Calibration Laboratory Assessment Service

CLAS Certificate Number 96-01

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Clients Served: All interested parties. Some calibration services are available on-site. These services are indicated in the "Remarks" column of the following pages.

Field of Calibration: Dimensional, Mechanical, Electrical, Temperature, Frequency, Vibration

SCC Accreditation: (ISO/IEC 17025)
Accredited Laboratory No. 220
First issued 1995-10-03

This scope of capabilities is published by the CLAS program of the National Research Council of Canada (NRC) in close co-operation with the PALCAN program of the Standards Council of Canada (SCC), Canada's accreditation body for calibration and testing laboratories. The SCC accredits the capabilities of the named laboratory for performing the listed calibrations at the given level of uncertainty with traceability to the national measurement standards of Canada. The total uncertainty of the following capabilities, in each case, has a confidence level of at least 95 % and includes the NRC (or other recognized national laboratory) uncertainty, and uncertainties associated with the measurements made by the accredited laboratory. The uncertainty quoted does not include the possible effects on the customer's device of transportation, long term stability or intended use. See Supplementary Notes. For clients requiring a confidence level of 99 %, the laboratory is able to adjust the uncertainty accordingly.

The PDF version is provided for convenience, the NRC web-site remains the authoritative source for the current approved calibration and measurement capabilities

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Type I Capability		
Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Gauge block, length: Steel, Rectangular and Square		Calibration procedure is Canadian Forces Technical Order TO 33K6-4-1-1 issued 15 March 1992, as amended by Ulrich Metrology Inc.
• Inch, up to 4 inches	(0.5 + 1.6L) µinch or 2 µinch, whichever greater (Note: L in 'inches')	
• Inch, 5 to 20 inches	(2.3 + 1.1L) µinch (Note: L in 'inches')	
• Metric, up to 100 mm	(0.019 + 0.0018L) µm or 0.064 µm, whichever greater (Note: L in 'millimetres')	
• Metric, 125 to 500 mm	(0.062 + 0.0011L) µm (Note: L in 'millimetres')	
• Variation in length of gauge blocks (parallelism)	1 µinch or ± 0.025 µm	This measured quantity is commonly known as parallelism of gauge blocks.
Cylindrical ring gauge, diameter:		ANSI/ASME B89.1.6
• Inch up to 12 inches	(16 + 5.0L) µinch (Note: L in 'inches')	
• Metric up to 300 millimetres	(0.41 + 0.005L) µm (Note: L in 'millimetres')	
Cylindrical plug gauge, diameter:		ASME B89.1.5
• Inch up to 12 inches	(16 + 5.0L) µinch (Note: L in 'inches')	
Metric up to 300 millimetres	(0.41 + 0.005L) µm (Note: L in 'millimetres')	

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Type I Capability		
Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Cylindrical pin gauge, diameter:		ASME B89.1.5
• Inch up to 1 inch	25 µinch	
• Metric up to 25.4 mm	0.64 µm	
Thread wire, diameter:		ASME B89.1.17
• Inch up to 1 inch	13 µinch	
• Metric up to 25 millimetres	0.33 µm	
60 degree thread plug gauge and thread setting plug gauge:		ASME B89.1.17 B.S. 919 and DIN 13 In normal commercial gauging practice, the pitch diameter of a thread plug gauge is determined by measuring the diameter over thread wires inserted in the thread groove on opposite sides of the axis. The preferred term for this measurement is 'thread groove diameter'. Other names for this measurement are 'simple effective diameter' and 'simple pitch diameter'.
• Pitch diameter (measured over thread wires)		
- Inch up to 1.5 inches	100 µinch	
- over 1.5 to 6 inches	200 µinch	
- over 6 to 12 inches	300 µinch	
- Metric up to 35 millimetres	2.5 µm	
- over 35 to 150 millimetres	5.1 µm	
- over 150 to 300 millimetres	7.6 µm	
• Major diameter		
- Inch up to 12 inches	(16 + 5L) µinch (Note: L in 'inches')	
- Metric up to 300 millimetres	(0.41 + 0.005L) µm (Note: L in 'millimetres')	

