SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3-2006

CONSTELLATION POWERLABS
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CALIBRATION

Valid To: August 31, 2027 Certificate Number: 2044.03

In recognition of the successful completion of the A2LA evaluation process (including an assessment of the organization's compliance with R205 – A2LA's Calibration Program Requirements), accreditation is granted to this laboratory to perform the following calibrations[1, 8]:

I. Dimensional

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Dial Indicators[3]	Up to 1 in	60 µin	Comparison to gage blocks
Micrometers[3, 5]	Up to 36 in	(4 + 8*L* + 0.6*R*) µin	Comparison to gage blocks
Calipers[3, 5]	Up to 36 in	(4 + 8*L* + 0.6*R*) µin	Comparison to gage blocks
Go/No-Go Gages[3]	Up to 1 in	22 µin	High resolution micrometer, compared to gage blocks

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II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4, 6] (±)	Comments
DC Voltage[3] – Measure	(0 to 120) mV 100 mV to 1.2 V (1 to 12) V (10 to 120) V (100 to 1050) V	7.1 µV/V + 0.3 µV 6 µV/V + 0.3 µV 6 µV/V + 0.5 µV 8 µV/V + 30 µV 8 µV/V + 120 µV	Long scale multimeter
DC Voltage – Generate	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	7.5 µV/V + 0.4 µV 5 µV/V + 0.7 µV 3.5 µV/V + 2.5 µV 3.5 µV/V + 4.4 µV 5 µV/V + 40 µV 6.5 µV/V + 400 µV	Primary multi-function calibrator
DC Current – Measure	(10 to 120) µA 100 µA to 1.2 mA (1 to 12) mA (10 to 120) mA 100 mA to 1.05 A	25 µA/A + 0.8 nA 25 µA/A + 5 nA 25 µA/A + 50 nA 40 µA/A + 500 nA 0.011 % + 10 µA	Long scale multimeter
DC Current – Generate	(0 to 220) µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A (11 to 15) A (15 to 20.5) A	40 µA/A + 6 nA 35 µA/A + 7.2 nA 35 µA/A + 41 nA 45 µA/A + 0.7 µA 80 µA/A + 12 µA 0.036 % + 480 µA 0.1 % + 750 µA 0.1 % + 880 µA	Primary multi-function calibrator
Resistance – Measure	(0 to 12) Ω (10 to 120) Ω (100 to 1200) Ω (1 to 12) kΩ (10 to 120) kΩ 100 kΩ to 1.2 MΩ (1 to 12) MΩ (10 to 120) MΩ 100 MΩ to 1.2 GΩ	18 µΩ/Ω + 50 µΩ 15 µΩ/Ω + 500 µΩ 13 µΩ/Ω + 500 µΩ 13 µΩ/Ω + 5 mΩ 13 µΩ/Ω + 50 mΩ 18 µΩ/Ω + 2 Ω 53 µΩ/Ω + 110 Ω 0.05 % + 1.9 kΩ 0.5 % + 50 kΩ	Long scale multimeter

Parameter/Equipment	Range	CMC[2, 4, 6] (±)	Comments
Resistance – Generate, Fixed Points	0.0 Ω 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	55 µΩ 0.011 % 98 µΩ/Ω 23 µΩ/Ω 23 µΩ/Ω 10 µΩ/Ω 10 µΩ/Ω 8.5 µΩ/Ω 8.5 µΩ/Ω 8.5 µΩ/Ω 8.5 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 20 µΩ/Ω 21 µΩ/Ω 40 µΩ/Ω 47 µΩ/Ω 100 µΩ/Ω	Primary multi-function calibrator

