Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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0511

Accredited to ISO/IEC 17025:2017

Quasartronics Ltd

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Calibration performed at the above address only

DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DIMENSIONAL CALIBRATION			
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED			
LENGTH			
Plain plug gauges (parallel)	1 to 50 diameter 50 to 100 100 to 150	0.81 1.5 on diameter 2.2	Laboratory procedure CP15.
Plain ring gauges (parallel) and setting standards	10 to 50 50 to 100 100 to 150	1.0 1.5 on diameter 2.0	Laboratory procedure CP20, CP22.
Screw plug gauges (parallel) including check and setting plugs	1 to 100 diameter 100 to 150	3.0 on pitch diameter 5.0	Laboratory procedure CP19. Single start, symmetrical thread forms only.
Screw ring gauges (parallel)	1 to 75 diameter 75 to 150	5.0 on pitch diameter 7.0	Laboratory procedure CP21. Single start, symmetrical thread forms only. 1 mm to 12 mm diameter range also relates to functional test of size using check plugs.
Screw pitch Screw flank angle	0.2 to 8 0° to 52°	1.5 7.0 minutes of arc	Laboratory procedure CP19, CP21.
Vee blocks	BS 3731:1987 20 to 150 diameter, vee capacity	2.5 to 5.0	
Length gauge, flat and spherical ended (excluding length bars)	BS 870: 2008 25 to 600	1.0 + (8.0 x length in m)	
Plain gap gauges (parallel)	BS 969:2008 2 to 100 100 to 200	 3.0 5.0	

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DIMENSIONAL CALIBRATION (continued)			
LENGTH (continued)			
Feeler gauges	BS 957: 2008 0.02 to 1.00	2.0	
Parallels	BS 906:Part 1:1972 5 to 50 x 100 x 400	2.5 to 5.0	
ANGLE			
Blade type squares	BS 939:2007 50 to 300	3.0 on squareness	The CMC is for the departure from flatness, straightness, parallelism, or squareness, i.e. the distance separating the two parallel planes which just enclose the surface under consideration.
Right angle and box angle plates	BS 5535:1978 0 to 300	Squareness: 3.0 + (1.0 per 100 mm) Parallelism: 1.0 + (1.0 per 100 mm)	
MEASURING INSTRUMENTS AND MACHINES			
Micrometers			
External	BS EN ISO 3611:2010, 0 to 1000	1.5 + (10 x length in m)	
External	BS 870: 2008, 0 to 450	Heads: 2.0 between any two points	
Internal	BS 959: 2008, 0 to 600	Setting and extension rods: 1.0 + (8.0 x length in m)	
Depth	BS 6468: 2008, 0 to 300		
Three point bore	5 to 50 50 to 100 100 to 150	3.0 3.5 4.0	Laboratory procedure CP40.
Vernier, Digital, Dial gauges			
Calliper	BS EN ISO 13385-1:2011 0 to 1000	18 + (20 x length in m)	
Calliper	BS 887:2008 0 to 1000	Overall performance 10 + (30 x length in m)	
Height	ISO13225:2012 BS 1643:2008 0 to 1000		
Depth	BS 6365:2008 0 to 600		
Dial gauges and dial test indicators	BS 907: 2008 and BS 2795:1981 0 to 50	2.0	

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TORQUE CALIBRATION			Calibration results may also be given in units of lbf.in and lbf.ft, or in the units of an electrical output signal. The uncertainty quoted is for both the application of the calibration torque and the characteristics of the device being calibrated.
Hand Torque Tools (not including torque screwdrivers)	BS EN ISO 6789:2003 (Withdrawn) 1.0 N·m to 1000 N·m	1.6 %	
	BS EN ISO 6789-2:2017 1.0 N·m to 1000 N·m to	1.0 %	
ELECTRICAL CALIBRATION			All electrical calibrations are performed as a direct comparison against a reference standard unless otherwise stated
DC VOLTAGE			For the calibration of voltage measuring instruments
Generation	0 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1 kV	18 ppm + 3.0 µV 10 ppm + 7.7 µV 9.0 ppm + 72 µV 14 ppm + 0.72 mV 14 ppm + 4.3 mV	
Measurement	0 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1 kV	13 ppm + 1.7 µV 8.0 ppm + 3.0 µV 9.0 ppm + 30 µV 12 ppm + 0.30 mV 12 ppm + 3.5 mV	For measurement of instrument outputs
DC RESISTANCE			
Generation	1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ	5.8 mΩ 5.8 mΩ 6.2 mΩ 22 mΩ 0.11 Ω 1.6 Ω 49 Ω 3.0 kΩ 310 kΩ 12 MΩ	For the calibration of resistance measuring instruments
Measurement	0 Ω to 1 Ω 1 Ω 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 1 GΩ 1 GΩ to 10 GΩ	35 ppm + 2.3 µΩ 22 ppm + 28 µΩ 18 ppm + 0.16 mΩ 15 ppm + 1.2 mΩ 18 ppm + 6.8 mΩ 28 ppm + 0.24 Ω 44 ppm + 3.1 Ω 0.029 % + 71 Ω 0.045 % + 3.4 kΩ 0.053 % + 230 kΩ 0.23 % + 46 MΩ	For measurement of instrument outputs
DC CURRENT			
Generation	0 µA to 200 µA 200 µA to 2 mA 2 mA to 20 mA 20 mA to 200 mA 200 mA to 2 A 2 A to 20 A 20 A to 30 A	120 ppm + 12 nA 58 ppm + 49 nA 58 ppm + 450 nA 58 ppm + 9.0 µA 150 ppm + 100 µA 350 ppm + 0.80 mA 580 ppm + 4.4 mA	For the calibration of current measuring instruments

