



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017  
& ANSI/NCSL Z540-1.1994 & ANSI/NCSL Z540.3.2006

ANKO ELECTRONICS  
1485 Poinsettia Ave., Suite 115  
Vista, CA 92081  
Darren Nachurski Phone: 760 752 3311

CALIBRATION

Valid to: March 31, 2020

Certificate Number: 3270.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1,5</sup>:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
DC Voltage – Generate	Up to 329.999 mV (0.33 to 3.299 999) V (3.3 to 32.999 99) V (33 to 329.9999) V (0.1 to 1) kV	16 µV/V + 1.0 µV 9.2 µV/V + 2.0 µV 9.8 µV/V + 20 µV 14 µV/V + 0.15 mV 14 µV/V + 1.5 mV	Fluke 5520A
DC Current – Generate	Up 329.999 µA (0.33 to 3.299 99) mA (3.3 to 32.9999) mA (33 to 329.999) mA (0.33 to 1.099 99) A (1.1 to 2.999 99) A (3 to 10.999 99) A (11 to 20.5) A	0.016 % + 17 nA 65 µA/A + 95 nA 70 µA/A + 0.51 µA 79 µA/A + 2.4 µA 0.016 % + 31 µA 0.12 mA/A + 1.3 mA 0.39 mA/A + 0.42 mA 0.78 mA/A + 0.59 mA	Fluke 5520A

Parameter/Equipment	Range	CMC <sup>2, 4</sup> (±)	Comments
DC Power – Generate  (33 mV to 1020 V)  329.99 mA 2.9999 A 20.5 A	  (0.01 to 330) W 330 W to 3 kW (3 to 20.9) kW	  0.023 % + 0.58 mW 0.046 % + 77 mW 0.092 % + 0.50 W	  Fluke 5520A
DC Resistance – Generate	Up to 10.9999 Ω (11 to 32.9999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω (0.33 to 1.0999 99) kΩ (1.1 to 3.299 999) kΩ (3.3 to 10.999 99) kΩ (11 to 32.9999) kΩ (33 to 109.9999) kΩ (110 to 329.9999) kΩ (0.33 to 1.099 999) MΩ (1.1 to 3.299 999) MΩ (3.3 to 10.999 99) MΩ (11 to 32.9999) MΩ (33 to 109.9999) MΩ (110 to 329.9999) MΩ (330 to 1100) MΩ	32 μΩ/Ω + 0.78 mΩ 23 μΩ/Ω + 1.2 mΩ 33 μΩ/Ω + 1.6 mΩ 33 μΩ/Ω + 2.3 mΩ 33 μΩ/Ω + 2.4 mΩ 34 μΩ/Ω + 22 mΩ 33 μΩ/Ω + 23 mΩ 33 μΩ/Ω + 0.23 Ω 33 μΩ/Ω + 0.23 Ω 38 μΩ/Ω + 2.3 Ω 37 μΩ/Ω + 2.4 Ω 71 μΩ/Ω + 33 Ω 0.15 mΩ/Ω + 58 Ω 0.30 mΩ/Ω + 2.8 kΩ 0.58 mΩ/Ω + 3.5 kΩ 0.35 % + 0.11 MΩ 1.7 % + 0.57 MΩ	Fluke 5520A
Capacitance – Generate	(0.19 to 0.3999) nF (0.4 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.9999) nF (11 to 32.9999) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 to 1.099 99) μF (1.1 to 3.299 99) μF (3.3 to 10.9999) μF (11 to 32.9999) μF (33 to 109.999) μF (110 to 329.999) μF (0.33 to 1.099 99) mF (1.1 to 3.299 99) mF (3.3 to 10.9999) mF (11 to 32.9999) mF (33 to 109.999) mF	0.57 % + 12 pF 0.55 % + 12 pF 0.58 % + 12 pF 0.29 % + 12 pF 0.29 % + 0.12 nF 0.29 % + 0.12 nF 0.30 % + 0.33 nF 0.31 % + 1.1 nF 0.30 % + 3.4 nF 0.38 % + 6.0 nF 0.47 % + 34 nF 0.56 % + 93 nF 0.53 % + 0.34 μF 0.50 % + 1.5 μF 0.52 % + 3.6 μF 0.53 % + 11 μF 0.87 % + 34 μF 1.3 % + 0.12 mF	Fluke 5520A

