



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

ASSOCIATED RESEARCH, INC
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CALIBRATION

Valid To: February 28, 2019

Certificate Number: 2789.01

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/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Measure			
(1 to 100) mV	10 Hz to 20 kHz	0.16 % rdg + 0.04 mV	HP 34401A direct read
100 mV to 1 V	10 Hz to 20 kHz	0.11 % rdg + 0.4 mV	
(1 to 750) V	10 Hz to 20 kHz	0.07 % rdg + 0.3 V	
(10 to 30) V	(40 to 1000) Hz	0.05 % rdg + 0.2 % rng	N4L PPA530 direct read
(30 to 100) V	(40 to 1000) Hz	0.14 % rdg + 0.1 % rng	
(100 to 300) V	(40 to 1000) Hz	0.09 % rdg + 0.1 % rng	
(300 to 1000) V	(40 to 1000) Hz	0.09 % rdg + 0.1 % rng	
(10 to 100) mV	(40 to 1000) Hz	0.012 % rdg + 2.0 μV	HP 3458A direct read for wideband leakage
100 mV to 1 V		0.012 % rdg + 20 μV	
(1 to 10) V		0.012 % rdg + 0.2 mV	
(10 to 100) V		0.012 % rdg + 2.0 mV	
(10 to 100) mV	(1 to 20) kHz	0.02 % rdg + 2.0 μV	
100 mV to 1 V		0.02 % rdg + 20 μV	
(1 to 10) V		0.02 % rdg + 0.2 mV	
(10 to 100) mV	(20 to 50) kHz	0.04 % rdg + 2.0 μV	
100 mV to 1 V		0.04 % rdg + 20 μV	
(1 to 10) V		0.04 % rdg + 0.2 mV	
(10 to 100) mV	(50 to 100) kHz	0.09 % rdg + 2.0 μV	
100 mV to 1 V		0.09 % rdg + 20 μV	
(1 to 10) V		0.09 % rdg + 0.2 mV	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Measure (cont) (10 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) mV 100 mV to 1 V (1 to 10) V	(100 to 300) kHz 300 kHz to 1 MHz	0.31 % rdg + 2.0 μV 0.32 % rdg + 0.1 mV 0.32 % rdg + 1 mV 1.1 % rdg + 10 μV 1.1 % rdg + 0.1 mV 1.1 % rdg + 1.0 mV	HP 3458A direct read for wideband leakage
AC High Voltage – Measure (0.3 to 10) kV (10 to 20) kV	(50, 60) Hz (50, 60) Hz	0.6 % rdg + 0.25 V 1.0 % rdg + 0.25 V	HP 34401A and Ross VD30-12.5Y-A-LB- TAL
AC Current – Measure (0 to 100) μA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) mA (1 to 10) mA (0.1 to 1) mA (1 to 10) mA (0.1 to 1) mA (1 to 10) mA (0.1 to 1) mA (1 to 10) mA (30 to 300) mA (0 to 300) μA (0.3 to 20) mA (20 to 100) mA (0.3 to 1) A (1 to 3) A (3 to 10) A (10 to 30) A (30 to 60) A (1 to 60) A	(45 to 1000) Hz (45 to 5000) Hz (45 to 5000) Hz (45 to 5000) Hz (5 to 20) kHz (5 to 20) kHz (20 to 50) kHz (20 to 50) kHz (50 to 100) kHz (50 to 100) kHz (50 to 60) Hz (65 to 800) Hz (65 to 800) Hz (65 to 800) Hz (50, 60) Hz (50, 60) Hz (50, 60) Hz (50, 60) Hz (50, 60) Hz (50, 60) Hz	0.1 % rdg 0.09 % rdg 0.09 % rdg 0.14 % rdg 0.09 % rdg 0.11 % rdg 0.44 % rdg 0.42 % rdg 0.71 % rdg 0.8 % rdg 0.5 % rdg + 0.3 mA 1.3 % rdg + 35 μA 1.3 % rdg + 35 μA 1.3 % rdg + 0.35 mA 0.15 % rdg + 0.1 % rng 0.35 % rdg + 0.1 % rng 0.21 % rdg + 0.1 % rng 0.35 % rdg + 0.1 % rng 1.3 % rdg 0.31 % rdg + 0.04 A	HP 3458A MetraHit 29s, Powerlogger 10 Line test with N4L PPA530 direct read With Metrawatt CP1100 100 A clamp Ground bond test with HP 34401A and Deltec CS100