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Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
60 degree adjustable thread ring gauge: • Set to thread setting plug - Inch or metric • Minor diameter - Inch up to 5 inches Metric up to 130 millimetres	 The adjustable thread ring gauge is set to the functional diameter of the thread setting plug 250 μinch 6.4 μm	ASME B89.1.17. On-site calibration available.
Pipe thread plug gauge • Pitch Diameter - Inch up to 1.5 inches - over 1.5 to 6 inches • Step Height **Pipe thread ring gauge** - Inch up to 6 inches • Standoff to master plug • Thickness	 100 μinch 200 μinch 40 μinch 0.001 inch 0.0001 inch	ASME B1.20.1 and ASME B1.20.5

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Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Indicators:		ANSI/ASME B89.1.10M
• Inch, 0.001 inch graduations	160 µinch	On-site calibration available.
• Inch, 0.0001 inch graduations	25 µinch	On-site calibration available.
• Inch, 0.00001 inch graduations	10 µinch	
• Metric, 0.02 mm graduations	4 µm	On-site calibration available.
• Metric, 0.002 mm graduations	0.65 µm	On-site calibration available.
• Metric, 0.0002 mm graduations	0.25 µm	
Electronic Linear Dimensional Probe:		Ulrich Metrology calibration procedure CP-56
• Up to 100 mm	(0.18 + 0.0031L) µm (Note: L in 'mm')	
Step gauges:		
• Inch up to 60 inches	(3 + 3.0L) µinch (Note: L in 'inches')	Ulrich Metrology calibration procedure CP-08
Metric up to 1500 mm	(0.08 + 0.003L) µm (Note: L in 'millimetres')	

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Type II Capability		
Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Height Gauges:		Ulrich Metrology calibration procedure CP-54
• Inch up to 40 inches	(240 + 1.2 L) µinch (Note: L in 'inches')	
• Metric up to 1000 mm	(6.1 + 0.0012 L) µm (Note: L in 'millimetres')	
Micrometers: Outside		CAN/CGSB-39.18 and GGG-C-105. On-site calibration available.
• Inch up to 6 inches	(30 + 2L) µinch (Note: L in 'inches')	
• over 6 to 60 inches	(60 + 5L) µinch (Note: L in 'inches')	
• Metric up to 150 millimetres	(0.8 + 0.002L) µm (Note: L in 'millimetres')	
• over 150 to 1500 millimetres	(1.5 + 0.005L) µm (Note: L in 'millimetres')	
Micrometer: Inside		CAN/CGSB-39.18 and GGG-C-105.
• Inch up to 24 inches	300 µinch	
• over 24 to 60 inches	400 µinch	
• Metric up to 600 millimetres	8 µm	
• over 600 to 1500 millimetres	10 µm	

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Type II Capability		
Measured Quantity & **Range or Instrument**	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Micrometer: Internal		Manufacturer's specifications
• Inch up to 8 inches	(75 + 2L) μinch (Note: L in 'inches')	
• Metric up to 200 millimetres	(2 + 0.002L) μm (Note: L in 'millimetres')	
Micrometer: Depth		
• Inch up to 12 inches	350 μinch	CAN/CGSB-39.18 and GGG-C-105
• Metric up to 300 millimetres	9 μm	

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Type II Capability		
Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Micrometer setting standards:		CAN/CGSB-39.18 and GGG-C-105
• Inch up to 60 inches	(35 + 3.2L) µinch (Note: L in 'inches')	
• Metric up to 1500 millimetres	(0.89 + 0.0032L) µm (Note: L in 'millimetres')	
Caliper: Outside		Manufacturer's specifications. On-site calibration available.
• Inch up to 12 inches	300 µinch	
• over 12 to 24 inches	430 µinch	
• over 24 to 40 inches	460 µinch	
• Metric up to 300 millimetres	7.6 µm	
• over 300 to 600 millimetres	11 µm	
• over 600 to 1000 millimetres	12 µm	
Caliper: Inside		Manufacturer's specifications. On-site calibration available.
• Inch up to 12 inches	300 µinch	
• Metric up to 300 millimetres	7.6 µm	
Caliper: Depth		Manufacturer's specifications. On-site calibration available.
• Inch up to 12 inches	300 µinch	
• Metric up to 300 millimetres	7.6 µm	