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Simulation of Thermocouples – Generate			
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.22 °C 0.13 °C 0.11 °C 0.14 °C 0.21 °C	Fluke 5520A
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.27 °C 0.15 °C 0.13 °C 0.23 °C 0.35 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.51 °C 0.20 °C 0.13 °C 0.12 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.33 °C 0.18 °C 0.16 °C 0.15 °C 0.24 °C	

Parameter/Range	Frequency	CMC <sup>2, 4</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	0.099 % + 6.0 μV 0.023 % + 6.0 μV 0.028 % + 6.0 μV 0.12 % + 6.0 μV 0.41 % + 12 μV 0.93 % + 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	0.043 % + 8 μV 0.018 % + 8 μV 0.019 % + 8 μV 0.042 % + 8 μV 0.094 % + 32 μV 0.24 % + 70 μV	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage – Generate (cont)			
(0.33 to 3.3) V	(10 to 45) Hz (0.045 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.035 % + 50 μV 0.018 % + 60 μV 0.023 % + 60 μV 0.036 % + 50 μV 0.082 % + 0.13 mV 0.29 % + 0.6 mV	Fluke 5520A
(3.3 to 33) V	(10 to 45) Hz (0.045 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.035 % + 0.65 mV 0.018 % + 0.60 mV 0.029 % + 0.60 mV 0.041 % + 0.60 mV 0.11 % + 1.6 mV	
(33 to 330) V	(0.045 to 1) kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz	0.023 % + 2 mV 0.024 % + 6 mV 0.030 % + 6 mV 0.038 % + 6 mV	
(330 to 1020) V	(0.045 to 1) kHz (1 to 5) kHz (5 to 10) kHz	0.035 % + 10 mV 0.029 % + 10 mV 0.035 % + 10 mV	
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	0.23 % + 0.10 μA 0.18 % + 0.10 μA 0.15 % + 0.10 μA 0.35 % + 0.15 μA 0.93 % + 0.20 μA 1.9 % + 0.40 μA	Fluke 5520A
(0.33 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	0.23 % + 0.15 μA 0.15 % + 0.15 μA 0.12 % + 0.15 μA 0.23 % + 0.20 μA 0.58 % + 0.30 μA 1.2 % + 0.60 μA	

Parameter/Range	Frequency	CMC <sup>2, 4</sup> (±)	Comments
AC Current – Generate (cont)			
(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	0.21 % + 2.0 µA 0.11 % + 2.0 µA 0.047 % + 2.0 µA 0.093 % + 2.0 µA 0.24 % + 3.0 µA 0.47 % + 4.0 µA	Fluke 5520A
(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	0.21 % + 20 µA 0.11 % + 20 µA 0.047 % + 20 µA 0.12 % + 50 µA 0.23 % + 0.1 mA 0.47 % + 0.2 mA	
(0.33 to 1.099 99) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.21 % + 0.1 mA 0.058 % + 0.1 mA 0.70 % + 1 mA 2.9 % + 5 mA	
(1.1 to 2.999 99) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.21 % + 0.1 mA 0.073 % + 0.1 mA 0.70 % + 1 mA 2.9 % + 5 mA	
(3 to 10.999 99) A	(45 to 100) Hz (0.1 to 1) kHz (1 to 5) kHz	0.072 % + 2 mA 0.12 % + 2 mA 3.5 % + 2 mA	
(11 to 20.5) A	(45 to 100) Hz (0.1 to 1) kHz (1 to 5) kHz	0.14 % + 5 mA 0.18 % + 5 mA 3.5 % + 5 mA	
AC Power – Generate			
(45 to 65) Hz PF = 1			
330 mV, 20.5 A	0.01 W to 6.5 kW	0.16 %	Fluke 5520A
1020 V, 20.5 A	0.01 W to 20.9 kW	0.14 %	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
Phase – Generate (+/-)179.99 (ΔΦ°)			
V vs. V	(10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz	0.22° 0.28° 0.43° 2.0°	Fluke 5520A
V vs. I	(1 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz	0.22° 0.28° 0.43° 2.0°	

