



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3-2006

NATIONAL TECHNICAL SYSTEMS (NTS)
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CALIBRATION

Valid To: March 31, 2020

Certificate Number: 0214.25

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Dimensional

Parameter/Equipment	Range	CMC ² (±)	Comments
Dial Indicators	Up to 4 in	23 µin	Mitutoyo 516-930
Digital/Dial Calipers – Inside, Outside, Depth	Up to 6 in	16 µin	Mitutoyo 516-930
Micrometers	Up to 6 in	16 µin	Mitutoyo 516-930

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
DC Voltage – Generate	(0 to 330) mV (0.33 to 3.3) V (3.3 to 33) V (30 to 330) V (100 to 1020) V	9.7 µV/V rdg + 3 µV 6.9 µV/V rdg + 5 µV 8.0 µV/V rdg + 50 µV 0.0012 % rdg + 500 µV 0.0015 % rdg + 1500 µV	Fluke 5500A
DC Voltage – Measure	(0 to 100) mV (0.1 to 1) V (1 to 10) V	0.00015 % rdg + 3.5 µV 0.00014 % rdg + 7 µV 0.00014 % rdg + 50 µV	Agilent 34401A

Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
DC Voltage – Measure (cont)	(10 to 100) V (100 to 1000) V	0.00019 % rdg + 0.6 mV 0.002 % rdg + 10 mV	Agilent 34401A
DC Current – Generate	(0 to 3.3) mA (3.3 to 33) mA (33 to 330) mA (0.33 to 2.2) A (2.2 to 11) A	0.0033 % rdg + 0.05 µA 0.0011 % rdg + 0.25 µA 0.0024 % rdg + 3.3 µA 0.0038 % rdg + 44 µA 0.018 % rdg + 330 µA	Fluke 5500A
Clamp-On Meters	(10 to 550) A	0.2 % rdg + 0.5 A	Fluke 5500A with 5500A/Coil
DC Current – Measure	(0 to 10) mA (10 to 100) mA (0.1 to 1) A (0 to 3) A (3 to 5) A (5 to 10) A	0.0015 % rdg + 0.02 % rng 0.0081 % rdg + 0.005 % rng 0.014 % rdg + 0.01 % rng 0.034 % rdg + 0.02 % rng 0.021 % rdg + 10 lsd 0.02 % rdg + 2 lsd	Agilent 34401A Fluke 289
Resistance – Generate	(1.00 to 10.99) Ω (11 to 32.99) Ω (33 to 109.9) Ω (33 to 329.99) Ω (0.33 to 1.099) kΩ (1.1 to 3.299) kΩ (3.3 to 10.9) kΩ (11 to 32.99) kΩ (33 to 109.99) kΩ (110 to 329.99) kΩ (0.33 to 1.099) MΩ (1.1 to 3.299) MΩ (3.3 to 10.99) MΩ (11 to 32.99) MΩ (33 to 110) MΩ	0.003 % rdg + 0.008 Ω 0.0029 % rdg + 0.015 Ω 0.0012 % rdg + 0.015 Ω 0.0014 % rdg + 0.015 Ω 0.0011 % rdg + 0.06 Ω 0.0043 % rdg + 0.06 Ω 0.0013 % rdg + 0.6 Ω 0.0019 % rdg + 0.6 Ω 0.0012 % rdg + 6 Ω 0.0024 % rdg + 6 Ω 0.0014 % rdg + 55 Ω 0.0018 % rdg + 55 Ω 0.0049 % rdg + 550 Ω 0.0076 % rdg + 5.5 kΩ 0.042 % rdg + 5.5 kΩ	Fluke 5500A (2 wire)
Resistance – Measure	(0 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ	0.0049 % rdg + 0.004 % rng 0.0018 % rdg + 0.001 % rng 0.0018 % rdg + 0.001 % rng 0.0021 % rdg + 0.001 % rng 0.0077 % rdg + 0.001 % rng 0.046 % rdg + 0.001 % rng 0.19 % rdg + 0.01 % rng	Agilent 34401A (2 wire)