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Type II Capability		
Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Torque wrenches & screwdrivers:		ASME B107.14M and equivalent standards. On-site calibration available.
Clockwise		
10 in•oz to 1000 ft•lb	0.5 % of reading	
0.07 N•m to 1356 N•m	0.5 % of reading	
Clockwise and Counterclockwise		On-site calibration available.
1000 ft•lb to 4000 ft•lb	2.1 % of reading	Ulrich procedure CP-15.
4000 ft•lb to 20000 ft•lb	1.4 % of reading	Ulrich procedure CP-15.
Pressure gauges:		Ulrich Metrology calibration procedure CP-10. On-site calibration available
0 psi to 300 psi	0.031 psi	
300 psi to 1000 psi	0.01 % of reading	Pneumatic
0 psi to 600 psi	0.13 psi	
600 psi to 30000 psi	0.02 % of reading	Hydraulic

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Type II Capability		
Measured Quantity & **Range or Instrument**	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
ELECTRICAL		
Voltage, DC		
0 V to 329.9999 mV	(0.002 % + 1 μV)	Source. For the calibration of dc voltage measuring devices. On-site calibration available.
0.33 V to 3.299999 V	(0.0011 % + 2 μV)	
3.3 V to 32.9999 V	(0.0012 % + 15 μV)	
33 V to 329.9999 V	(0.0018 % + 150 μV)	
100 V to 1000 V	(0.0018 % + 1500 μV)	
1 kV to 10 kV	0.25 %	
0 V to 100 mV	(0.0009 % + 0.3 μV)	Measure. For the calibration of dc voltage generating devices. On-site calibration available.
100 mV to 1 V	(0.0008 % + 0.3 μV)	
1 V to 10 V	(0.0008 % + 0.5 μV)	
10 V to 100 V	(0.0010 % + 30 μV)	
100 V to 1000 V	(0.0010 % + 100 μV)	
1 kV to 10 kV	0.02 %	
5 kV to 60 kV	0.23 %	
Current, DC		
0 to 329.999 μA	(0.015 % + 0.02 μA)	Source. For the calibration of dc current measuring devices. On-site calibration available.
0.33 mA to 3.29999 mA	(0.01 % + 0.05 μA)	
3.3 mA to 32.9999 mA	(0.01 % + 0.25 μA)	
33 mA to 329.999 mA	(0.01 % + 2.5 μA)	
0 to 1.09999 A	(0.02 % + 40 μA)	
1.1 A to 2.99999 A	(0.038 % + 40 μA)	
0 to 10.9999 A	(0.05 % + 500 μA)	
11 A to 20.5 A	(0.1 % + 750 μA)	
0 to 100 nA	(0.03 % + 0.04 nA)	Measure. For the calibration of dc current generating devices. On-site calibration available.
100 nA to 1 μA	(0.002 % + 0.04 nA)	
1 μA to 10 μA	(0.002 % + 0.1 nA)	
10 μA to 100 μA	(0.002 % + 0.8 nA)	
100 μA to 1 mA	(0.002 % + 5 nA)	
1 mA to 10 mA	(0.003 % + 50 nA)	
10 mA to 100 mA	(0.0035 % + 500 nA)	
100 mA to 1 A	(0.011 % + 10 μA)	

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Type II Capability			
Measured Quantity & Range or Instrument	Frequency	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Voltage, AC			
1 mV to 32.999 mV	10 Hz to 500 kHz	0.0332 % to 5.8 %	Source. For the calibration of sinewave voltage measurement devices. See Annex A for details. On-site calibration available.
33 mV to 329.999 mV	10 Hz to 500 kHz	0.0169 % to 0.41 %	
0.33 V to 3.29999 V	10 Hz to 500 kHz	0.0168 % to 0.42 %	
3.3 V to 32. 9999 V	10 Hz to 100 kHz	0.0168 % to 0.14 %	
33 V to 329.999 V	45 Hz to 20 kHz	0.0196 % to 0.35 %	
330 V to 1020 V	45 Hz to 10 kHz	0.0260 % to 0.033 %	
1 mV to 700 V	1 Hz to 8 MHz	0.007 % to 1.5 %	Measure. For the calibration of voltage sources using a digital multimeter. See Annex C for details. On-site calibration available.
1 kV to 40 kV	60 Hz	1.1 %	Measure: For the calibration of voltage sources using a high voltage divider and digital multimeter. On-site calibration available.

