Schedule of Accreditation

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Calibration, Maintenance and Repair Ltd

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Calibration performed by the Organisation at the locations specified

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details		Activity	Location code
Address 11 Frensham Road Norwich NR3 2BT	**Local contact:** Mr P K Clark Tel: +44 (0)1603 279557	Electrical Calibration Accelerometer calibration	A
Address 5 Octavian Way, Team Valley Trading Est Gateshead NE11 0HZ	**Local contact:** Mr John Fryer Tel: +44 (0)191 4875951	Electrical Calibration Pressure Calibration	B

DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
Values and uncertainties listed below are applicable for the calibration of both measuring instruments and for instruments with an output. The method used is by direct comparison against laboratory references unless otherwise stated in the remarks column.				
ELECTRICAL MEASUREMENTS			Calibrations are performed as a direct comparison against a reference standard	
DC VOLTAGE				A
Generation	0 mV to 10 mV 10 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1100 V	0.55 μV 1.4 μV 6.6 μV 44 μV 630 μV 8.0 mV	For the calibration of measuring instruments	
Measurement	0 mV to 10 mV 10 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1 kV	1.0 μV 2.0 μV 10 μV 98 μV 1.3 mV 14 mV	For instruments with a voltage output	
DC RESISTANCE				A
Sourcing - Spot Values	1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	110 μΩ 210 μΩ 270 μΩ 540 μΩ 1.2 mΩ 2.5 mΩ 8.7 mΩ 17 mΩ 81 mΩ 170 mΩ 1.1 Ω 2.4 Ω 16 Ω 48 Ω 460 Ω 1.1 kΩ 12 kΩ	For the calibration of measuring instruments	

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DC RESISTANCE (continued)				A
Sourcing - Range values	0Ω 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 33 MΩ 33 MΩ to 110 MΩ 110 MΩ to 330 MΩ 330 MΩ to 1.1 GΩ	2.0 mΩ 5.0 mΩ 31 mΩ 310 mΩ 3.0 Ω 37 Ω 2.0 kΩ 11 kΩ 60 kΩ 1.0 MΩ 17 MΩ	For the calibration of measuring instruments	
Measurement	0 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 GΩ 10 GΩ to 1 TΩ	250 μΩ 2.0 mΩ 14 mΩ 140 mΩ 1.0 Ω 22 Ω 0.71 % 1.0 %	For instruments with a resistance output	
DC CURRENT				A
Generation	0 μA to 10 μA 10 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 3 A 3 A to 5 A 5 A to 10 A 10 A to 20 A 16 A to 160 A 160 A to 1000 A	7.4 nA 12 nA 49 nA 450 nA 6.0 μA 110 μA 1.0 mA 4.0 mA 6.0 mA 12 mA 25 mA 580 mA	For the calibration of measuring instruments Current clamp calibration using a multi turn coil	