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
ELECTRICAL CALIBRATION (continued)			
DC CURRENT (continued)			
Measurement	0 µA to 100 µA 100 µA to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A 1 A to 10 A 10 A to 30 A	21 ppm + 0.80 nA 21 ppm + 8.0 nA 23 ppm + 85 nA 61 ppm + 0.80 µA 0.029 % + 11 µA 650 ppm + 1.7 mA 880 ppm + 5.0 mA	For measurement of instrument outputs
AC VOLTAGE			
Generation	20 mV to 200 mV *40 Hz to 1 kHz* *1 kHz to 20 kHz* *20 kHz to 100 kHz* 200 mV to 2 V *40 Hz to 1 kHz* *1 kHz to 20 kHz* *20 kHz to 50 kHz* 2 V to 20 V *40 Hz to 1 kHz* *1 kHz to 20 kHz* 20 V to 200 V *40 Hz to 1 kHz* *1 kHz to 10 kHz* *10 kHz to 20 kHz* 200 V to 1000 V *40 Hz to 1 kHz* 200 V to 700 V *1 kHz to 10 kHz*	 0.021 % + 18 µV 0.027 % + 33 µV 0.12 % + 2.5 mV 0.021 % + 260 µV 0.030 % + 300 µV 0.075 % + 530 µV 0.021 % + 1.2 mV 0.030 % + 1.9 mV 0.018 % + 28 mV 0.023 % + 44 mV 0.035 % + 53 mV 0.023 % + 150 mV 0.029 % + 200 mV	For the calibration of voltage measuring instruments
Measurement	13 mV to 100 mV *10 Hz to 40 Hz* *40 Hz to 200 Hz* *200 Hz to 2 kHz* *2 kHz to 20 kHz* *20 kHz to 100 kHz* 100 mV to 1 V *10 Hz to 40 Hz* *40 Hz to 200 Hz* *200 Hz to 1 kHz* *1 kHz to 2 kHz* *2 kHz to 20 kHz* *20 kHz to 100 kHz*	 0.075 % + 27 µV 0.045 % + 34 µV 0.044 % + 30 µV 0.047 % + 30 µV 0.16 % + 120 µV 0.087 % + 130 µV 0.042 % + 120 µV 0.030 % + 120 µV 0.030 % + 190 µV 0.058 % + 0.97 mV 0.16 % + 0.97 mV	For measurement of instrument outputs

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
ELECTRICAL CALIBRATION (continued)			
AC VOLTAGE (continued)			
Measurement (continued)	1 V to 10 V		
	10 Hz to 40 Hz	0.087 % + 1.3 mV	
	40 Hz to 200 Hz	0.042 % + 1.2 mV	
	200 Hz to 1 kHz	0.030 % + 1.2 mV	
	1 kHz to 2 kHz	0.030 % + 2.0 mV	
	2 kHz to 20 kHz	0.058 % + 9.7 mV	
	20 kHz to 100 kHz	0.016 % + 9.7 mV	
	10 V to 100 V		
	10 Hz to 40 Hz	0.11 % + 27 mV	
	40 Hz to 200 Hz	0.045 % + 27 mV	
	200 Hz to 1 kHz	0.043 % + 27 mV	
	1 kHz to 2 kHz	0.043 % + 27 mV	
	2 kHz to 20 kHz	0.035 % + 45 mV	
	100 V to 1000 V		
	40 Hz to 200 Hz	0.045 % + 0.35 V	
	200 Hz to 1 kHz	0.043 % + 0.52 V	
	1 kHz to 2 kHz	0.043 % + 0.52 V	
	2 kHz to 10 kHz	0.070 % + 0.73 V	
AC CURRENT			
Generation	*40 Hz to 1 kHz*		For the calibration of current measuring instruments
	20 µA to 200 µA	0.081 % + 0.18 µA	
	200 µA to 2 mA	0.069 % + 0.46 µA	
	2 mA to 20 mA	0.046 % + 4.6 µA	
	20 mA to 200 mA	0.046 % + 46 µA	
	200 mA to 2 A	0.071 % + 230 µA	
	40 Hz to 100 Hz		
	2 A to 20 A	0.10 % + 2.3 mA	
Measurement	*40 Hz to 1 kHz*		For measurement of instrument outputs
	13 µA to 100 µA	0.072 % + 20 nA	
	100 µA to 1 mA	0.072 % + 190 nA	
	1 mA to 10 mA	0.072 % + 2.0 µA	
	10 mA to 100 mA	0.072 % + 20 µA	
	100 mA to 1 A	0.098 % + 200 µA	
	1 A to 10 A	0.17 % + 5.0 mA	
	10 A to 30 A	0.17 % + 13 mA	
FREQUENCY			
Generation	1 Hz to 10 MHz	5.0 ppm + 2.0 mHz	

