Schedule of Accreditation

issued by

United Kingdom Accreditation Service

21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK

0324

Accredited to ISO/IEC 17025:2005

Transmille 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
ELECTRICAL			
DC Resistance			
Specific Values	1 mΩ	280 nΩ	
	10 mΩ	1.0 μΩ	
	100 mΩ	1.7 μΩ	
	1 Ω	3.0 μΩ	
	10 Ω	28 μΩ	
	100 Ω	200 μΩ	
	1 kΩ	1.5 mΩ	
	10 kΩ	16 mΩ	
	100 kΩ	350 mΩ	
	1 MΩ	6.1 Ω	
	10 MΩ	50 Ω	
	100 MΩ	3.4 kΩ	
	1 GΩ	220 kΩ	
	10 GΩ	45 MΩ	100 V
	100 GΩ	510 MΩ	100 V
Other Values	0 Ω to 10 Ω	22 ppm + 84 μΩ	
	10 Ω to 100 Ω	19 ppm + 680 μΩ	
	100 Ω to 1 kΩ	12 ppm + 1.4 mΩ	
	1.0 kΩ to 10 kΩ	12 ppm + 13 mΩ	
	10. kΩ to 100 kΩ	14 ppm + 120 mΩ	
	100 kΩ to 1 MΩ	19 ppm + 3.5 Ω	
	1.0 MΩ to 10 MΩ	69 ppm + 165 Ω	
	10 MΩ to 100 MΩ	580 ppm + 4.2 kΩ	
	100 MΩ to 1 GΩ	0.58 % + 100 kΩ	
AC Resistance	*40 Hz to 1.592 kHz*		
Specific Values	1 Ω	41 μΩ	
	10 Ω	410 μΩ	
	100 Ω	4.1 mΩ	
	1 kΩ	41 mΩ	
	10 kΩ	410 mΩ	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC Voltage			
Standard cell values	1.018 V nominal	1.4 μV	This uncertainty can be realised with cells only if they have their own temperature-controlled enclosure maintained at a nominal 30 °C with the appropriate thermal stability
Other Values	0 mV to 10 mV 10 mV to 100 mV 100 mV to 1 V 1.0 V to 1 kV	440 nV 490 nV 2.0 ppm + 440 nV 3.0 ppm	
High Voltage	1 kV to 20 kV 20 kV to 40 kV	57 V 110 V	
DC Current	0 μA to 100 μA 100 μA to 1 mA 1.0 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A 1.0 A to 10 A 10. A to 30 A	6 ppm + 130 pA 5.9 ppm + 1.8 nA 5.9 ppm + 26 nA 5.9 ppm + 185 nA 8.8 ppm + 1.6 μA 36 ppm + 27 μA 130 ppm + 500 μA	
	10 A to 1000 A	0.23 % + 1.3 A	For the calibration of clamp-on ammeters
AC Voltage	*40 Hz to 1 kHz* 1 mV to 999 mV	 230 ppm + 4.0 μV	 Generation only
Specific Values	1 V *10 Hz* *40 Hz* *1 kHz* *10 kHz* *100 kHz* *1 MHz*	 40 μV 40 μV 40 μV 40 μV 230 μV 660 μV	
	10 V *10 Hz* *40 Hz* *1 kHz* *10 kHz* *100 kHz* *200 kHz* *1 MHz*	 390 μV 390 μV 100 μV 410 μV 2.3 mV 4.2 mV 4.1 mV	
	20 V *40 Hz* *1 kHz* *10 kHz* *100 kHz*	 780 μV 780 μV 800 μV 4.6 mV	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC Voltage (continued)			
Specific values (continued)	100 V		
	40 Hz	6.5 mV	
	1 kHz	6.4 mV	
	10 kHz	6.4 mV	
	50 kHz	78 mV	
	200 V		
	40 Hz	13 mV	
	1 kHz	13 mV	
	10 kHz	13 mV	
	50 kHz	160 mV	
	1000 V		
	40 Hz	95 mV	
	1 kHz	95 mV	
	10 kHz	95 mV	
	50 kHz	200 mV	
Other values	10 mV to 100 mV		
	10 Hz to 40 Hz	200 ppm + 7.0 μV	
	40 Hz to 1 kHz	290 ppm + 5.0 μV	
	1 kHz to 20 kHz	250 ppm + 5.0 μV	
	100 mV to 1 V		
	10 Hz to 40 Hz	80 ppm + 48 μV	
	40 Hz to 1 kHz	85 ppm + 25 μV	
	1 kHz to 10 kHz	160 ppm + 25 μV	
	10 kHz to 100 kHz	950 ppm + 20 μV	
	100 kHz to 1 MHz	1.2 % + 100 μV	
	1 V to 10 V		
	10 Hz to 40 Hz	85 ppm + 450 μV	