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DC CURRENT (continued)				A
Measurement	0 μA to 10 μA	2.0 nA	For instruments which generate current	
	10 μA to 100 μA	4.0 nA		
	100 μA to 1 mA	34 nA		
	1 mA to 10 mA	340 nA		
	10 mA to 100 mA	5.0 μA		
	100 mA to 1 A	150 μA		
	1 A to 2 A	2.4 mA		
	2 A to 10 A	25 mA		
AC VOLTAGE				A
Generation	*1 Hz to 10 Hz*			
	10 μV to 10 mV	60 μV	For the calibration of measuring instruments	
	10 mV to 100 mV	270 μV		
	100 mV to 1 V	1.9 mV		
	1 V to 7 V	9.2 mV		
	10 μV to 2.2 mV			
	10 Hz to 20 Hz	5.3 μV		
	20 Hz to 40 Hz	4.9 μV		
	40Hz to 500 Hz	4.9 μV		
	500 Hz to 1 kHz	4.9 μV		
	1 kHz to 10 kHz	4.9 μV		
	10 kHz to 20 kHz	4.9 μV		
	20 kHz to 50 kHz	5.2 μV		
	50 kHz to 100 kHz	7.1 μV		
	100 kHz to 300 kHz	14 μV		
	300 kHz to 500 kHz	27 μV		
	500 kHz to 1 MHz	30 μV		
	2.2 mV to 22 mV			
	10 Hz to 20 Hz	11 μV		
	20 Hz to 40 Hz	7.1 μV		
	40Hz to 500 Hz	6.9 μV		
	500 Hz to 1 kHz	6.9 μV		
	1 kHz to 10 kHz	6.9 μV		
	10 kHz to 20 kHz	6.9 μV		
	20 kHz to 50 kHz	10 μV		
	50 kHz to 100 kHz	19 μV		
	100 kHz to 300 kHz	38 μV		
	300 kHz to 500 kHz	59 μV		
	500 kHz to 1 MHz	92 μV		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
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AC VOLTAGE (continued)				A
Generation (continued)	22 mV to 220 mV			
	10 Hz to 20 Hz	76 µV	For measuring instruments	
	20 Hz to 40 Hz	31 µV		
	40Hz to 500 Hz	23 µV		
	500 Hz to 1 kHz	23 µV		
	1 kHz to 10 kHz	23 µV		
	10 kHz to 20 kHz	23 µV		
	20 kHz to 50 kHz	39 µV		
	50 kHz to 100 kHz	99 µV		
	100 kHz to 300 kHz	190 µV		
	300 kHz to 500 kHz	380 µV		
	500 kHz to 1 MHz	740 µV		
	220 mV to 2.2 V			
	10 Hz to 20 Hz	660 µV		
	20 Hz to 40 Hz	250 µV		
	40Hz to 500 Hz	120 µV		
	500 Hz to 1 kHz	120 µV		
	1 kHz to 10 kHz	120 µV		
	10 kHz to 20 kHz	120 µV		
	20 kHz to 50 kHz	180 µV		
	50 kHz to 100 kHz	250 µV		
	100 kHz to 300 kHz	950 µV		
	300 kHz to 500 kHz	2.8 mV		
	500 kHz to 1 MHz	4.7 mV		
	2.2 V to 22 V			
	10 Hz to 20 Hz	6.6 mV		
	20 Hz to 40 Hz	2.5 mV		
	40Hz to 500 Hz	1.1 mV		
	500 Hz to 1 kHz	1.1 mV		
	1 kHz to 10 kHz	1.1 mV		
	10 kHz to 20 kHz	1.1 mV		
	20 kHz to 50 kHz	1.8 mV		
	50 kHz to 100 kHz	2.3 mV		
	100 kHz to 300 kHz	7.2 mV		
	300 kHz to 500 kHz	28 mV		
	500 kHz to 1 MHz	42 mV		
	22 V to 220 V			
	10 Hz to 20 Hz	66 mV		
	20 Hz to 40 Hz	25 mV		
	40Hz to 500 Hz	14 mV		
	500 Hz to 1 kHz	14 mV		
	1 kHz to 10 kHz	14 mV		
	10 kHz to 20 kHz	14 mV		
	20 kHz to 50 kHz	22 mV		
	50 kHz to 100 kHz	41 mV		