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
AC Voltage – Generate			
(0 to 32.99) mV	45 Hz (0.045 to 1) kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz	0.03 % rdg + 20 μV 0.018 % rdg + 20 μV 0.017 % rdg + 20 μV 0.018 % rdg + 20 μV 0.033 % rdg + 20 μV	Fluke 5500A
(33 to 329.99) mV	45 Hz (0.045 to 1) kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz	0.019 % rdg + 20 μV 0.0055 % rdg + 20 μV 0.0065 % rdg + 20 μV 0.011 % rdg + 20 μV 0.022 % rdg + 40 μV	
(0.33 to 3.299) V	45 Hz (0.045 to 1) kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz	0.012 % rdg + 250 μV 0.0043 % rdg + 60 μV 0.0042 % rdg + 60 μV 0.0076 % rdg + 60 μV 0.016 % rdg + 300 μV	
(3.3 to 32.99) V	45 Hz (0.045 to 1) kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz	0.012 % rdg + 2500 μV 0.0088 % rdg + 600 μV 0.0075 % rdg + 600 μV 0.0098 % rdg + 2600 μV 0.018 % rdg + 5000 μV	
(33 to 329.99) V	45 Hz (0.045 to 1) kHz (1 to 10) kHz (10 to 20) kHz	0.043 % rdg + 6.6 mV 0.0081 % rdg + 6.6 mV 0.0099 % rdg + 15 mV 0.011 % rdg + 33 mV	
(330 to 1020) V	45 Hz (0.045 to 1) kHz (1 to 5) kHz (5 to 10) kHz	0.01 % rdg + 80 mV 0.0077 % rdg + 80 mV 0.015 % rdg + 100 mV 0.015 % rdg + 500 mV	
AC Current – Generate			
(29 to 329) μA	45 Hz 1 kHz 5 kHz 10 kHz	0.025% rdg + 0.25 μA 0.03% rdg + 0.25 μA 0.043% rdg + 0.15 μA 0.11% rdg + 0.15 μA	Fluke 5500A
(0.33 to 3.29) mA	45 Hz 1 kHz 5 kHz 10 kHz	0.019% rdg + 0.3 μA 0.024% rdg + 0.3 μA 0.026% rdg + 0.3 μA 0.11% rdg + 0.3 μA	

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
AC Current – Generate (cont)			
(3.3 to 32.9) mA	45 Hz 1 kHz 5 kHz 10 kHz	0.059 % rdg + 3 µA 0.039 % rdg + 3 µA 0.036 % rdg + 3 µA 0.056 % rdg + 3 µA	Fluke 5500A
(33 to 329.9) mA	45 Hz 1 kHz 5 kHz 10 kHz	0.015 % rdg + 30 µA 0.021 % rdg + 30 µA 0.022 % rdg + 30 µA 0.054 % rdg + 30 µA	
(0.33 to 2.19) A	45 Hz 1 kHz 5 kHz	0.037 % rdg + 300 µA 0.034 % rdg + 300 µA 0.14 % rdg + 300 µA	
(2.2 to 11) A	45 Hz 500 Hz 1 kHz	0.027 % rdg + 2000 µA 0.03 % rdg + 2000 µA 0.037 % rdg + 2000 µA	
Clamp-On Meters (10 to 550) A	(50 to 400) Hz	0.42 % rdg + 0.1 A	
AC Voltage – Measure			
(0 to 100) mV	0.045 Hz to 20 kHz (20 to 50) kHz	0.019 % rdg + 0.04 % rng 0.072 % rdg + 0.04 % rng	Agilent 34401A
(0.1 to 1) V	0.045 Hz to 20 kHz (20 to 50) kHz	0.0096 % rdg + 0.03 % rng 0.033 % rdg + 0.05 % rng	
(1 to 10) V	0.045 Hz to 20 kHz (20 to 50) kHz	0.0079 % rdg + 0.03 % rng 0.015 % rdg + 0.05 % rng	
(10 to 100) V	0.045 Hz to 20 kHz (20 to 50) kHz	0.0089 % rdg + 0.03 % rng 0.039 % rdg + 0.05 % rng	
(100 to 750) V	0.045 Hz to 1 kHz	0.027 % rdg + 0.03 % rng	
AC Current – Measure			
(0 to 1) A	(0.045 to 5) kHz	0.052 % rdg + 0.04 % rng	Agilent 34401A
(1 to 3) A	(0.045 to 5) kHz	0.12 % rdg + 0.06 % rng	

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
Capacitance – Generate	400 pF (0.4 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 30) μF (33 to 110) μF	0.54 % rdg + 0.01 nF 0.21 % rdg + 0.01 nF 0.14 % rdg + 0.01 nF 0.10 % rdg + 0.01 nF 0.067 % rdg + 0.1 nF 0.069 % rdg + 0.1 nF 0.11 % rdg + 0.3 nF 0.071 % rdg + 1 nF 0.088 % rdg + 3 nF 0.098 % rdg + 10 nF 0.12 % rdg + 30 nF 0.22 % rdg + 100 nF	Fluke 5500A
Electrical Simulation of Thermocouples –			Fluke 5500A
Type T	(-200 to 400) °C	0.1 °C	
Type J	(-200 to 760) °C	0.1 °C	
Type E	(-230 to 1000) °C	0.11 °C	
Type K	(-190 to 0) °C (0 to 100) °C (100 to 500) °C (500 to 1000) °C (1000 to 1370) °C	0.12 °C 0.085 °C 0.061 °C 0.071 °C 0.093 °C	

