SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

GUILDLINE INSTRUMENTS LIMITED
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CALIBRATION

Valid To: September 30, 2025 Certificate Number: 2906.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1, 7]:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 3, 6] (±)	Comments
DC Resistance Ratios			
Bridge Ratios	1:1 @ 1 Ω	0.02 parts per 10^6	Measurement of resistance ratio bridges using an interchange technique
	1:1 @ 10 Ω	0.02 parts per 10^6	
	1:1 @ 100 Ω	0.02 parts per 10^6	
	1:1 @ 1 kΩ	0.02 parts per 10^6	
	1:1 @ 10 kΩ	0.05 parts per 10^6	
	1:1 @ 100 kΩ	0.1 parts per 10^6	
	1:1 @ 1 MΩ	0.15 parts per 10^6	
	1:1 @ 10 MΩ	0.5 parts per 10^6	
	1:1 @ 100 MΩ	1.5 parts per 10^6	
	10:1 @ 1 Ω	0.03 parts per 10^6	Measurement of resistance ratio bridges using a reference ratio bridge
	10:1 @ 10 Ω	0.03 parts per 10^6	
	10:1 @ 100 Ω	0.03 parts per 10^6	
	10:1 @ 1 kΩ	0.03 parts per 10^6	
	10:1 @ 10 kΩ	0.05 parts per 10^6	Reference resistance ratio bridge
	10:1 @ 100 kΩ	0.25 parts per 10^6	
	10:1 @ 1 MΩ	0.80 parts per 10^6	
	10:1 @ 10 MΩ	2.2 parts per 10^6	
	10:1 @ 100 MΩ	5.0 parts per 10^6	

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Parameter/Equipment	Range	CMC[2, 3, 6] (±)	Comments
DC Resistance Ratios (cont)			
Bridge Ratios	0.1:1 @ 1 Ω 0.1:1 @ 10 Ω 0.1:1 @ 100 Ω 0.1:1 @ 1 kΩ 0.1:1 @ 10 kΩ 0.1:1 @ 100 kΩ 0.1:1 @ 1 MΩ 0.1:1 @ 10 MΩ 0.1:1 @ 100 MΩ	0.05 parts per 10^6 0.05 parts per 10^6 0.05 parts per 10^6 0.05 parts per 10^6 0.05 parts per 10^6 0.1 parts per 10^6 0.3 parts per 10^6 1.0 parts per 10^6 3.0 parts per 10^6	Measurement of resistance ratio bridges using a reference ratio bridge Reference resistance ratio bridge
	100:1 @ 1 Ω 100:1 @ 10 Ω 100:1 @ 100 Ω 100:1 @ 1 kΩ 100:1 @ 10 kΩ 100:1 @ 100 kΩ 100:1 @ 1 MΩ 100:1 @ 10 MΩ	0.05 parts per 10^6 0.05 parts per 10^6 0.05 parts per 10^6 0.1 parts per 10^6 0.3 parts per 10^6 1.0 parts per 10^6 3.0 parts per 10^6 6.0 parts per 10^6	Measurement of resistance ratio bridges using a reference ratio bridge Reference resistance ratio bridge
Extender Ratios	x10 @ 1 Ω x20 @ 1 Ω x100 @ 1 Ω x200 @ 1 Ω x400 @ 1 Ω x1000 @ 1 Ω x2000 @ 1 Ω x4000 @ 1 Ω x10 000 @ 1 Ω x20 000 @ 1 Ω x40 000 @ 1 Ω x100 000 @ 1 Ω	0.6 parts per 10^6 0.6 parts per 10^6 0.6 parts per 10^6 0.6 parts per 10^6 0.6 parts per 10^6 0.7 parts per 10^6 0.7 parts per 10^6 0.7 parts per 10^6 0.7 parts per 10^6 1.5 parts per 10^6 1.4 parts per 10^6 2.5 parts per 10^6	Measurement of associated range extenders using a reference ratio bridge Reference resistance ratio bridge

Parameter/Equipment	Range	CMC[2, 3, 6] (±)	Comments
DC Resistance[5] – Generate and Measure			
Resistance Ranges	(1 to 10) μΩ (10 to 100) μΩ 100 μΩ to 1 mΩ (1 to 10) mΩ (10 to 100) mΩ 100 mΩ to 1 Ω	100 μΩ/Ω 80 μΩ/Ω 50 μΩ/Ω 12 μΩ/Ω 12 μΩ/Ω 12 μΩ/Ω	Ratio metric comparison against reference high power resistance standards and shunts, using Guildline 6622A current comparator bridges and associated range extenders up to 1000 A
	(1 to 10) μΩ (10 to 100) μΩ 100 μΩ to 1 mΩ (1 to 10) mΩ (10 to 100) mΩ 100 mΩ to 1 Ω 1 Ω to 10 kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	25 μΩ/Ω 15 μΩ/Ω 2.0 μΩ/Ω 1.0 μΩ/Ω 0.80 μΩ/Ω 0.70 μΩ/Ω 0.25 μΩ/Ω 0.50 μΩ/Ω 1.3 μΩ/Ω 3.0 μΩ/Ω 7.0 μΩ/Ω 11 μΩ/Ω	Ratio metric comparison against reference resistance standards, using Guildline 6622A current comparator bridges up to 1000 V and associated range extenders up to 100 A
Fixed Decade Points	1 μΩ 10 μΩ 100 μΩ 1 mΩ 10 mΩ 100 mΩ	100 μΩ/Ω 80 μΩ/Ω 50 μΩ/Ω 10 μΩ/Ω 10 μΩ/Ω 10 μΩ/Ω	Ratio metric comparison against reference high powers resistance standards and shunts, using Guildline 6622A current comparator bridges and range extenders up to 1000 A
	1 μΩ 10 μΩ 100 μΩ 1 mΩ 10 mΩ 100 mΩ 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ	25 μΩ/Ω 15 μΩ/Ω 2.0 μΩ/Ω 1.0 μΩ/Ω 0.80 μΩ/Ω 0.70 μΩ/Ω 0.25 μΩ/Ω 0.25 μΩ/Ω 0.25 μΩ/Ω 0.25 μΩ/Ω 0.25 μΩ/Ω 1.0 μΩ/Ω 1.5 μΩ/Ω 4.5 μΩ/Ω 7.5 μΩ/Ω 12 μΩ/Ω	Ratio metric comparison against reference resistance standards, using interchange where 1:1 transfers exist on Guildline 6622A current comparator bridges (up to 1000 V) and associated range extenders up to 300 A