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Voltage – Measure			
(1 to 12) 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 µV 0.02 % + 1.1 µV 0.03 % + 1.1 µV 0.1 % + 1.1 µV 0.5 % + 1.1 µV 4 % + 2 µV	Long scale multimeter
(12 to 120) 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	72 µV/V + 4 µV 72 µV/V + 2 µV 0.014 % + 2 µV 0.033 % + 2.5 µV 0.08 % + 2 µV 0.3 % + 10 µV 1 % + 10 µV 1.5 % + 10 µV	
120 mV to 1.2 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	72 µV/V + 40 µV 72 µV/V + 20 µV 0.014 % + 20 µV 0.03 % + 20 µV 0.08 % + 20 µV 0.3 % + 100 µV 1 % + 100 µV 1.5 % + 100 µV	

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Voltage – Measure (cont)			
(1.2 to 12) 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	72 µV/V + 0.4 mV 72 µV/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	Long scale multimeter
(12 to 120) 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 % + 2 mV 0.02 % + 2 mV 0.04 % + 2 mV 0.12 % + 2 mV 0.4 % + 10 mV 1.5 % + 10 mV	
(120 to 700) 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 0.12 % + 20 mV 0.3 % + 20 mV	
AC Voltage – Generate			
(0.22 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	0.025 % + 4 µV 91 µV/V + 4 µV 90 µV/V + 4 µV 0.02 % + 4 µV 0.053 % + 5 µV 0.11 % + 10 µV 0.14 % + 20 µV 0.27 % + 20 µV	Primary multi-function calibrator with precision amplifier
(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	0.028 % + 4 µV 94 µV/V + 4 µV 84 µV/V + 4 µV 0.02 % + 4 µV 0.05 % + 5 µV 0.11 % + 10 µV 0.14 % + 20 µV 0.27 % + 20 µV	

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	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	0.024 % + 12 µV 91 µV/V + 7 µV 81 µV/V + 7 µV 0.02 % + 8 µV 0.046 % + 17 µV 0.09 % + 20 µV 0.14 % + 25 µV 0.27 % + 45 µV	Primary multi-function calibrator with precision amplifier
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	0.024 % + 44 µV 90 µV/V + 18 µV 48 µV/V + 8 µV 80 µV/V + 12 µV 0.011 % + 35 µV 0.042 % + 80 µV 0.1 % + 200 µV 0.17 % + 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	0.024 % + 420 µV 90 µV/V + 150 µV 45 µV/V + 80 µV 75 µV/V + 140 µV 0.01 % + 350 µV 0.028 % + 600 µV 0.1 % + 2000 µV 0.15 % + 3200 µV	
(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	0.024 % + 4.1 mV 91 µV/V + 1.5 mV 53 µV/V + 0.8 mV 82 µV/V + 1.5 mV 0.015 % + 3.4 mV 0.09 % + 16 mV 0.44 % + 40 mV 0.8 % + 80 mV	Primary multi-function calibrator
(220 to 250) V	(15 to 50) Hz	0.03 % + 16 mV	
(220 to 1100) V	50 Hz to 1 kHz	71 µV/V + 3.7 mV	
(220 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	90 µV/V + 4.5 mV 0.017 % + 6 mV 0.06 % + 11 mV	Primary multi-function calibrator with precision amplifier
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.06 % + 11 mV 0.23 % + 45 mV	

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Current – Measure			
(12 to 120) µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz	0.4 % + 30 nA 0.15 % + 30 nA 0.06 % + 30 nA 0.06 % + 30 nA	Long scale multimeter
120 µA to 1.2 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.4 % + 200 nA 0.15 % + 200 nA 0.06 % + 200 nA 0.03 % + 200 nA	
(1.2 to 12) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.4 % + 2 µA 0.15 % + 2 µA 0.06 % + 2 µA 0.03 % + 2 µA	
(12 to 120) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.4 % + 20 µA 0.15 % + 20 µA 0.06 % + 20 µA 0.03 % + 20 µA	
(0.12 to 1) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.4 % + 200 µA 0.16 % + 200 µA 0.08 % + 200 µA 0.1 % + 200 µA	
(0.04 to 0.1999) A (0.2 to 0.9999) A (1 to 20) A	(20 to 500) Hz (20 to 500) Hz (20 to 500) Hz	0.15 % 0.081 % 0.051 %	Precision current monitor
(20 to 5000) A (5 to 17) kA	60 Hz 60 Hz	0.08 % 0.38 %	Primary current transformers & precision current monitor