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Measured Quantity & Range or Instrument	Frequency	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Current, AC			
0.029 mA to 0.32999 mA	10 Hz to 30 kHz	0.16 % to 3 %	Source. For the calibration of sinewave current measurement devices. See Annex B for details. On-site calibration available.
0.33 mA to 329.999 mA	10 Hz to 30 kHz	0.046 % to 1.2 %	
0.33 A to 2.9999 A	10 Hz to 10 kHz	0.06 % to 3 %	
3.0 A to 20.5 A	45 Hz to 5 kHz	0.078 % to 3 %	
10 μA to 1 A	10 Hz to 100 kHz	0.03 % to 1 %	Measure. For the calibration of current sources using a digital multimeter. See Annex D for details. On-site calibration available.

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Type II Capability			
Measured Quantity & Range or Instrument	Frequency	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Resistance			
1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ 10 MΩ 100 MΩ 1 GΩ, 10 GΩ 100 GΩ 1 TΩ		0.002 % 0.005 % 0.01 % 0.5 % 1 % 2 %	For the calibration of resistance measurement devices On-site calibration available.
0 Ω to 32.999 Ω 33 Ω to 109.9999 kΩ 110 kΩ to 1.099999 MΩ 1.1 MΩ to 3.29999 MΩ 3.3 MΩ to 10.99999 MΩ 11 MΩ to 32.99999 MΩ 33 MΩ to 109.9999 MΩ 110 MΩ to 329.9999 MΩ 330 MΩ to 1100 MΩ		0.003 % + 0.001 Ω 0.0028 % + 0.015 Ω 0.0032 % + 2 Ω 0.006 % + 30 Ω 0.013 % + 50 Ω 0.025 % + 2500 Ω 0.05 % + 3000 Ω 0.3 % + 100000 Ω 1.5 % + 500000 Ω	Source. For the calibration of resistance measurement devices On-site calibration available.
0.1 mΩ to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ 1 kΩ to 10 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1GΩ		(0.0015 % + 50 μΩ) (0.0012 % + 0.5 mΩ) (0.001 % + 0.5 mΩ) (0.001 % + 5 mΩ) (0.001 % + 50 mΩ) (0.0015 % + 2 Ω) (0.005 % + 100 Ω) (0.05 % + 1 kΩ) (0.5 % + 10 kΩ)	Measure capability using a digital multimeter. On-site calibration available.

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Type II Capability			
Measured Quantity & Range or Instrument	Frequency	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Capacitance			
10 pF	1 kHz	0.1 %	For the calibration of capacitance measuring devices. On-site calibration available.
100 pF to 1.111 μF	1 kHz	0.07 % + 0.05 pF	For the calibration of capacitance measuring devices using a decade capacitor. On-site calibration available.
0.19 nF to 1.1 nF	10 Hz to 10 kHz	0.5 % + 0.01 nF	Source synthesized capacitance using a multiproduct calibrator. For the calibration of capacitance measuring devices. On-site calibration available.
1.1 nF to 3.3 nF	10 Hz to 3 kHz	0.5 % + 0.01 nF	
3.3 nF to 11 nF	10 Hz to 1 kHz	0.25 % + 0.01 nF	
11 nF to 110 nF	10 Hz to 1 kHz	0.25 % + 0.1 nF	
110 nF to 330 nF	10 Hz to 1 kHz	0.25 % + 0.3 nF	
0.33 μF to 1.1 μF	10 Hz to 600 Hz	0.25 % + 1 nF	
1.1 μF to 3.3 μF	10 Hz to 300 Hz	0.25 % + 3 nF	
3.3 μF to 11 μF	10 Hz to 150 Hz	0.25 % + 10 nF	
11 μF to 33 μF	10 Hz to 120 Hz	0.40 % + 30 nF	
33 μF to 110 μF	10 Hz to 80 Hz	0.45 % + 100 nF	
110 μF to 330 μF	DC to 50 Hz	0.45 % + 300 nF	
0.33 mF to 1.1 mF	DC to 20 Hz	0.45 % + 1 μF	
1.1 mF to 3.3 mF	DC to 6 Hz	0.45 % + 3 μF	
3.3 mF to 11 mF	DC to 2 Hz	0.45 % + 10 μF	
11 mF to 33 mF	DC to 0.6 Hz	0.75 % + 30 μF	
33 mF to 110 mF	DC to 0.2 Hz	1.1 % + 100 μF	