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Oscilloscopes –			
Level Sine Amplitude 50 kHz Reference	5 mV to 5.5 V	2.6 % + 0.33 mV	Fluke 5520A/ SC1100
Level Sine Amplitude 5 mV to 5.5 V (Relative to 50 kHz Reference)	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	1.9 % + 0.11 mV 2.5 % + 0.12 mV 4.7 % + 0.61 mV 5.9 % + 0.12 mV	
Square Wave Amplitude Into 1 MΩ Load Into 50 Ω Load	1 mV to 130 V 1 mV to 6.6 V	0.15 % + 48 μV 0.38 % + 47 μV	
DC Level	Up to 130 V into 1 MΩ Up to 6.6 V into 50 Ω	0.067 % + 47 μV 0.32 % + 46 μV	
Time Marker Output into 50 Ω	1 ns to 20 ms 50 ms to 5 s	0.10 % + 2.1 ps 0.59 % – 0.28 ms	
Edge Transition Time	1 kHz to 10 MHz	120 ps	

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
DC Voltage – Measure	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (0.1 to 1) kV	5.9 $\mu\text{V}/\text{V} + 0.30 \mu\text{V}$ 4.6 $\mu\text{V}/\text{V} + 0.30 \mu\text{V}$ 4.6 $\mu\text{V}/\text{V} + 0.50 \mu\text{V}$ 7.0 $\mu\text{V}/\text{V} + 30 \mu\text{V}$ 44 $\mu\text{V}/\text{V} + 0.10 \text{mV}$	Agilent 3458A/002
DC Resistance – Measure	(0 to 10) $\Omega$ (10 to 100) $\Omega$ (100 to 1000) $\Omega$ (1 to 10) k $\Omega$ (10 to 100) k $\Omega$ (0.1 to 1) M $\Omega$ (1 to 10) M $\Omega$ (10 to 100) M $\Omega$ (100 to 1) G $\Omega$	18 $\mu\Omega/\Omega + 50 \mu\Omega$ 15 $\mu\Omega/\Omega + 0.5 \text{m}\Omega$ 12 $\mu\Omega/\Omega + 0.5 \text{m}\Omega$ 12 $\mu\Omega/\Omega + 5 \text{m}\Omega$ 12 $\mu\Omega/\Omega + 50 \text{m}\Omega$ 18 $\mu\Omega/\Omega + 2 \Omega$ 59 $\mu\Omega/\Omega + 0.1 \text{k}\Omega$ 0.58 $\text{m}\Omega/\Omega + 1 \text{k}\Omega$ 5.8 $\text{m}\Omega/\Omega + 10 \text{k}\Omega$	Agilent 3458A/002
DC Current – Measure	(0 to 100) nA (0.1 to 1) $\mu\text{A}$ (1 to 10) $\mu\text{A}$ (10 to 100) $\mu\text{A}$ (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	0.19 $\text{mA}/\text{A} + 0.04 \text{nA}$ 36 $\mu\text{A}/\text{A} + 0.04 \text{nA}$ 24 $\mu\text{A}/\text{A} + 0.1 \text{nA}$ 23 $\mu\text{A}/\text{A} + 0.8 \text{nA}$ 23 $\mu\text{A}/\text{A} + 5 \text{nA}$ 23 $\mu\text{A}/\text{A} + 50 \text{nA}$ 41 $\mu\text{A}/\text{A} + 0.5 \mu\text{A}$ 0.13 $\text{mA}/\text{A} + 10 \mu\text{A}$	Agilent 3458A/002