	40 Hz to 1 kHz	88 ppm + 220 μV	
	1 kHz to 10 kHz	170 ppm + 220 μV	
	10 kHz to 100 kHz	940 ppm + 300 μV	
	100 kHz to 1 MHz	1.2 % + 1.0 mV	
	10 V to 100 V		
	40 Hz to 1 kHz	230 ppm + 2.3 mV	
	1 kHz to 10 kHz	230 ppm + 2.3 mV	
	10 kHz to 50 kHz	870 ppm + 2.0 mV	
	100 V to 1 kV		
	40 Hz to 1 kHz	470 ppm +20 mV	
	1 kHz to 10 kHz	700 ppm + 25 mV	
	10 kHz to 50 kHz	0.14 % + 20 mV	
	1 kV to 28 kV		
	50 Hz	0.42 % + 4.0 V	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC Current	*40 Hz to 1 kHz*		
	25 μA to 100 μA	150 ppm + 4 nA	
	100 μA to 1 mA	160 ppm + 30 nA	
	1.0 mA to 10 mA	160 ppm + 300 nA	
	10 mA to 100 mA	160 ppm + 3.0 μA	
	100 mA to 1 A	170 ppm + 20 μA	
	1.0 A to 10 A	350 ppm + 1.0 mA	
	10 A to 30 A	360 ppm + 1.0 mA	
	50 Hz		
	10 A to 1000 A	0.25 % + 1.3 A	For the calibration of clamp-on ammeters
Loop impedance	*At 50 Hz:*		
	0.6 Ω to 1.6 Ω	24 mΩ	Nominal values for the calibration of earth loop testers
	5.5 Ω to 100 Ω	42 mΩ	
	1 kΩ	5.8 mΩ	
Inductance			
Specific Values	*1 kHz*		
	10 μH	8.9 nH	Specific values are those that fall within 1 % of the stated values.
	100 μH	39 nH	
	1 mH	350 nH	
	10 mH	3.7 μH	
	100 mH	31 μH	
	1 H	280 μH	
Capacitance			
Specific Values, three-terminal	*1 kHz*		Specific values are those that fall within 1 % of the stated values
	10 pF	26 fF	
	100 pF	170 fF	
	1 nF	280 fF	
Specific Values, two- and three-terminal	*1 kHz*		
	10 nF	2.8 pF	
	100 nF	28 pF	
	1 μF	280 pF	
Other Values	*1 kHz*		
	10 pF to 10 μF	0.050 % + 0.20 pF	
Frequency			
Measurement	10 mHz to 1 GHz	0.24 ppm	The CMC is for an average frequency measured or generated over a 10-minute period. The uncertainties may be increased for shorter periods.
Generation	1 Hz to 10 MHz	2.1 Hz	

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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
Time Interval	20 ms to 900 ms	390 μs	For the calibration of RCD testers
Phase Measurement Voltage : Current	*40 Hz to 50 Hz* -180 0 ° to +180°	 170 m°	Voltage range: 1 V to 500 V Current range: 10 mA to 30 A
Temperature simulation			
Reference junction measurements	Reference at 0 °C Ambient 18 °C to 28 °C	0.12 °C 0.12 °C	
Thermocouple type			Including Reference Junction Compensation
B	100 °C to 1820 °C	2.4 °C	
E	0°C to 800 °C	0.35 °C	
J	-180 °C to +150 °C 150 °C to 750 °C	0.35 °C 0.50 °C	
K	-140 °C to +200 °C 200 °C to 1340 °C	0.40 °C 0.60 °C	
N	-270 °C to +260 °C 260 °C to 1300 °C	0.35 °C 0.60 °C	
R	100 °C to 1700 °C	1.2 °C	
S	50 °C to 1700 °C	1.7 °C	
T	-250 °C to +400 °C	0.40 °C	
Resistance Thermometer			
PT 100	-100 °C to +800 °C	0.020 °C	

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, and an indication of how they are to be interpreted, are shown 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.