Schedule of Accreditation

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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 10 mΩ 100 mΩ 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ 10 GΩ 100 GΩ 1TΩ	260 nΩ 68 nΩ 890 μΩ 2.3 μΩ 28 μΩ 160 μΩ 1.2 mΩ 7.0 mΩ 150 mΩ 3.1 Ω 64 Ω 3.2 kΩ 140 kΩ 35 MΩ 550 MΩ 7.8 GΩ	
Other values	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 10 G Ω to 100 GΩ	16 ppm + 60 μΩ 16 ppm + 84 μΩ 14 ppm + 600 μΩ 12 ppm + 600 μΩ 12 ppm + 6.0 mΩ 12 ppm + 60 mΩ 18 ppm + 2.4 Ω 60 ppm + 130 Ω 580 ppm + 1.7 kΩ 0.58 % + 20 kΩ 0.41 % 1.6 %	
DC Voltage ranges	0 mV to 10 mV 10 mV to 100 mV 100 mV to 1 V 1 V to 100V 100 V to 1 kV	440 nV 480 nV 1.5 ppm + 440 nV 1.5 ppm 1.5 ppm	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC Voltage set points	1V 10 V 100 V 1 kV	1 μV 7 μV 100 μV 1 mV	
High Voltage	1 kV to 20 kV	57 V	
	20 kV to 40 kV	110 V	
DC Current			
	1 pA to 10nA	0.3 % + 1 pA	
	10 nA to 100 nA	40 ppm + 28 pA	
	100 nA to 1μA	21 ppm + 29 pA	
	1 μA to 10 μA	15 ppm + 33 pA	
	10 μA to 100 μA	4.3 ppm + 100 pA	
	100 μA to 1 mA	4.5 ppm + 950 pA	
	1.0 mA to 10 mA	3.6 ppm + 22 nA	
	10 mA to 100 mA	4.4 ppm + 100 nA	
	100 mA to 1 A	7.6 ppm + 700 nA	
	1 A to 10 A	53 ppm + 5 μA	
	10 A to 30 A	60 ppm	
	10 A to 1500 A	0.23 % + 1.3 A	For the calibration of clamp-on ammeters
AC Voltage			
Specific values			
	10 mV		
	40 Hz	3.6 μV	
	206 Hz	3.6 μV	
	1 kHz	3.6 μV	
	20 mV		
	40 Hz	3.7 μV	
	206 Hz	3.7 μV	
	1 kHz	3.7 μV	
	10 kHz	3.7 μV	
	500 kHz	11 μV	
	100 mV		
	10 Hz	24 μV	
	23 Hz	11 μV	
	40 Hz	6.3 μV	
	206 Hz	6.3 μV	
	1 kHz	6.3 μV	
	10 kHz	6.3 μV	
	20 kHz	6.3 μV	
	50 kHz	12 μV	
	100 kHz	18 μV	
	200 kHz	52 μV	
	500 kHz	70 μV	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC Voltages Secific Values (cont'd)			
	200 mV		
	10 Hz	140 µV	
	23 Hz	19 µV	
	40 Hz	10 µV	
	206 Hz	10 µV	
	1 kHz	10 µV	
	10 kHz	10 µV	
	20 kHz	10 µV	
	50 kHz	23 µV	
	100 kHz	35 µV	
	200 kHz	100 µV	
	500 kHz	140 µV	
	500 mV		
	10 Hz	130 µV	
	23 Hz	47 µV	
	40 Hz	30 µV	
	206 Hz	30 µV	
	1 kHz	30 µV	
	10 kHz	30 µV	
	20 kHz	30 µV	
	50 kHz	58 µV	
	100 kHz	87 µV	
	200 kHz	260 µV	
	500 kHz	350 µV	
	700 mV		
	10 Hz	160 µV	
	23 Hz	58 µV	
	40 Hz	26 µV	
	206 Hz	22 µV	
	1 kHz	23µV	
	10 kHz	23 µV	
	1 V		
	10 Hz	220 µV	
	23 Hz	71 µV	
	40 Hz	38 µV	
	206 Hz	24 µV	
	1 kHz	24 µV	
	10 kHz	24 µV	
	20 kHz	24 µV	
	50 kHz	49 µV	
	100 kHz	60 µV	
	200 kHz	130 µV	
	500 kHz	500 µV	
	1 MHz	520 µV	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC Voltages Secific Values (cont'd)			
	2 V		
	10 Hz	440 µV	
	23 Hz	140 µV	
	40 Hz	71 µV	
	206 Hz	50 µV	
	1 kHz	46 µV	
	10 kHz	46 µV	
	20 kHz	49 µV	
	50 kHz	100 µV	
	100 kHz	120 µV	
