C 0.33 °C	Fluke 5522A
Type C	(0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.3 °C 0.27 °C 0.31 °C 0.5 °C 0.84 °C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Stimulation of Thermocouple (cont)			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.5 °C 0.17 °C 0.15 °C 0.17 °C 0.22 °C	Fluke 5522A
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.28 °C 0.17 °C 0.15 °C 0.18 °C 0.24 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.33 °C 0.19 °C 0.17 °C 0.27 °C 0.4 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.4 °C 0.23 °C 0.2 °C 0.19 °C 0.28 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.57 °C 0.35 °C 0.33 °C 0.4 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.47 °C 0.36 °C 0.37 °C 0.46 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.63 °C 0.25 °C 0.17 °C 0.15 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.56 °C 0.28 °C	

Parameter/Equipment	Range	CMC <sup>2,3</sup> (±)	Comments
Oscilloscopes –			
DC Voltage:			Fluke 5522A/SC1100
50 Ω	(0 to 6.6) V	0.25 % + 40 μV	
1 MΩ	(0 to 130) V	0.06 % + 40 μV	
AC Voltage (Square Wave):			
50 Ω	±1 mV <sub>pk-pk</sub> to ± 6.6 V <sub>pk-pk</sub> 10 Hz to 10 kHz	0.25 % + 40 μV	
1 MΩ	±1 mV <sub>pk-pk</sub> to ± 130 V <sub>pk-pk</sub> 10 Hz to 1 kHz (1 to 10) kHz	0.1 % + 40 μV 0.25 % + 40 μV	
Leveled Sine Wave (Amplitude)	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz 600 MHz to 1.1 GHz	0.19 V 0.22 V 0.33 V 0.25 V	
Time Markers	5 s to 50 ms 20 ms to 100 ns (50 to 20) ns 10 ns (5 to 2) ns	25 ms 50 ns 0.13 ps 26 fs 14 fs	
Wave Generator:			
50 Ω	1.8 mV <sub>pk-pk</sub> to 2.5 V <sub>pk-pk</sub>	75 mV <sub>pk-pk</sub>	
1 MΩ	1.8 mV <sub>pk-pk</sub> to 55 V <sub>pk-pk</sub>	1.7 V <sub>pk-pk</sub>	
Pulse Generator: (4 to 500) ns width	10 mV to 2.5 V	0.2 μS	

<sup>1</sup> This laboratory offers commercial 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> In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.





## *Accredited Laboratory*

A2LA has accredited

### **AVALON TEST EQUIPMENT**

*Vista, 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 April 2017*).



Presented this 14<sup>th</sup> day of August 2018.

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

President and CEO  
For the Accreditation Council  
Certificate Number 4859.01  
Valid to July 31, 2020

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