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Current – Generate			
(10 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 16 nA 0.016 % + 10 nA 0.012 % + 8 nA 0.028 % + 12 nA 0.11 % + 65 nA	Precision multi-function calibrator
(0.22 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	0.025 % + 40 nA 0.016 % + 35 nA 0.012 % + 35 nA 0.02 % + 110 nA 0.11 % + 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	0.025 % + 400 nA 0.016 % + 350 nA 0.012 % + 350 nA 0.02 % + 550 nA 0.11 % + 5000 nA	
(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	0.025 % + 4 µA 0.016 % + 3.5 µA 0.012 % + 2.5 µA 0.02 % + 3.5 µA 0.11 % + 10 µA	
(0.22 to 2.2) A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.026 % + 39 µA 0.045 % + 80 µA 0.7 % + 160 µA	
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.046 % + 170 µA 0.095 % + 380 µA 0.36 % + 750 µA	Precision multi-function calibrator with precision amplifier
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.12 % + 5000 µA 0.15 % + 5000 µA 3 % + 5000 µA	Precision multi-function calibrator
Phase – Generate[3]			
(0 to 90)°	(10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.1° 0.25° 0.5° 2.5° 5° 10°	Precision multi-function calibrator with phase generation

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Electrical Calibration of Thermocouple Devices[3] –			
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 0.16 °C 0.14 °C 0.16 °C 0.21 °C	Precision multi-function calibrator with temperature generation
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.27 °C 0.16 °C 0.14 °C 0.17 °C 0.23 °C	
Type K	(-200 to -100) °C (-100 to -30) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.33 °C 0.18 °C 0.16 °C 0.26 °C 0.4 °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 0.24 °C 0.16 °C 0.14 °C	

III. Mechanical

Parameter/Equipment	Range	CMC[2, 4, 9] (±)	Comments
Gage Pressure	(0 to 1000) psig	0.27 psig	Precision pressure calibrator
	(150 to 830) psig (830 to 1080) psig (1080 to 1330) psig (1330 to 1500) psig (1500 to 8650) psig (8650 to 10 900) psig (10 900 to 13 150) psig (13 150 to 15 000) psig	0.026 % 0.027 % 0.028 % 0.029 % 0.031 % 0.032 % 0.033 % 0.034 %	Primary deadweight tester
	(10 000 to 40 000) psig	11 psig	Precision pressure calibrator
Torque Transducers	(5 to 250) lbf·ft (5 to 1000) lbf·ft	0.07 % 0.086 %	Class F weights mounted on a precision torque arm
Torque Wrenches[3]	(5 to 1000) lbf·ft	0.7 %	Precision torque transducer system
Mass – Measure, Fixed Points	1 mg 2 mg 3 mg 5 mg 10 mg 20 mg 30 mg 50 mg 100 mg 200 mg 300 mg 500 mg 1 g 2 g 3 g 5 g 10 g 20 g 30 g 50 g 100 g 200 g 300 g 500 g 1000 g 2000 g	0.0033 mg 0.0033 mg 0.0033 mg 0.0033 mg 0.0069 mg 0.0069 mg 0.0069 mg 0.0069 mg 0.0088 mg 0.0088 mg 0.0088 mg 0.0089 mg 0.0081 mg 0.0089 mg 0.0085 mg 0.011 mg 0.024 mg 0.025 mg 0.024 mg 0.032 mg 0.077 mg 0.11 mg 0.11 mg 0.42 mg 0.46 mg 0.94 mg	Double substitution method comparison to Ultra Class standard weights using a precision balance