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AC VOLTAGE (continued)				A
Generation (continued)	220 V to 1100 V		For measuring instruments	
	55 Hz to 1 kHz	110 mV		
	220 V to 500 V *50 Hz to 10 kHz*	180 mV		
	500 V to 750 V *50 Hz to 10 kHz*	260 mV		
	750 V to 1 kV *50 Hz to 10 kHz*	350 mV		
Measurement	30 μV to 10 mV		For instruments with a voltage output	
	1 Hz to 40 Hz	8.0 μV		
	40 Hz to 1kHz	5.0 μV		
	1 kHz to 20 kHz	6.0 μV		
	20 kHz to 50 kHz	13 μV		
	50 kHz to 100 kHz	60 μV		
	100 kHz to 1 MHz	160 μV		
	10 mV to 100 mV			
	1 Hz to 40 Hz	15 μV		
	40 Hz to 1kHz	13 μV		
	1kHz to 20 kHz	20 μV		
	20 kHz to 50 kHz	38 μV		
	50 kHz to 100 kHz	100 μV		
	100 kHz to 300 kHz	360 μV		
	300 kHz to 1 MHz	2.3 mV		
	100mV to 1V			
	1 Hz to 40 Hz	140 μV		
	40 Hz to 1kHz	120 μV		
	1kHz to 20 kHz	200 μV		
	20 kHz to 50 kHz	390 μV		
	50 kHz to 100 kHz	970 μV		
	100 kHz to 300 kHz	3.6 mV		
	300 kHz to 1 MHz	24 mV		
	1 V to 10 V			
	1 Hz to 40 Hz	2.0 mV		
	40 Hz to 1 kHz	1.0 mV		
	1kHz to 20 kHz	2.0 mV		
	20 kHz to 50 kHz	4.0 mV		
	50 kHz to 100 kHz	10 mV		
	100 kHz to 300 kHz	36 mV		
	300 kHz to 1 MHz	240 mV		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
Values and uncertainties listed below are applicable for the calibration of both measuring instruments and for instruments with an output. The method used is by direct comparison against laboratory references unless otherwise stated in the remarks column.				
AC VOLTAGE (continued) Measurement (continued)	10V to 100V *1 Hz to 40 Hz* *40 Hz to 1kHz* *1kHz to 20 kHz* *20 kHz to 50 kHz* *50 kHz to 100 kHz* *100kHz to 300 kHz* 100V to 1 kV *1 Hz to 40 Hz* *40 Hz to 1 kHz* *1 kHz to 20 kHz* *20 kHz to 50 kHz* *50 kHz to 100 kHz*	 38 mV 36 mV 37 mV 51 mV 150 mV 480 mV 520 mV 490 mV 720 mV 1.4 V 3.5 V	For instruments with a voltage output.	A
AC CURRENT Generation	10 µA to 220 µA *55 Hz to400 Hz* *400 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz* 220 µA to 2.2 mA *55 Hz to400 Hz* *400 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz* 2.2 mA to 22 mA *55 Hz to400 Hz* *400 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz* 22 mA to 220 mA *55 Hz to400 Hz* *400 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz* 220 mA to 2.2 A *55 Hz to400 Hz* *400 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz* *10 Hz to 1 kHz* *2 A to 3 A* *3 A to 5 A* *5 A to 10 A*	 38 nA 38 nA 88 nA 360 nA 320 nA 320 nA 660 nA 3.6 µA 29 µA 29 µA 55 µA 290 µA 3.0 µA 3.0 µA 5.7 µA 34 µA 660 µA 660 µA 1.3 mA 18 mA 7.0 mA 9.0 mA 14 mA	For the calibration measuring instruments	A

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Values and uncertainties listed below are applicable for the calibration of both measuring instruments and for instruments with an output. The method used is by direct comparison against laboratory references unless otherwise stated in the remarks column.				
AC CURRENT (continued)				A
Generation (continued)	*10 Hz to 100 Hz* 10 A to 32 A 16 A to 160 A 160 A to 1000 A	 9.0 mA 35 mA 580 mA	Calibration of current clamps using a multi turn coil	
Measurement	20 nA to 10 μA *20 Hz to 45 kHz* *45 Hz to 1 kHz* 10 μA to 100 μA *20 Hz to 45 kHz* *45 Hz to 1 kHz* 100 μA to 1 mA *20 Hz to 45 kHz* *45 Hz to 20 kHz* *20 kHz to 50 kHz* 1 mA to 10 mA *20 Hz to 45 kHz* *45 Hz to 20 kHz* *20 kHz to 50 kHz* 10 mA to 100 mA *20Hz to 45Hz* *45Hz to 20kHz* *20kHz to 50kHz* 100 mA to 1 A *20Hz to 45Hz* *45Hz to 20kHz* *20kHz to 50kHz*	 23 nA 14 nA 210 nA 110 nA 2.0 μA 1.0 μA 5.0 μA 20 μA 9.0 μA 51 μA 200 μA 95 μA 510 μA 2.0 mA 1.0 mA 12 mA	For instruments which generate current	
FREQUENCY				A
Generation	0.5 Hz to 5.4 GHz 1 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 27 GHz	2.1 in 10^9 35 μHz 0.40 Hz 0.24 ppm	For the calibration of measuring instruments May be reported as events per unit time For instruments outputting frequency	
Generation	0.5 Hz to 5.4 GHz 5.4 GHz to 20 GHz	2.1 in 10^9 4.0 MHz	For the calibration of measuring instruments May be reported as events per unit time	