Parameter/Range	Frequency	CMC <sup>2, 4</sup> (±)	Comments
AC Voltage – Measure			
(1 to 10) mV	40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.24 mV/V + 1.1 μV 0.36 mV/V + 1.1 μV 1.2 mV/V + 1.1 μV 5.8 mV/V + 1.1 μV 46 mV/V + 2 μV	Agilent 3458A/002
(10 to 100) mV	40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (1 to 2) MHz	87 μV/V + 2 μV 0.17 mV/V + 2.0 μV 0.36 mV/V + 2.0 μV 0.93 mV/V + 2.0 μV 3.5 mV/V + 10 μV 12 mV/V + 10 μV 17 mV/V + 10 μV	
(0.1 to 1) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	85 μV/V + 20 μV 0.16 mV/V + 20 μV 0.35 mV/V + 20 μV 0.93 mV/V + 20 μV 3.5 mV/V + 0.10 mV 12 mV/V + 0.10 mV 17 mV/V + 0.10 mV 46 mV/V + 0.70 mV 46 mV/V + 0.80 mV 0.17 V/V + 1.0 mV	
(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 (0.3 to 1) MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	89 μV/V + 0.40 mV 85 μV/V + 0.20 mV 0.16 mV/V + 0.20 mV 0.35 mV/V + 0.20 mV 0.93 mV/V + 0.20 mV 3.5 mV/V + 1.0 mV 12 mV/V + 1.0 mV 17 mV/V + 1 mV 46 mV/V + 7 mV 46 mV/V + 8 mV 0.17 V/V + 10 mV	
(10 to 100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.23 mV/V + 2.0 mV 0.23 mV/V + 2.0 mV 0.41 mV/V + 2.0 mV 1.4 mV/V + 2.0 mV	
(100 to 700) V	40 Hz to 1 kHz (1 to 20) kHz	0.33 mV/V + 20 mV 0.49 mV/V + 20 mV	



Parameter/Range	Frequency	CMC <sup>2, 4</sup> (±)	Comments
AC High Voltage – Measure			
(1 to 4) kV	60 Hz	6.0 V/kV	Ross Engineering VD30-8.3- A-K-AAA & Fluke 87 III
(4 to 30) kV	60 Hz	5.6 V/kV + 3.4 V	
AC Current – Measure			
(10 to 100) µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz	4.6 mA/A + 30 nA 1.7 mA/A + 30 nA 0.7 mA/A + 30 nA 0.7 mA/A + 30 nA	Agilent 3458A/002
(0.1 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	4.6 mA/A + 0.2 µA 1.7 mA/A + 0.2 µA 0.7 mA/A + 0.2 µA 0.35 mA/A + 0.2 µA 0.7 mA/A + 0.2 µA 4.6 mA/A + 0.4 µA 6.4 mA/A + 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	4.6 mA/A + 2 µA 1.7 mA/A + 2 µA 0.7 mA/A + 2 µA 0.35 mA/A + 2 µA 0.7 mA/A + 2 µA 4.6 mA/A + 4 µA 6.4 mA/A + 15 µA	
(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	4.6 mA/A + 20 µA 1.7 mA/A + 20 µA 0.7 mA/A + 20 µA 0.35 mA/A + 20 µA 0.7 mA/A + 20 µA 4.6 mA/A + 40 µA 6.4 mA/A + 0.15 mA	
(0.1 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	4.6 mA/A + 0.2 mA 1.9 mA/A + 0.2 mA 0.93 mA/A + 0.2 mA 1.2 mA/A + 0.2 mA 3.5 mA/A + 0.2 mA 12 mA/A + 0.4 mA	

Parameter/Equipment	Range	CMC <sup>2, 4</sup> (±)	Comments
DC High Current – Measure	(1 to 15) A (15 to 20) A	1.2 mA/A + 0.59 mA 2.4 mA/A + 0.10 mA	Agilent 3458A/002 w/ L&N 15A Shunt w/ Weston 100A Shunt
DC High Voltage – Measure	(1 to 4) kV (4 to 30) kV	1.0 V/kV + 0.60 V 0.98 V/kV + 8.0 V	Ross Engineering VD30-8.3- A-K-AAA & Fluke 87 III

## II. Mechanical

Parameter/Equipment	Range	CMC <sup>2, 3, 6</sup> (±)	Comments
Pressure – Measure and Measuring Equipment	(0 to 750) psi (750 to 3000) psi	0.13% 0.13 % + 0.0070 psi	Crystal 3KPSIXP2I w/ Ashcroft 1327D
	(2500 to 5000) psi (5000 to 10000) psi	0.13 % + 0.10 psi 0.15 % + 0.90 psi	Crystal 10KPSIXP2I w/ Ashcroft 1327D

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

<sup>2</sup> 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.

<sup>3</sup> In the statement of CMC, percentages are to be read as percent of reading unless otherwise noted.

<sup>4</sup> 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. CMC's are expressed as either a specific value that covers the full range or as a percent or fraction of the reading plus a fixed floor specification.

<sup>5</sup> This scope meets A2LA's P112 Flexible Scope Policy.

<sup>6</sup> The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.