CLAS Certificate Number 2002-04

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Clients Served:	All interested parties. On-site calibration services are available for the capabilities for which it is indicated in the remarks column.
Field of Calibration	Electrical (dc and lf), Temperature, Mechanical, Frequency and Time
SCC Accreditation (ISO/IEC 17025)	Accredited Laboratory No. 461 Issued 2002-08-15

This scope of calibration 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 capability of the named laboratory for being able to perform the listed calibrations at the given Calibration Measurement Capability (see Supplementary Notes C and D) with traceability to the International System of Units (SI) or to standards acceptable to the CLAS program.

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Type II capability			
Measured Quantity & Range or Instrument	Frequency	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
ELECTRICAL			
Current, AC			
1 mA to 1 A	3 Hz to 5 Hz	1% + 0.4 mA	For the calibration of current generating devices and equipment.
1 mA to 1 A	5 Hz to 10 Hz	0.3% + 0.4 mA	
1 mA to 1 A	10 Hz to 5 kHz	0.1% + 0.4 mA	
1 A to 3 A	3 Hz to 5 Hz	1.1% + 1.8 mA	On-site calibration services available.
1 A to 3 A	5 Hz to 10 Hz	0.35% +1.8 mA	
1 A to 3 A	10 Hz to 5 kHz	0.15% + 1.8 mA	
Voltage, AC			
1 mV to 100 mV	3 Hz to 5 Hz	1% + 40 µV	For the calibration of voltage sources using digital multimeters.
1 mV to 100 mV	5 Hz to 10 Hz	0.35% + 40 µV	
1 mV to 100 mV	10 Hz to 20 kHz	0.06% + 40 µV	
1 mV to 100 mV	20 kHz to 50 kHz	0.12% + 50 µV	
1 mV to 100 mV	50 kHz to 100 kHz	0.6% + 80 µV	On site calibration services available.
1 mV to 100 mV	100 kHz to 300 kHz	4% + 0.5 mV	
1 V to 750 V	3 Hz to 5 Hz	1% + 0.23 V	
1 V to 750 V	5 Hz to 10 Hz	0.35% + 0.23 V	
1 V to 750 V	10 Hz to 20 kHz	0.06% + 0.23 V	
1 V to 750 V	20 kHz to 50 kHz	0.12% + 0.38 V	
1 V to 750 V	50 kHz to 100 kHz	0.6% + 0.6 V	
1 V to 750 V	100 kHz to 300 kHz	4% + 3.8 V	

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Type II capability		
Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Current, DC 10 mA to 100 mA 100 mA to 1 A 1 A to 3 A	0.05% + 5 µA 0.1% + 0.1 mA 0.12% + 0.6 mA	For the calibration of current generating devices and equipment. On-site calibration services available.
Voltage, DC 1 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1000 V	0.005% + 3.5 µV 0.004% + 7 µV 0.0035% + 50 µV 0.0045% + 0.6 mV 0.0045% + 10 mV	For the calibration of voltage sources using digital multimeters. On site calibration services available.
Resistance 1 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	0.01% + 4 mΩ 0.01% + 10 mΩ 0.01% + 0.1 Ω 0.01% + 1 Ω 0.01% + 10 Ω 0.04% + 0.1 kΩ 0.8% + 10 kΩ	For the calibration of resistors and resistance devices over a wide range of resistance and conditions. On site calibration services available.
ELECTRICAL CALIBRATION OF TEMPERATURE INDICATORS Thermocouple Temperature Indicators -200 °C to 200 °C 200 °C to 400 °C 400 °C to 1370 °C	 0.3 °C 0.6 °C 0.8 to 1.3 °C	Source simulated temperature for types J, K, N and T thermocouples using multifunction calibrator. Suitable for the calibration of temperature indicators by electrical simulation. The calibration measurement capability does not include the uncertainty of the device under test or the thermocouple error. ITS-90 or IPTS-68 temperature scales available. On site calibration services available.