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TIME and FREQUENCY				A
Elapsed time			Mechanical timers / stop watches	
Single event	10 s to 12 hrs	0.23 s		
Revolutions Per Minute	60 RPM to 1000 RPM 1000 RPM to 30000 RPM 30000 RPM to 96000 RPM	0.37 RPM 1.6 RPM 23 RPM		
CAPACITANCE				A
Measurement For capacitance sources	*1 kHz* 0.1 pF to 1 pF 1 pF to 10 pF 10 pF to 100 pF 100 pF to 1000 pF	 0.030 pF 0.035 pF 0.10 pF 1.2 pF	 For capacitance sources	
	1 MHz 0.1 pF to 1 pF 1 pF to 10 pF 10 pF to 100 pF 100 pF to 1000 pF	 0.0050 pF 0.030 pF 0.90 pF 8.0 pF		
Simulated For capacitance meters	*10 Hz to 10 kHz* 220 pF to 400 pF 400 pF to1.1 nF	 13 pF 16 pF		
	10 Hz to 3 kHz 1.1 nF to 3.3 nF	 27 pF		
	10 Hz to 1 kHz 3.3 nF to 11 nF 11 nF to 33 nF	 39 pF 180 pF		
	10 Hz to 1 kHz 33 nF to 110 nF 110 nF to 330 nF	 380 pF 1.0 nF		
	10 Hz to 600 Hz 330 nF to 1.1 µF	 5.0 nF		
	10 Hz to 300 Hz 1.1 µF to 3.3 µF	 12 nF		
	10 Hz to 150 Hz 3.3 µF to 11 µF	 39 nF		
	10 Hz to 120 Hz 11 µF to 33 µF	 140 nF		
	10 Hz to 80 Hz 33 µF to 110 µF	 610 nF		

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CAPACITANCE (continued)				A
For capacitance meters	*0 Hz to 50 Hz* 110 µF to 330 µF	2.0 µF		
	0 Hz to 20 Hz 330 µF to 1.1 mF	6.0 µF		
	0 Hz to 6 Hz 1.1 mF to 3.3 mF	2.0 µF		
	0 Hz to 2 Hz 3.3 mF to 11 mF	60 µF		
	0 Hz to 0.6 Hz 11 mF to 33 mF	280 µF		
	0 Hz to 0.2 Hz 33 mF to 110 mF	1.0 mF		
CALIBRATION OF INSULATION TESTERS				A
Insulation Resistance	100 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1 GΩ	2.0 kΩ 32 kΩ 510 kΩ 7.0 MΩ	Up to 1350 V	
Insulation test voltage Nominal	50 V 100 V 250 V 500 V 1 kV	1.0 V 2.0 V 3.0 V 4.0 V 7.0 V	The test voltage will normally be measured with a 1 mA load.	
Continuity Resistance	0 Ω to 1 Ω 1 Ω to 50 Ω 50 Ω to 100 Ω 100 Ω to 200 Ω	58 mΩ 100 mΩ 120 mΩ 140 mΩ		

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Temperature indicators, calibration by electrical simulation				A
Type k thermocouple	-200 °C to +1372 °C	0.73 °C	Including reference junction compensation	
Type T thermocouple	-250 °C to +400 °C	0.65 °C	Including reference junction compensation	
Type N thermocouple	-200 °C to +1300 °C	0.46 °C	Including reference junction compensation	
Type S thermocouple	0 °C to 1767 °C	0.77 °C	Including reference junction compensation	
Type J thermocouple	-210 °C to +1200 °C	0.23 °C	Including reference junction compensation	
Type E thermocouple	-250 °C to +1000 °C	0.26 °C	Including reference junction compensation	
Resistance thermometer (Pt 100)	-200°C to +800°C	0.05°C		
Calibration of Oscilloscopes				A
Voltage deflection	0 V to 6 V 11 V to 130 V	0.33 % 0.22 %	Into 50 Ω Into 1 MΩ	
Edge verification - Amplitude	4.5 mV to 2.27 V 1 kHz, 10 kHz & 100 kHz	 2.7 %		
Time markers	100 ns to 20 ms 20 ms to 50 ms	83 ns 250 µs		
Rise time	1 kHz to 2 MHz 2 MHz to 10 MHz	300 ps 350 ps		
Bandwidth Level flatness 50 kHz ref Nominal 3 V	 To 100 MHz To 300 MHz To 600 MHz To 1.1 GHz	 3.3 % 5.4 % 8.5 % 9.5 %	CMC is with respect to relative amplitude of level flatness this will be quoted in frequency terms when stating bandwidth uncertainty as it will vary from device to device.	