	200 kHz	270 µV	
	500 kHz	990 µV	
	1 MHz	1.0 mV	
	5 V		
	10 Hz	1.1 mV	
	23 Hz	360 µV	
	40 Hz	180 µV	
	206 Hz	110 µV	
	1 kHz	110 µV	
	10 kHz	120 µV	
	20 kHz	110 µV	
	50 kHz	250 µV	
	100 kHz	300 µV	
	200 kHz	700 µV	
	500 kHz	2.5 mV	
	10 V		
	10 Hz	2.2 mV	
	23 Hz	710 µV	
	40 Hz	390 µV	
	206 Hz	290 µV	
	1 kHz	290 µV	
	10 kHz	290 µV	
	20 kHz	290 µV	
	50 kHz	490 µV	
	100 kHz	600 µV	
	200 kHz	1.4 mV	
	500 kHz	5.0 mV	
	19 V		
	500 kHz	9.4 mV	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC Voltages			
Secific Values (cont'd)			
	20 V		
	10 Hz	4.4 mV	
	23 Hz	1.4 mV	
	40 Hz	700 μV	
	206 Hz	520 μV	
	1 kHz	520 μV	
	10 kHz	540 μV	
	20 kHz	550 μV	
	50 kHz	1.0 mV	
	100 kHz	1.2 mV	
	200 kHz	2.8 mV	
	50 V		
	10 Hz	11 mV	
	23 Hz	3.6 mV	
	40 Hz	1.7 mV	
	206 Hz	1.5 mV	
	1 kHz	1.5 mV	
	10 kHz	1.5 mV	
	20 kHz	1.5 mV	
	50 kHz	3.0 mV	
	100 kHz	3.9 mV	
	100 V		
	40 Hz	3.9 mV	
	206 Hz	3.9 mV	
	1 kHz	3.9 mV	
	10 kHz	3.9 mV	
	20 kHz	3.9 mV	
	50 kHz	7.7 mV	
	100 kHz	8.3 mV	
	200 V		
	40 Hz	7.4 mV	
	206 Hz	7.4 mV	
	1 kHz	7.4 mV	
	10 kHz	7.4 mV	
	20 kHz	7.4 mV	
	50 kHz	15 mV	
	100 kHz	17 mV	
	500 V		
	40 Hz	25 mV	
	206 Hz	25 mV	
	1 kHz	25 mV	
	10 kHz	25 mV	
	20 kHz	26 mV	
	50 kHz	41 mV	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC Voltages Secific Values (cont'd)			
	1 kV		
	40 Hz	37 mV	
	206 Hz	37 mV	
	1 kHz	37 mV	
	10 kHz	37 mV	
	20 kHz	42 mV	
	50 kHz	79 mV	
Other values 10 count devices			
	10 mV to 100 mV		
	10 Hz to 40 Hz	220 ppm + 7μV	
	40 Hz to 1 kHz	100 ppm + 6 μV	
	1 kHz to 20 kHz	140 ppm + 6 μV	
	20 kHz to 50 kHz	330 ppm + 6 μV	
	50 kHz to 100 kHz	910 ppm + 6 μV	
	100 kHz to 300 kHz	0.35 % + 12 μV	
	300 kHz to 500 kHz	1.2 % + 30 μV	
	100 mV to 1 V		
	10 Hz to 40 Hz	210 ppm + 40 μV	
	40 Hz to 1 kHz	85 ppm + 25 μV	
	1 kHz to 20 kHz	160 ppm + 30 μV	
	20 kHz to 50 kHz	345 ppm + 25 μV	
	50 kHz to 100 kHz	920 ppm + 30 μV	
	100 kHz to 300 kHz	0.35 % + 120 μV	
	300 kHz to 1 MHz	1.2 % + 100 μV	
	1 V to 10 V		
	10 Hz to 40 Hz	210 ppm + 400 μV	
	40 Hz to 1 kHz	90 ppm + 220 μV	
	1 kHz to 20 kHz	170 ppm + 220 μV	
	20 kHz to 50 kHz	345 ppm + 250 μV	
	50 kHz to 100 kHz	920 ppm + 300 μV	
	100 kHz to 300 kHz	0.35 % + 1.1 mV	
	300 kHz to 1 MHz	1.2 % + 1.0 mV	
	10 V to 100 V		
	40 Hz to 20 kHz	240 ppm + 2.2 mV	
	20 kHz to 50 kHz	420 ppm + 2.2 mV	
	50 kHz to 100 kHz	920 ppm + 20 mV	
	100 V to 1 kV		
	40 Hz to 1 kHz	470 ppm +22 mV	
	1 kHz to 20 kHz	700 ppm + 22 mV	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC Voltages Range values continued 300 count devices	100 mV to 300mV *10 Hz to 23 Hz* *23 Hz to 40 Hz* *40 Hz to 20 kHz* *20 kHz to 200 kHz* *200 kHz to 500 kHz*	 695 ppm + 2μV 100 ppm + 2μV 80 ppm + 2μV 500 ppm + 2uV 800 ppm	