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Inductance 100 mH	1 kHz	0.1 %	For the calibration of inductance measuring devices. On-site calibration available.
ELECTRICAL CALIBRATION OF TEMPERATURE INDICATORS AND SIMULATORS **Thermocouple simulation** Type B: 600 to 800°C 800 to 1000°C 1000 to 1550°C 1550 to 1820°C Type C: 0 to 150°C 150 to 650°C 650 to 1000°C 1000 to 1800°C 1800 to 2316°C Type E: -250 to -100°C -100 to -25°C -25 to 350°C 350 to 650°C 650 to 1000°C Type J: -210 to -100°C -100 to -30°C -30 to 150°C 150 to 760°C 760 to 1200°C		0.44°C 0.34°C 0.30°C 0.33°C 0.30°C 0.26°C 0.31°C 0.50°C 0.84°C 0.50°C 0.16°C 0.14°C 0.16°C 0.21°C 0.27°C 0.16°C 0.14°C 0.17°C 0.23°C	Source. For the calibration of temperature indicators and process calibrators by electrical simulation of temperature. On-site calibration available.

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Type II Capability			
Measured Quantity & Range or Instrument	Frequency	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Type K: -200 to -100°C -100 to -25°C -25 to 120°C 120 to 1000°C 1000 to 1372°C Type L: -200 to -100°C -100 to 800°C 800 to 900°C Type N: -200 to -100°C -100 to -25°C -25 to 120°C 120 to 410°C 410 to 1300°C Type R: 0 to 250°C 250 to 400°C 400 to 1000°C 1000 to 1767°C Type S: 0 to 250°C 250 to 1000°C 1000 to 1400°C 1400 to 1767°C Type T: -250 to -150°C -150 to 0°C 0 to 120°C 120 to 400°C Type U: -200 to 0°C 0 to 600°C		0.33°C 0.18°C 0.16°C 0.26°C 0.40°C 0.37°C 0.26°C 0.17°C 0.40°C 0.22°C 0.19°C 0.18°C 0.27°C 0.57°C 0.35°C 0.33°C 0.40°C 0.47°C 0.36°C 0.37°C 0.46°C 0.63°C 0.24°C 0.16°C 0.14°C 0.56°C 0.27°C	
RTD simulation -200°C to 630°C		0.04°C to 0.23°C	Source. For the calibration of temperature indicators and process calibrators by electrical simulation of temperature. On-site calibration available.

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Type II Capability			
Measured Quantity & Range or Instrument	Frequency	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Current clamp calibration **Effective DC current output** 10 to 16.5 A Turns 16.5 to 150 A Turns 150 to 1025 A Turns **Effective AC current output** 20 to 150 A Turns 150 to 1000 A Turns	 45 to 440 Hz 45 to 440 Hz	 0.5 % + 20 mA 0.5 % + 140 mA 0.5 % + 500 mA 0.32 % + 50 mA 0.35 % + 90 mA	Source using a multifunction calibrator and a 50 turn coil. For the calibration of clamp meters. On-site calibration available.

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Type II Capability			
Measured Quantity & Range or Instrument	Frequency	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Oscilloscope Amplitude 1.8 mV to 55 V p-p (1 MΩ) 1.8 mV to 2.5 V (50 Ω) Flatness. Leveled Sine Wave 5 mV to 5.5 V relative to 50 kHz Time Marker 1 ns to 20 ms 50 ms to 5 s Rise Time	10 Hz to 100 kHz 50 kHz to 100 MHz 100 MHz to 300 MHz 300 MHz to 600 MHz 600 MHz to 1.1 GHz 1 kHz to 2 MHz 2 MHz to 10 MHz	3 % of p-p output + 100 µV 1.5 % + 100 µV 2 % + 100 µV 4 % + 100 µV 5 % + 100 µV (25 + 1000T) ppm (Note: T in seconds) 300 ps 350 ps	Source. For the calibration of oscilloscopes. On-site calibration available.
Input Resistance 40 Ω to 60 Ω 500 KΩ to 1.5 MΩ Input Capacitance 5 pF to 50 pF (1 MΩ)		0.1 % 0.1 % 5 % + 0.5 pF	