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ACCELEROMETRY			Uncertainties for accelerometry sensitivity calibrations at	A
Accelerometer calibration Charge	Sensitivity range: 0.3 pC/g to 1000 pC/g (0.03 pC/ms^2 to 100 pC/m^2)		ambient temperature applies for masses up to 40 grams.	
	1 Hz to 2 Hz	3.0 %		
	2 Hz to 5 Hz	1.2 %	Nominal acceleration ms^{-2}:	
	5 Hz to 5 kHz	0.80 %	2 Hz: 0.10	
	5 kHz to 10 kHz	0.90 %	3 Hz: 0.20	
			4 Hz to 10 kHz: 0.31 to 1.0	
	Sensitivity range: 0.04 pC/g to 0.3 pC/g (0.004 pC/ms^2 to 0.03 pC/ms^2)			
	20 Hz to 10 kHz	3.0 %	Nominal acceleration 0.31 ms^{-2} to 1.0 ms^{-2}:	
Devices with integral electronics				
Voltage (mV/ms^2)	0.03 mV/ms^2 to 1000 mV/ms^2		Nominal acceleration ms^{-2}:	
	1 Hz to 2 Hz	2.0 %	1 Hz: 0.10	
	2 Hz to 5 Hz	0.83 %	3 Hz: 0.20	
	5 Hz to 5 kHz	0.86 %	4 Hz to 10 kHz: 0.31 to 1.0	
	5 kHz to 10 kHz	0.90 %		
	0.004 mV/ms^2 to 0.03 mV/ms^2			
	20 Hz to 10 kHz	3.0 %		
Resistive/Capacitive	0.01 mV/ms^2 to 100 mV/ms^2		Nominal acceleration ms^{-2}:	
	1 Hz to 2 Hz	2.0 %	1 Hz: 0.10	
	2 Hz to 5 Hz	0.83 %	3 Hz: 0.20	
	5 Hz to 5 kHz	0.86 %	4 Hz to 10 kHz: 0.31 to 1.0	
	5 kHz to 10 kHz	0.90 %		
Transducer at any temperature from -60 ^{0}C to +180 ^{0}C:	0.03 mV/ms^2 to 1000 mV/ms^2		At a nominal 1 g_n	
	20 Hz to 630 Hz	3.0 %	This uncertainty applies for masses up to 60 grams, larger masses can be calibrated but at greater uncertainties.	

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ACCELEROMETRY (continued)				A
Transducer at any temperature from -60 ^{0}C to +180 ^{0}C:	0.03 mV/ms^2 to 1000 mV/ms^2 *20 Hz to 630 Hz*	3.0 %	At a nominal 1 g_n This uncertainty applies for masses up to 60 grams, larger masses can be calibrated but at greater uncertainties	
Portable calibrators	*Frequency 160 Hz* 1 ms^2 nominal	1.5 %		
Bench Calibrators			Note indicated outputs on Bench Calibrators for acceleration are normally indicated in "g".	
Acceleration	*10mV to 10V, 5 Hz to 10KHz Up to 25g*	2.4 %		
Velocity	*10mV to 10V, 10 Hz to 1KHz Up to 1000 m/sec pk*	2.4 %		
Displacement	*10 mV to 10V, 10 Hz to 250 Hz Up to 10 mm pk to pk*	2.4 %		
ACCELERATION TRANSDUCERS - SHOCK CALIBRATION				A
<u>Piezoelectric and Piezoresistive and voltage types</u>			Calibration of charge sensitivity by comparison with a reference (precision grade) transducer	
Transducer at nominal 23 ^{0}C	Sensitivity 0.001 pC/ms^2 to 100 pC/ms^2 0.001 mV/ms^2 to 10 mV/ms^2 Within the range of: 4 ms^2 to 1000 ms^2	3.0 %	The transducer to be calibrated must have a mass of no more than 40 grams.	
Vibration meters and analysers	*Frequency 10 Hz to 1 kHz* Range 0.1 ms^2 to 1 ms^2	5.0 %		
Shock and Impulse hammers	Half Sine Wave *Frequency 500 Hz to 20 kHz* Applied Force 0.2 N to 450 N	4.0 %		
Spring hammers				
Impact Energy Imparted from Spring Operated Impact Test Apparatus - as specified in BS EN 60068-2-75:1997 and IEC 60068-2-75 1997	0.1 Joule to 1.0 Joule	0.015 Joule	Calibrations can be given in Joule or Newton Metre units.	