	300 mV to 1V *10 Hz to 23 Hz* *23 Hz to 40 Hz* *40 Hz to 20 kHz* *20 kHz to 200 kHz* *200 kHz to 500 kHz* *500 kHz to 1 MHz*	 225 ppm 60 ppm 50 ppm 160 ppm 635 ppm 0.11 %	
	1 V to 3 V *10 Hz to 23 Hz* *23 Hz to 40 Hz* *40 Hz to 20 kHz* *20 kHz to 200 kHz* *200 kHz to 500 kHz* *500 kHz to 1 MHz*	 225 ppm 75 ppm 60 ppm 140 ppm 635 ppm 0.11 %	
	3 V to 10 V *10 Hz to 23 Hz* *23 Hz to 40 Hz* *40 Hz to 20 kHz* *20 kHz to 200 kHz*	 225 ppm 80 ppm 55 ppm 170 ppm	
	10 V to 30 V *10 Hz to 23 Hz* *23 Hz to 40 Hz* *40 Hz to 20 kHz* *20 kHz to 200 kHz*	 225 ppm 80 ppm 50 ppm 130 ppm	
	30 V to 100 V *40 Hz to 20 kHz* *20 kHz to 100 kHz*	 55 ppm 130 ppm	
	100 V to 300 V *40 Hz to 20 kHz* *20 kHz to 100 kHz*	 55 ppm 150 ppm	
	300 V to 1000 V *40 Hz to 20 kHz*	 65 ppm	
	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			
	25 µA to 100 µA		
	40 Hz to 1 kHz	100 ppm + 2 nA	
	100 µA to 1 mA		
	40 Hz to 1 kHz	100 ppm + 22 nA	
	1 mA to 10 mA		
	40 Hz to 1 kHz	100 ppm + 220 nA	
	10 mA to 100 mA		
	10 Hz to 40 Hz	220 ppm + 4 µA	
	40 Hz to 1 kHz	100 ppm + 2 µA	
	1 kHz to 10 kHz	165 ppm + 2.5 µA	
	10 kHz to 30 kHz	345 ppm + 2.5 µA	
	100 mA to 1 A		
	23 Hz to 40 Hz	220 ppm + 40 µA	
	40 Hz to 1 kHz	100 ppm + 22 µA	
	1 kHz to 10 kHz	165 ppm + 25 µA	
	1 A to 10 A		
	40 Hz to 1 kHz	370 ppm + 100 µA	
	10 A to 30 A		
	10 Hz to 40 Hz	260 ppm + 100 µA	
	40 Hz to 1 kHz	150 ppm	
	1 kHz to 10 kHz	200 ppm + 100 µA	
AC Current simulation	*50 Hz*		
	10 A to 1500 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	14 nH	Specific values are those that fall within 1 % of the stated values.
	100 µH	29 nH	
	1 mH	330 nH	
	10 mH	3.2 µH	
	100 mH	29 µH	
	1 H	260 µH	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
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	27 fF	
	1 nF	280 fF	
Specific Values, two- and three-terminal	*1 kHz*		
	10 nF	2.9 pF	
	100 nF	29 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 will be increased for shorter periods.
Generation	1 Hz to 10 MHz	0.21 ppm	
Time Interval	20 ms to 900 ms	390 μs	For the calibration of RCD testers
Phase Measurement			
Voltage : Current	*40 Hz to 60 Hz*		Voltage range: 1 V to 500 V
	-180 ° to 180°	130 m°	
Temperature simulation			
Reference junction measurements	Ambient 18 °C to 28 °C	0.12 °C	Including Reference Junction Compensation
Thermocouple type			
B	100 °C to 1820 °C	2.4 °C	
E	0 °C to 800 °C	0.35 °C	
J	-180 °C to +150 °C	0.35 °C	
	150 °C to 750 °C	0.50 °C	
K	-140 °C to +200 °C	0.40 °C	
	200 °C to 1340 °C	0.60 °C	
N	-270 °C to 260 °C	0.35 °C	
	260 °C to 1300 °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.