Parameter/Equipment	Range	CMC[2] (±)	Comments
Scales & Balances[3]	(2 to 500) mg 500 mg to 5 g (5 to 20) g (20 to 50) g (50 to 100) g (100 to 200) g (200 to 500) g (0.5 to 1) kg (1 to 2) kg (2 to 3) kg (3 to 5) kg (5 to 10) kg (10 to 32) kg	0.0013 mg 0.007 mg 0.03 mg 0.064 mg 0.13 mg 0.24 mg 0.61 mg 1.5 mg 2.5 mg 10 mg 0.15 g 0.2 g 0.36 g	Reference weights up to 32 kg
Force[3] – Compression & Tension – Measure	(40 to 1000) lbf (1001 to 2000) lbf (2001 to 5000) lbf (5001 to 10 000) lbf (10 001 to 25 000) lbf (25 001 to 50 000) lbf (50 001 to 100 000) lbf	0.52 lbf 1.1 lbf 1.4 lbf 2.6 lbf 6.3 lbf 13 lbf 25 lbf	Precision Load Cells & system

IV. Thermodynamics

Parameter/Equipment	Range	CMC[2, 9] (±)	Comments
Temperature – Measure	(-190 to 660) °C	0.044 °C	Precision thermometer with reference SPRT, precision temperature baths & furnace
	(200 to 1000) °C	0.9 °C	Precision temperature baths & furnace
Temperature – Measuring Equipment, Thermocouples[7]			
Type E	(20 to 660) °C	0.6 °C	Blackstack, SPRT, precision temperature baths & furnace
Type J	(50 to 660) °C	0.6 °C	
Type K	(50 to 660) °C	0.61 °C	
Type N	(50 to 660) °C	0.6 °C	
Type T	(50 to 350) °C	0.6 °C	
Type J	(200 to 700) °C	1.1 °C	Type S thermocouple, indicator, baths&furnaces
Type K	(200 to 700) °C	1.1 °C	

Parameter/Equipment	Range	CMC[2, 9] (±)	Comments
Infrared Temperature - Measuring Equipment 3	(-15 to 120) °C (120 to 200) °C (200 to 350) °C (350 to 500) °C	0.67 °C 1 °C 1.6 °C 2.2 °C	Primary infrared temperature blackbody sources ε = 0.9 to 1.0 λ = (8 to 14) µm

V. Time & Frequency

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Frequency – Measuring Equipment[3]	0.01 Hz to 2 MHz	2.5 µHz/Hz + 5 µHz	Precision multi-function calibrator
Frequency – Measure	(1 to 100) Hz 100 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz 100 kHz to 1 MHz (1 to 10) MHz (10 to 100) MHz (100 to 225) MHz 225 MHz to 1 GHz (1 to 3) GHz	6.6 µHz 20 µHz 130 µHz 1.2 mHz 9.3 mHz 9.3 mHz 2.4 mHz 5.1 mHz 23 mHz 65 mHz	Precision frequency counter referenced to the GPS

[1] This laboratory offers commercial and field calibration service where noted.

[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] Field calibration service is available for this calibration. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found 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 actual uncertainty introduced by the item being calibrated, (e.g., resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC

[4] In the statement of CMC, *L* is the numerical value of the nominal length of the device measured in inches, *R* is the resolution of the device under test, and % is the percentage of the reading.

[5] Uncertainties for metric micrometers and calipers up to 900 mm are available upon request.

[6] 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 percent or fraction of the reading plus a fixed floor specification.

[7] The CMC associated with Temperature – Measuring Equipment, Thermocouples does not include inhomogeneity of the test thermocouple.

[8] This scope meets A2LA's *P112 Flexible Scope Policy*.

[9] 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.

Accredited Laboratory

A2LA has accredited

CONSTELLATION POWERLABS - MADISON, PA

Madison, PA

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and the requirements of ANSI/NCSL Z540.3-2006 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 8th day of September 2025.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2044.03
Valid to August 31, 2027

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