National Research Council Canada
Institute for National Measurement Standards

Conseil national de recherches Canada
Institut des étalons nationaux de mesure

Calibration Laboratory Assessment Service

CLAS Certificate Number 2004-01

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Clients Served: All interested parties

Field(s) of Calibration: Electrical (dc)

SCC Accreditation: Accredited Laboratory No. 536
(ISO/IEC 17025) First issued 2004-05-25

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 Best 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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Measured Quantity & Range or Instrument	Best Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Type	Remarks
Resistance		I	
1 μΩ to 10 μΩ	500 to 20 ppm		For the calibration of resistors using MIL 6010 current comparator bridges and associated range extenders.
10 μΩ to 100 μΩ	20 to 2 ppm		
100 μΩ to 1 mΩ	2 to 0.9 ppm		
1 mΩ to 10 mΩ	0.9 to 0.22 ppm		
10 mΩ to 100 mΩ	0.22 to 0.17 ppm		
100 mΩ to 1Ω	0.17 to 0.16 ppm		
1Ω to 10 Ω	0.16 to 0.19 ppm		
10 Ω to 100 Ω	0.19 to 0.22 ppm		
100 Ω to 1kΩ	0.22 to 0.25 ppm		
1kΩ to 10 kΩ	0.25 to 0.15 ppm		
13 kΩ	0.2 ppm		
10 kΩ to 100 kΩ	0.15 to 0.27 ppm		
100 kΩ to 1 MΩ	0.27 to 0.37 ppm		For the calibration of resistors using a MIL 6000 high resistance bridge.
1MΩ TO 10 MΩ	0.37 to 0.64 ppm		
10 MΩ TO 100 MΩ	0.64 to 2 ppm		
100 MΩ TO 1GΩ	2 to 13 ppm		
1GΩ TO 10 GΩ	13 to 200 ppm		
10 GΩ TO 100 GΩ	200 to 250 ppm		For the calibration of resistors using a Teraohmmeter.
100 GΩ TO 1 TΩ	250 to 500 ppm		
1 TΩ TO 10 TΩ	500 to 1000 ppm		
10 TΩ TO 100 TΩ	1000 to 5500 ppm		
Voltage DC		I	
100 mV to 10 V	10 ppm		For the calibration of voltage sources using a zener reference standard and Binary Voltage Divider (BVD).
10 V to 30 V	10 ppm		
30 V to 300 V	10 ppm		
300 V to 1000 V	10 ppm		

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Measured Quantity & Range or Instrument	Best Measurement Capability expressed as an Uncertainty (±) (see Supplementary Notes)	Type	Remarks
Current DC 1 mA to 10 mA 10 mA to 100 A 100 A to 400 A	 5 to 10 ppm 3 to 13 ppm 13 to 50 ppm	I	For the calibration of current shunts and current sources.
Resistance ratio 10:1 resistance ratios 0.1 Ω to 1 Ω 1 Ω to 10 Ω 10 Ω to 100Ω 100 Ω to 1kΩ 1 kΩ to 10 kΩ 1 kΩ to 13 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1MΩ 1 MΩ TO 10MΩ 10 MΩ TO 100 MΩ 1:1 resistance ratios 1 Ω to 1 Ω 10 Ω to 10 Ω 100 Ω to 100 Ω 1 kΩ to 1 kΩ 10 kΩ to 10 kΩ 100 kΩ to 100 kΩ 1 MΩ TO 1 MΩ 10 MΩ TO 10 MΩ 100 MΩ TO 100 MΩ	 0.08 ppm 0.08 ppm 0.08 ppm 0.08 ppm 0.08 ppm 0.08 ppm 0.08 ppm 0.1 ppm 0.15 ppm 1.5 ppm 0.07 ppm 0.07 ppm 0.07 ppm 0.07 ppm 0.07 ppm 0.10 ppm 0.12 ppm 0.15 ppm 1.5 ppm	I	For the calibration of the ratio errors of DC current comparator bridges.

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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 best 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 of transportation, long term stability or intended use.

D. The uncertainty of a specific calibration by the laboratory can be greater than the best 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.