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Gateshead Laboratory				
ELECTRICAL				B
DC VOLTAGE				B
Generation	0 mV to 330 mV	9.3 μV		
	330 mV to 3.3 V	47 μV		
	3.3 V to 33 V	510 μV		
	33 V to 330 V	7.4 mV		
	330 V to 1020 V	24 mV		
Measurement	0 mV to 100 mV	1.7 μV		
	100 mV to 1 V	5.8 μV		
	1 V to 10 V	54 μV		
	10 V to 100 V	0.82 mV		
	100 V to 1 kV	9.1 mV		
DC RESISTANCE				B
Generation	0 Ω to 11 Ω	0.79 mΩ		
	11 Ω to 33 Ω	1.5 mΩ		
	33 Ω to 110 Ω	3.9 mΩ		
	110 Ω to 330 Ω	11 mΩ		
	330 Ω to 1.1 kΩ	36 mΩ		
	1.1 kΩ to 3.3 kΩ	110 mΩ		
	3.3 kΩ to 11 kΩ	130 mΩ		
	11 k Ω to 33 kΩ	1.1 Ω		
	33 kΩ to 110 kΩ	3.6 Ω		
	110 kΩ to 330 kΩ	13 Ω		
	330 kΩ to 1.1 MΩ	43 Ω		
	1.1 MΩ to 3.3 MΩ	240 Ω		
	3.3 MΩ to 11 MΩ	1.7 kΩ		
	11 MΩ to 33 MΩ	9.6 kΩ		
	33 MΩ to 110 MΩ	65 kΩ		
	110 MΩ to 330 MΩ	1.1 MΩ		
	330 MΩ to 1.1 GΩ	19 MΩ		
Measurement	0 Ω to 10 Ω	270 μΩ		
	10 Ω to 100 Ω	2.5 mΩ		
	100 Ω to 1 kΩ	14 mΩ		
	1 kΩ to 10 kΩ	140 mΩ		
	10 kΩ to 100 kΩ	1.4 Ω		
	100 kΩ to 1 MΩ	22 Ω		
	1 MΩ to 10 MΩ	0.74 kΩ		
	10 MΩ to 100 MΩ	64 kΩ		