Parameter/Equipment	Range	CMC[2, 3, 4, 6] (±)	Comments
High Resistance[3] – Generate and Measure			
Resistance Ranges	100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ (1 to 10) GΩ (10 to 100) GΩ 100 GΩ to 1 TΩ (1 to 10) TΩ (10 to 100) TΩ 100 TΩ to 1 PΩ (1 to 10) PΩ	50 µΩ/Ω 12 µΩ/Ω 12 µΩ/Ω 15 µΩ/Ω 50 µΩ/Ω 70 µΩ/Ω 100 µΩ/Ω 190 µΩ/Ω 800 µΩ/Ω 0.80 % 8.0 %	Substitution of electrical resistance standards, using Guildline Teraohmmeter 6520 or 6530-XPR/C The uncertainties are based on the typical applied voltage is 1000 V for values 100 GΩ to 10 PΩ, 100 V for 10 GΩ, 10 V for 1 GΩ and 1 V for 100 MΩ down to 100 kΩ;
Fixed Decade Points	100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ 10 GΩ 100 GΩ 1 TΩ 10 TΩ 100 TΩ 1 PΩ 10 PΩ	50 µΩ/Ω 12 µΩ/Ω 12 µΩ/Ω 12 µΩ/Ω 15 µΩ/Ω 50 µΩ/Ω 70 µΩ/Ω 100 µΩ/Ω 190 µΩ/Ω 800 µΩ/Ω 0.80 % 8.0 %	Voltages outside the typical are available for most resistance values note that the uncertainties outside the typical voltages at high values may also depend on applied voltage (1 V to 1000 V) The above conditions are applied in both fixed decade points and resistance ranges.
DC Voltage – Generate	220 mV 2.2 V 11 V 22 V 220 V 1100 V	15 µV/V + 0.51 µV 8.8 µV/V + 0.90 µV 6.3 µV/V + 4.0 µV 6.3 µV/V + 6.0 µV 9.0 µV/V + 60 µV 13 µV/V + 600 µV	Generate voltage using calibrator: Fluke 5720A
DC Voltage – Measure	200 mV 2 V 20 V 200 V 1000 V	7.6 µV/V + 0.12 µV 5.0 µV/V + 0.51 µV 5.0 µV/V + 5.1 µV 7.5 µV/V + 51 µV 7.6 µV/V + 610 µV	Direct measurement of voltage using DMM: Fluke 8508A

Parameter/Equipment	Range	CMC[2, 3, 4, 6] (±)	Comments
DC Current – Generate	100 fA 1 pA 10 pA 100 pA 1 nA 10 nA 100 nA 1 µA 10 µA 220 µA 2.2 mA 22 mA 220 mA 2.2 A	2.0 % 0.20 % 0.20 % 500 µA/A 300 µA/A 300 µA/A 150 µA/A 150 µA/A 150 µA/A 63 µA/A + 7.1 nA 50 µA/A + 9 nA 50 µA/A + 60 nA 64 µA/A + 900 nA 110 µA/A + 16 µA	Generate low current through calibrator (Fluke 5720A) DC voltage stimulus over reference resistance value Uncertainties are based on applied voltage and resistance value used Generate current with calibrator (Fluke 5720A)
DC Current – Measure	(0.1 to 1) pA (1 to 10) pA (10 to 100) pA 100 pA to 1 nA (1 to 10) nA (10 to 100) nA 100 nA to 1 µA (1 to 10) µA 100 nA 1 µA 10 µA 100 µA 1 mA 10 mA 100 mA 1 A	3.0 % 0.50 % 0.10 % 650 µA/A 400 µA/A 250 µA/A 200 µA/A 150 µA/A 39 µA/A + 50 pA 29 µA/A + 50 pA 29 µA/A + 110 pA 28 µA/A + 900 pA 28 µA/A + 6 nA 28 µA/A + 60 nA 44 µA/A + 600 nA 130 µA/A + 11 µA	Direct measurement of low DC current using Teraohmeter Guildline 6520 or 6530-XPR/C Direct measurement of DC current using DMM: Keysight/Agilent 3458A

[1] This laboratory offers commercial calibration service.

[2] 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. 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] Where ranges are not specified, CMC stated is for the cardinal points only.

[4] In the statement of CMC, the value is defined as the percentage of reading.

[5] The stated uncertainties refer to negligible power dissipation. Resistors with significant power dissipation can be measured at voltages up to 1000 V and currents up to 1000 A with uncertainties in the range (3 to 300) x 10^{-6}. Resistors of modest dimensions suitable for oil immersion can be measured in the range from (20 to 28) °C. Resistors which are not oil immersible, depending on dimensions, can be measured over a temperature range (20 to 30) °C. Specific values are those which fall within ±0.5 % of the stated values.

[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. 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.

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

Accredited Laboratory

A2LA has accredited

GUILDLINE INSTRUMENTS LIMITED

Smiths Falls, Ontario, CANADA

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 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 27th day of March 2024.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2906.01
Valid to September 30, 2025

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