III. Mechanical

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Force – Measuring Instruments (Tension)	(5 to 500) mg	3.9 μg	Class S1
	(1 to 100) g	46 μg	Class S1
	(100 to 500) g	3.6 mg	NBS-C
	(500 to 5000) g	2.7 mg	Class 1
	(1 to 10) lbs, (0.4 to 4.5) kg	23 mg	NBS-C
	(10 to 160) lbs, (4.5 to 72.6) kg	1.9 g	NBS-C

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Pressure –Measuring Equipment	Nitrogen		Easton Pressure Standard
	(0 to 20) psia	0.068 % of rng	
	(0 to 50) psia	0.055 % of rng	
	(0 to 100) psia	0.031 % of rng	
	(0 to 20) psig	0.068 % of rng	
	(0 to 50) psig	0.055 % of rng	
	(0 to 100) psig	0.031 % of rng	
	(0 to 200) psig	0.036 % of rng	
	(0 to 500) psig	0.049 % of rng	
	(0 to 1000) psig	0.041 % of rng	
	(0 to 2000) psig	0.040 % of rng	
	(0 to 5000) psig	0.049 % of rng	
	(0 to 100) psig		
Vacuum	(0 to 30) inHg	0.068 % of rng	Mansfield & Green T-100
Hydraulic	(0 to 10 000) lbs	0.046 % of rng	Mansfield & Green T-100
Scales & Balances	(5 to 500) mg	3.9 µg	Class S1
	(1 to 100) g	46 µg	Class S1
	(100 to 500) g	3.6 mg	NBS-C
	(500 to 5000) g	2.7 mg	Class 1
	(1 to 10) lbs	23 mg	NBS-C
	(10 to 160) lbs	1.9 g	NBS-C
Torque - Wrenches and Drivers	(>25 to 50) in.lbf	0.29 % of rdg	Proto Tool J6472
	(>50 to 100) in.lbf	0.24 % of rdg	
	(>100 to 150) in.lbf	0.12 % of rdg	
	(>150 to 200) in.lbf	0.18 % of rdg	
	(>200 to 250) in.lbf	0.18 % of rdg	
	(>25 to 50) ft.lbf	0.53 % of rdg	Proto Tool J6476
	(>50 to 100) ft.lbf	0.33 % of rdg	
	(>100 to 150) ft.lbf	0.46 % of rdg	
	(>150 to 200) ft.lbf	0.8 % of rdg	
	(>200 to 250) ft.lbf	0.94 % of rdg	

IV. Thermodynamics

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Temperature – Measure			
Type T	(-200 to 400) °C	0.19 °C	Omega CL26
Type J	(-200 to 760) °C	0.29 °C	
Type E	(-230 to 1000) °C	0.21 °C	
Type K	(-190 to 0) °C	0.5 °C	
	(0 to 100) °C	0.18 °C	
	(100 to 500) °C	0.19 °C	
	(500 to 1000) °C	0.19 °C	
	(1000 to 1370) °C	0.22 °C	
Humidity – Generate			Humidity standard:
Fixed Points	0.5 % RH	0.32 % RH	EA00-SCS
	10 % RH	0.32 % RH	EA10-SCS
	35 % RH	0.42 % RH	EA35-SCS
	50 % RH	0.6 % RH	EA50-SCS
	80 % RH	0.71 % RH	EA80-SCS
	95 % RH	0.81 % RH	EA95-SCS
Humidity – Measure	(0 to 100) % RH	0.56 % RH	Rotronic HP22

V. Time & Frequency



Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Timers & Stop Watches	(0 to 24) Hours	1.2 µHz/Hz	HP 5335B HP 3325A
Frequency – Measuring Equipment	DC to 20 MHz	0.66 µHz/Hz	HP 3325A
	(20 to 250) MHz	0.45 % of rdg	TEK SG 503
	(250 to 1) GHz	0.67 % of rdg	TEK SG 504
Frequency – Measure	DC to 200 MHz	1.2 µHz/Hz	HP 5335A

¹ This laboratory does not offer commercial calibration service 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 of 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. CMC's are expressed as either a specific value that covers the full range of as a percent or fraction 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

NATIONAL TECHNICAL SYSTEMS (NTS)

Fullerton, 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 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 20th day of September 2018.

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

President and CEO
For the Accreditation Council
Certificate Number 0214.25
Valid to March 31, 2020

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