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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
CAPACITANCE Generation	*1 kHz* 1 nF 10 nF 100 nF 1 µF 10 µF	 20 pF 87 pF 420 pF 4.9 nF 76 nF	For the calibration of capacitance measuring instruments
OSCILLOSCOPE CALIBRATION			
Horizontal and vertical deflection coefficients			
Horizontal Deflection	10 ns to 50 ns 100 ns to 500 ns 1 µs to 5 µs 10 µs to 50 µs 100 µs to 1 s	110 ppm + 58 ps 10 ppm + 35 ps 1.0 ppm + 35 ps 0.15 ppm + 35 ps 0.12 ppm + 35 ps	
Vertical Deflection	6 mV to 500 mV 500 mV to 20 V 20 V to 200 V	0.23 % + 28 µV 0.060 % + 1.2 mV 0.060 % + 12 mV	
END			

Appendix - Calibration and Measurement Capabilities

Introduction

The definitive statement of the accreditation status of a calibration laboratory is the Accreditation Certificate and the associated Schedule of Accreditation. This Schedule of Accreditation is a critical document, as it defines the measurement capabilities, ranges and boundaries of the calibration activities for which the organisation holds accreditation.

Calibration and Measurement Capabilities (CMCs)

The capabilities provided by accredited calibration laboratories are described by the Calibration and Measurement Capability (CMC), which expresses the lowest uncertainty of measurement that can be achieved during a calibration. If a particular device under calibration itself contributes significantly to the uncertainty (for example, if it has limited resolution or exhibits significant non-repeatability) then the uncertainty quoted on a calibration certificate will be increased to account for such factors. The CIPM-ILAC definition of the CMC is as follows:

A CMC is a calibration and measurement capability available to customers under normal conditions:
(a) as published in the BIPM key comparison database (KCDB) of the CIPM MRA; or
(b) as described in the laboratory's scope of accreditation granted by a signatory to the ILAC Arrangement.

The CMC is normally used to describe the uncertainty that appears in an accredited calibration laboratory's schedule of accreditation and is the uncertainty for which the laboratory has been accredited using the procedure that was the subject of assessment. The CMC is calculated according to the procedures given in M3003 and is normally stated as an expanded uncertainty at a coverage probability of 95 %, which usually requires the use of a coverage factor of $k = 2$. An accredited laboratory is not permitted to quote an uncertainty that is smaller than the published CMC in certificates issued under its accreditation.

The CMC may be described using various methods in the Schedule of Accreditation:

As a single value that is valid throughout the range.
As an explicit function of the measurand or of a parameter (see below).
As a range of values. The range is stated such that the customer can make a reasonable estimate of the likely uncertainty at any point within the range.
As a matrix or table where the CMCs depend on the values of the measurand and a further quantity.
In graphical form, providing there is sufficient resolution on each axis to obtain at least two significant figures for the CMC.

Expression of CMCs - symbols and units

In general, only units of the SI and those units recognised for use with the SI are used to express the values of quantities and of the associated CMCs. Nevertheless, other commonly used units may be used where considered appropriate for the intended audience. For example, the term "ppm" (part per million) is frequently used by manufacturers of test and measurement equipment to specify the performance of their products. Terms like this may be used in Schedules of Accreditation where they are in common use and understood by the users of such equipment, providing their use does not introduce any ambiguity in the capability that is being described.

When the CMC is expressed as an explicit function of the measurand or of a parameter, this often comprises a relative term (e.g., percentage) and an absolute term, i.e. one expressed in the same units as those of the measurand. This form of expression is used to describe the capability that can be achieved over a range of values. Some examples are shown below. It should be noted that these expressions are *not* mathematical formulae but are instead written in a commonly used shorthand for expressing uncertainties - therefore, for purposes of clarity, an indication of how they are to be interpreted is also provided below.

DC voltage, 100 mV to 1 V: 0.0025 % + 5.0 µV

Over the range 100 mV to 1 V, the CMC is 0.0025 %·V + 5.0 µV, where V is the measured voltage.

Hydraulic pressure, 0.5 MPa to 140 MPa: 0.0036 % + 0.12 ppm/MPa + 4.0 Pa

Over the range 0.5 MPa to 140 MPa, the CMC is 0.0036 %·p + ($0.12 \cdot 10^{-6} \cdot p \cdot 10^{-6}$) + 4.0 Pa, where p is the measured pressure in Pa.

It should be noted that the percentage symbol (%) simply represents the number 0.01. In cases where the CMC is stated only as a percentage, this is to be interpreted as meaning percentage of the measured value or indication.

Thus, for example, a CMC of 1.5 % means $1.5 \cdot 0.01 \cdot i$, where i is the instrument indication.