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Type II capability		
Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Resistance Thermometer Temperature Indicators -195 °C to 815 °C	0.4 °C	Source simulated temperature for 100 platinum RTDs. Suitable for the calibration of temperature indicators by electrical simulation. The calibration measurement capability does not include the uncertainty of the device under test or the thermocouple error. ITS-90 or IPTS-68 temperature scales available. On-site calibration services available.
TEMPERATURE **Liquid in glass thermometers** -77 °C -35 to 0 °C 0 to 200 °C 200 to 400 °C	 0.24 °C 0.20 °C 0.15 °C 0.43 °C	 Dry ice and alcohol bath Calibrations are made in accordance with a laboratory developed calibration procedure, which is based in part on ASTM E 77-98, 'Standard Test Method for Inspection and Verification of Thermometers'.
Thermocouples/ thermocouple thermometers (type J,K,T,N) -77 °C -50 to 0 °C 0 to 200 °C 200 to 400 °C 400 to 1100 °C	 0.3 °C 0.3 °C 0.3 °C 0.6 °C 0.8 °C to 1.3 °C	Dry ice and alcohol bath Individual thermocouples are calibrated using the laboratory's measuring devices. It is the client's responsibility to evaluate any additional uncertainties introduced by the client's measurement system. Thermocouple thermometers consisting of a temperature indicator and thermocouple(s) are calibrated as a system. On site calibration services available.
Thermocouples/ thermocouple thermometers (type R & S) 0 to 200 °C 200 to 400 °C 400 to 1100 °C	 0.8°C 0.8°C 1.1 °C to 1.5 °C	Individual thermocouples are calibrated using the laboratory's measuring devices. It is the client's responsibility to evaluate any additional uncertainties introduced by the client's measurement system. Thermocouple thermometers consisting of a temperature indicator and thermocouple(s) are calibrated as a system. On site calibration services available.

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Type II capability		
Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Remarks
Thermistor Thermometers -40 to 100 °C	 0.2 °C	 For the calibration of thermistor thermometers.
Resistance Temperature Devices -77 °C -50 to 0 °C 0 to 200 °C 200 to 400 °C	 0.26 °C 0.20 °C 0.19 °C 0.40 °C	Dry ice and alcohol bath. Individual RTDs are calibrated using the laboratory's measuring devices. It is the client's responsibility to evaluate any additional uncertainties introduced by the client's measurement system. RTD thermometers consisting of a temperature indicator and RTD(s) are calibrated as a system. On site calibration services available.
TIMERS Timebase error	 0.25 s per 24h	For the calibration of manually-activated time interval measurement devices, including stopwatches and timers, by direct comparison with a reference timer over a minimum period of 24 h. On-site calibration services available.
MECHANICAL **Pressure Indicators and Gauges** (Gauge Pressure) 0 to 5 inch H20 0 to 20 inch H20 0 to 2000 inch H20 10 to 10000 psi	 0.06 inch H20 0.21 inch H20 1.0 inch H20 0.1% of reading	 For the calibration of pressure indicators and gauges. On-site calibration services available.
Vacuum Gauges 0 to 28 inch Hg	 0.07 inch Hg	 For the calibration of vacuum gauges.

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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. The laboratory's specific measurement capabilities are certified by the NRC's Calibration Laboratory Assessment Service (CLAS) and accredited by the Standards Council of Canada (SCC) in accordance with the following definitions:

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 of the laboratory includes the uncertainty associated with the calibration of the 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 laboratory, uncertainties of the calibration process in the laboratory, and uncertainties due to the behaviour of the most ideal available standard or measurement device for a specific measurement technology. 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 because of transportation, long term stability or intended use.

D. The uncertainty of a specific calibration by the 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. CLAS certification and SCC accreditation is the formal recognition of specific calibration capabilities. Neither the NRC nor SCC guarantee the accuracy of individual calibrations by the laboratory.