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Vibration Accelerometers 0.1 g to 10 g	 5 Hz to 10 Hz 10 Hz to 99 Hz 100 Hz 101 Hz to 920 Hz 921 Hz to 5000 Hz 5001 Hz to 10 kHz 10 kHz to 15 Khz	 2.20 % 1.70 % 1.25 % 1.40 % 1.70 % 2.20 % 3.65 %	ISO 16063-21. On-site calibration available.
Frequency 1 Hz to 40 Hz 40 Hz to 10 MHz DC to 3 GHz 0.01 Hz to 2 MHz		 0.05 % 0.01 % 0.1 ppm 2.5 ppm + 5 μHz	 Measure capability. On-site calibration available. Source using a multifunction calibrator. On-site calibration available.

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Tachometers		
Contact 55-40000 RPM	0.005 %	Source: for calibration of contact tachometers. On-site calibration available.
Non-Contact 6-60 RPM 60-600 RPM 600-99999 RPM	 53 ppm 7.5 ppm 3 ppm	Source: for calibration of non-contact tachometers. On-site calibration available.
Thermometry		
Liquid Bath and Dry Well -200 °C to 630 °C	0.1°C	Ulrich Metrology calibration procedure CP-58. On-site calibration available.
Thermometers, RTD, PRT and Thermistor probes 50°C to 150°C 150°C to 450°C 450°C to 650°C -30°C to 155°C	 0.17°C 0.5°C 0.65°C 0.15°C	Ulrich Metrology calibration procedures CP-67 and CP-68. On-site calibration available.
Digital Thermometers (Thermocouples) 50°C to 660°C -30°C to 50°C 50°C to 155°C	 0.7 °C to 1.1°C 0.3°C 0.4°C	Ulrich Metrology calibration procedures CP-67 and CP-68. On-site calibration available.

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Supplementary Notes

A. Calibration capabilities are traceable to the national measurement standards of Canada held or accepted by the National Research Council (NRC) or, with the agreement of NRC, to the national measurement standards of other countries and are thus traceable to the internationally accepted representation of the appropriate SI (Système International) unit.

B. Laboratories are certified by the NRC's Calibration Laboratory Assessment Service (CLAS) for one or more of the following capabilities:

Type I: A capability of which the primary purpose is the calibration of measurement standards for other calibration laboratories. A laboratory with this type of capability has the appropriate reference standards, working standards, check standards, and calibration systems to be able to assess dynamically and to quantify its measurement uncertainty, and is able to monitor its measurement processes continually. The environmental conditions that affect the laboratory's measurements are closely monitored and controlled. A laboratory with this type of capability usually reports a measurement value accompanied by a comprehensive statement of uncertainty. A laboratory with this type of capability is often referred to as a standards or standards calibration laboratory.

Type II: A capability of which the main purpose is the calibration and adjustment of test, measurement and diagnostic equipment for use in product testing, manufacturing, servicing, etc. A laboratory with this type of capability has the appropriate working standards and calibration systems to be able to calibrate to a manufacturer's specification and tolerance or calibrate to a written standard, using appropriate test uncertainty ratios (TUR). A laboratory with this type of capability usually reports a measurement value and indicates if the test equipment complies with a specification, tolerance or a written standard. It will, usually, base its capabilities on the specifications and tolerances of the working standards being used. It also has, normally, the means to check its working standards between calibrations and has available the appropriate environment(s). A laboratory with this type of capability is often referred to as a test equipment calibration laboratory.

Type III: A calibration capability, within a laboratory, mobile or fixed, with the appropriate reference or working standards, of which the main purpose is to provide a reference. A laboratory with this type of capability usually has minimal means to monitor its calibration system. It relies mainly on the values assigned by higher echelon laboratories to its standards and uses these values with few other considerations to assign values or verify the compliance of equipment being calibrated to their specifications and tolerances or to written standards. This could be an on-site service subject to a wide range of environmental factors.