Parameter/Range	Frequency	CMC ² (±)	Comments
Real Power – Measure & Generate ³		Pf = W/VA	Power factor is computed based on measured real power divided by apparent power. Accuracy is dependant of measured watt
Power Factor (0 to 1)	(50, 60) Hz	0.1 % reading + (1 - 0.990 × e ^{1/W})	CMCpower (Watts) = Ireading*Verror + Vreading*Ierror
Voltage Range (10, 30, 100, 300, 1000) V	DC, (40 to 1000) Hz	where: Verror = % rdg + % rng	Line test with N4L PPA530 direct read
Current Range (1, 3, 10, 30, 100) A	DC, (50, 60) Hz	Ierror = % rdg + % rng	

Parameter/Equipment	Range	CMC ² (±)	Comments
DC Voltage – Measure	(1 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V	0.015 % rdg + 3.5 μV 0.017 % rdg + 70 μV 0.014 % rdg + 50 μV 92 μV/V + 600 μV 64 μV/V + 10 mV	HP 34401A direct read
	(10 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V	0.002 % rdg 0.001 % rdg 0.001 % rdg 0.001 % rdg	HP 3458A direct read for DC line leakage test
DC High Voltage – Measure	(0.3 to 10) kV	0.3 % rdg	HP 34401A and Ross VD30-12.5Y-A-LB- TAL
	(10 to 20) kV	0.5 % rdg	

Parameter/Equipment	Range	CMC ² (±)	Comments
DC Current – Measure	Up to 100 nA (0.1 to 1) μA (1 to 10) μA (10 to 100) μA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA	0.49 nA/A + 0.04 nA 71 μA/A + 0.04 nA 68 μA/A + 0.4 nA 33 μA/A + 0.8 nA 35 μA/A + 5.0 nA 0.41 mA/A + 5.0 nA 0.016 % + 0.5 μA	HP 3458A
	(30 to 300) mA	0.05 % rdg + 35 μA	MetraHit 29s and Powerlogger 10
	(1 to 40) A	0.3 % rdg	Ground bond test with HP 3458A and Deltec CS100
Resistance – Generate	(10 to 600) mΩ	0.45 mΩ	Custom load fixture
	(0.01 to 0.1) Ω (0.1 to 100) Ω (100 to 1000) Ω	0.37 % rdg + 15 mΩ 0.1 % rdg + 15 mΩ 0.1 % rdg + 15 mΩ	Prime Technology RDS52-A
	(1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ	0.1 % rdg 0.1 % rdg 0.1 % rdg 0.1 % rdg	Prime Technology RDS56-A
	(10 to 1000) MΩ (1 to 100) GΩ	1.2 % rdg 2.0 % rdg	Custom built resistance load fixture
Resistance – Measure	(0.010 to 10) Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) kΩ (10 to 100) kΩ (100 to 1000) kΩ (1 to 10) MΩ (10 to 100) MΩ (100 to 1000) MΩ	14 μΩ/Ω + 50 μΩ 15 μΩ/Ω + 0.5 mΩ 13 μΩ/Ω + 0.5 mΩ 13 μΩ/Ω + 5.0 mΩ 13 μΩ/Ω + 50 mΩ 43 μΩ/Ω + 2.0 Ω 0.012 % + 100 Ω 0.3 % + 1.0 kΩ 0.53 % + 10 kΩ	HP 3458A

II. Time & Frequency

Parameter/Range	Frequency	CMC ² (\pm)	Comments
Frequency – Measure 100 mV to 750 V	40 Hz to 300 kHz	0.02 % rdg	HP 34401A
Time Interval	1 s to 1 hr	2.2 μ s/s	HP 5316B

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 CMC is computed based on voltage and current measurement.



Accredited Laboratory

A2LA has accredited

ASSOCIATED RESEARCH, INC.

Lake Forest, IL

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 28th day of April, 2017.

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

President and CEO
For the Accreditation Council
Certificate Number 2789.01
Valid to February 28, 2019

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