C. The "Calibration measurement capability" includes the uncertainty associated with the calibration of the accredited laboratory's reference or transfer standard by NRC, or by a laboratory acceptable to CLAS, uncertainties caused by the transportation of the calibrated reference standard from NRC (or other laboratories) to the accredited laboratory, uncertainties of the calibration process in the accredited laboratory, and uncertainties due to the behaviour of the highest quality device available for each specific technology device during its calibration. These uncertainties include components which could have been evaluated by statistical methods on a series of repeated measurements and which can be characterised by experimental standard deviations. The other components, which can also be characterized by standard deviations, are evaluated from assumed probability distributions based on experience or other information. These have been combined to form an expanded uncertainty $U = ku_c$ with U determined from a combined standard uncertainty u_c and a coverage factor $k = 2$. Since it can be assumed that the probability distribution characterised by the reported result and u_c is approximately normal, the value of a calibrated device can be asserted to lie in the interval represented by the expanded uncertainty U with a level of confidence of approximately 95 percent. The uncertainties quoted do not include the possible effects on the calibrated device of transportation, long term stability or intended use. For clients requiring a confidence level of 99 %, the laboratory is able to adjust the uncertainty accordingly.

D. The uncertainty of a specific calibration by an accredited laboratory can be greater than the "Calibration measurement capability" because it will include uncertainties due to the actual condition and behaviour of the customer's device during its calibration.

E. As a rule, the smaller the uncertainty sought the greater the cost. Users should not demand uncertainties inappropriate to the device being calibrated or its intended use.

F. SCC accreditation and CLAS certification is the formal recognition of specific calibration capabilities. Neither the NRC nor the SCC guarantees the accuracy of individual calibrations by recognized laboratories.

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Ulrich Metrology Inc.

Annex A
Calibration Measurement Capability for the Calibration of Sinewave Voltage Measuring Devices,
expressed as ± { (% of reading) + residual in µV }

	Frequency					
Voltage, ac	10 Hz to 45 Hz	45 Hz to 10 kHz	10 kHz to 20 kHz	20 kHz to 50 kHz	50 kHz to 100 kHz	100 kHz to 500 kHz
1.0 mV to32.999 mV	0.08 + 6	0.015 + 6	0.02 + 6	0.1 + 6	0.35 + 12	0.8 + 50
33 mV to 329.999 mV	0.03 + 8	0.0145 + 8	0.016 + 8	0.035 + 8	0.08 + 32	0.2 + 70
0.33 V to 3.29999 V	0.03 + 50	0.015 + 60	0.019 + 60	0.03 + 50	0.07 + 125	0.24 + 600
3.3 V to 32.9999 V	0.03 + 650	0.015 + 600	0.024 + 600	0.035 + 600	0.09 + 1600	
	45 Hz to 1 kHz	1 kHz to 10 kHz	10 kHz to 20 kHz	20 kHz to 50 kHz	50 kHz to 100 kHz	
33 V to 329.999 V	0.019 + 2000	0.02 + 6000	0.025 + 6000	0.03 + 6000	0.2 + 50000	
	45 Hz to 1 kHz	1 kHz to 5 kHz	5 kHz to 10 kHz			
330 V to 1020 V	0.03 + 10000	0.025 + 10000	0.03 + 10000			

Annex B
Calibration Measurement Capability for the Calibration of Sinewave Current Measuring Devices, expressed as ± { (% of reading) + residual in µA }

	Frequency					
Current, ac	10 Hz to 20 Hz	20 Hz to 45 Hz	45 Hz to 1 kHz	1 kHz to 5 kHz	5 kHz to 10 kHz	10 kHz to 30 kHz
29 µA to 329.99 µA	0.2 + 0.1	0.15 + 0.1	0.125 + 0.1	0.3 + 0.15	0.8 + 0.2	1.6 + 0.4
0.33 mA to 3.2999 mA	0.2 + 0.15	0.125 + 0.15	0.1 + 0.15	0.2 + 0.2	0.5 + 0.3	1 + 0.6
3.3 mA to 32.999 mA	0.18 + 2	0.09 + 2	0.04 + 2	0.08 + 2	0.2 + 3	0.4 + 4
33 mA to 329.99 mA	0.18 + 20	0.09 + 20	0.04 + 20	0.10+ 50	0.2 + 100	0.4 + 200
	10 Hz to 45 Hz	45 Hz to 1 kHz	1 kHz to 5 kHz	5 kHz to 10 kHz		
0.33 A to 1.09999 A	0.18 + 100	0.05 + 100	0.6 + 1000	2.5 + 5000		
1.1 A to 2.99999 A	0.18 + 100	0.06 + 100	0.6 + 1000	2.5 + 5000		
	45 Hz to 100 Hz	100 Hz to 1 kHz	1 kHz to 5 kHz			
3 A to 10.9999 A	0.06+ 2000	0.1 + 2000	3 + 2000			
11 A to 20.5 A	0.12 + 5000	0.15 + 5000	3 + 5000			

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Annex C
Calibration Measurement Capability for the Calibration of Sinewave Voltage Generating Devices,
expressed as ± { (% of reading) + residual in µV }

	Frequency					
Voltage, ac	1 Hz to 40 Hz	40 Hz to 1 kHz	1 kHz to 20 kHz	20 kHz to 50 kHz	50 kHz to 100 kHz	100 kHz to 300 kHz
1 mV to 10 mV	0.03 + 3	0.02 + 1.1	0.03 + 1.1	0.1 + 1.1	0.5 + 1.1	4+2
10 mV to 100 mV	0.007 + 4	0.007 + 2	0.014 + 2	0.03 + 2	0.08 + 2	0.3 + 10
100 mV to 1 V	0.007 + 40	0.007 + 20	0.014 + 20	0.03 + 20	0.08 + 20	0.3 + 100
1 V to 10 V	0.007 + 400	0.007 + 200	0.014 + 200	0.03 + 200	0.08 + 200	0.3 + 1000
10 V to 100 V	0.02 + 4000	0.02 + 2000	0.02 + 2000	0.035 + 2000	0.12 + 2000	0.4 + 10000
100 V to 700 V	0.04 + 40000	0.04 + 20000	0.06 + 20000	0.12 + 20000	0.3 + 20000	
	300 kHz to 1 MHz	1 MHz to 2 MHz	2 MHz to 4 MHz	4 MHz to 8 MHz	8 MHz to 10 MHz	
1 mV to 10 mV	1.2 + 5	7 + 7	7 + 7	20 + 8		
10 mV to 100 mV	1 + 10	1.5 + 10	4 + 70	4 + 80	15 + 100	
100 mV to 1 V	1 + 100	1.5 + 100	4 + 700	4 + 800	15 + 1000	
1 V to 10 V	1 + 1000	1.5 + 1000	4 + 7000	4 + 8000	15 + 10000	
10 V to 100 V	1.5 + 10000					

Annex D
Calibration Measurement Capability for the Calibration of Sinewave Current Generating Devices,
expressed as ± { (% of reading) + residual in µA }

	Frequency						
Voltage, ac	10 Hz to 20 Hz	20 Hz to 45 Hz	45 Hz to 100 Hz	100 Hz to 5 kHz	5 kHz to 20 kHz	20 kHz to 50 kHz	50 kHz to 100 kHz
10 µA to 100 µA	0.4 + 0.03	0.15 + 0.03	0.06 + 0.03	0.06 + 0.03			
100 µA to 1 mA	0.4 + 0.2	0.15 + 0.2	0.06 + 0.2	0.03 + 0.2	0.06 + 0.2	0.4 + 0.4	0.55 + 1.5
1 mA to 10 mA	0.4 + 2	0.15 + 2	0.06 + 2	0.03 + 2	0.06 + 2	0.4 + 4	0.55 + 15
10 mA to 100 mA	0.4 + 20	0.15 + 20	0.06 + 20	0.03 + 20	0.06 + 20	0.4 + 40	0.55 + 150
100 mA to 1 A	0.4 + 200	0.16 + 200	0.08 + 200	0.1 + 200	0.3 + 200	1 + 400	

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