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DC CURRENT				B
Generation	0 μA to 330 μA	81 nA		
	330 μA to 3.3 mA	450 nA		
	3.3 mA to 33 mA	4.2 μA		
	33 mA to 330 mA	42 μA		
	330 mA to 1.1 A	300 μA		
	1.1 A to 3 A	1.4 mA		
	3 A to 11 A	7.0 mA		
	11 A to 20.5 A	25 mA		
	11 A to 30 A	110 mA	Current clamp calibration using a multi turn coil	
	30 A to 110 A	420 mA		
	110 A to 150 A	560 mA		
	150 A to 550 A	2.0 A		
	550 A to 1025 A	3.9 A		
Measurement	0 μA to 100 μA	3.6 nA		
	100 μA to 1 mA	31 nA		
	1 mA to 10 mA	320 nA		
	10 mA to 100 mA	5.2 μA		
	100 mA to 1 A	150 μA		
AC VOLTAGE				B
Generation	1 mV to 33 mV			
	10 Hz to 45 Hz	38 μV		
	45 Hz to 1 kHz	13 μV		
	1 kHz to 10 kHz	13 μV		
	10 kHz to 20 kHz	15 μV		
	20 kHz to 50 kHz	45 μV		
	50 kHz to 100 kHz	150 μV		
	100 kHz to 500 kHz	360 μV		
	33 mV to 330 mV			
	10 Hz to 45 Hz	130 μV		
	45 Hz to 1 kHz	65 μV		
	1 kHz to 10 kHz	65 μV		
	10 kHz to 20 kHz	71 μV		
	20 kHz to 50 kHz	140 μV		
	50 kHz to 100 kHz	340 μV		
	100 kHz to 500 kHz	850 μV		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
Values and uncertainties listed below are applicable for the calibration of both measuring instruments and for instruments with an output. The method used is by direct comparison against laboratory references unless otherwise stated in the remarks column.				
AC VOLTAGE (cont'd)				B
Generation (cont'd)	330 mV to 3.3 V			
	10 Hz to 45 Hz	1.2 mV		
	45 Hz to 1 kHz	640 µV		
	1 kHz to 10 kHz	640 µV		
	10 kHz to 20 kHz	800 µV		
	20 kHz to 50 kHz	1.2 mV		
	50 kHz to 100 kHz	2.8 mV		
	100 kHz to 500 kHz	9.8 mV		
	3.3 V to 33 V			
	10 Hz to 45 Hz	12 mV		
	45 Hz to 1 kHz	6.4 mV		
	1 kHz to 10 kHz	6.4 mV		
	10 kHz to 20 kHz	9.9 mV		
	20 kHz to 50 kHz	14 mV		
	50 kHz to 100 kHz	36 mV		
	33 V to 330 V*45 Hz to 1 kHz*	75 mV		
	1 kHz to 10 kHz	83 mV		
	10 kHz to 20 kHz	100 mV		
	20 kHz to 50 kHz	120 mV		
	50 kHz to 100 kHz	820 mV		
	330 V to 1020 V			
	45 Hz to 1 kHz	380 mV		
	1 kHz to 5 kHz	130 mV		
	5 kHz to 10 kHz	380 mV		
Measurement	10 mV to 100 mV			
	40 Hz to 1kHz	14 µV		
	1kHz to 20 kHz	21 µV		
	20 kHz to 50 kHz	39 µV		
	50 kHz to 100 kHz	100 µV		
	100 kHz to 300 kHz	360 µV		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
Values and uncertainties listed below are applicable for the calibration of both measuring instruments and for instruments with an output. The method used is by direct comparison against laboratory references unless otherwise stated in the remarks column.				
AC VOLTAGE (cont'd) Measurement (cont'd)	100 mV to 1 V *40 Hz to 1kHz* *1kHz to 20 kHz* *20 kHz to 50 kHz* *50 kHz to 100 kHz* *100 kHz to 300 kHz* 1 V to 10 V *40 Hz to 1 kHz* *1kHz to 20 kHz* *20 kHz to 50 kHz* *50 kHz to 100 kHz* *100 kHz to 300 kHz* 10 V to 100 V *40 Hz to 1kHz* *1kHz to 20 kHz* *20 kHz to 50 kHz* *50 kHz to 100 kHz* 100 V to 700 V *40 Hz to 1 kHz*	 110 µV 200 µV 390 µV 970 µV 3.6 mV 1.2 mV 2.0 mV 3.9 mV 9.6 mV 36 mV 26 mV 27 mV 43 mV 140 mV 490 mV		B
AC CURRENT Generation	29 µA to 330 µA *10 Hz to 20 Hz* *20 Hz to 45 Hz* *45 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz* 330 µA to 3.3 mA *10 Hz to 20 Hz* *20 Hz to 45 Hz* *45 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz* 3.3 mA to 33 mA *10 Hz to 20 Hz* *20 Hz to 45 Hz* *45 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz*	 0.88 µA 0.69 µA 0.50 µA 1.3 µA 3.3 µA 7.8 µA 5.0 µA 4.0 µA 7.9 µA 19 µA 71 µA 37 µA 18 µA 33 µA 80 µA		B

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
Values and uncertainties listed below are applicable for the calibration of both measuring instruments and for instruments with an output. The method used is by direct comparison against laboratory references unless otherwise stated in the remarks column.				
AC CURRENT (cont'd) Generation (cont'd)	33 mA to 330 mA *10 Hz to 20 Hz* *20 Hz to 45 Hz* *45 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz* 330 mA to 1.1 A *10 Hz to 45 Hz* *45 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz* 1.1 A to 3 A *10 Hz to 45 Hz* *45 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz* 3 A to 11 A *45 Hz to 100 Hz* *100 Hz to 1 kHz* *1 kHz to 5 kHz* 11 A to 20.5 A *45 Hz to 100 Hz* *100 Hz to 1 kHz* *1 kHz to 5 kHz* *45 Hz to 1 kHz* 11 A to 30 A 30 A to 110 A *45 Hz to 100 Hz* *100 Hz to 1 kHz* 110 A to 150 A *45 Hz to 1 kHz* *150 A to 550 A* *45 Hz to 100 Hz* *100 Hz to 1 kHz* 550 A to 1025 A *45 Hz to 100 Hz* *100 Hz to 1 kHz*	710 µA 370 µA 180 µA 440 µA 880 µA 2.5 mA 0.81 mA 8.8 mA 38 mA 6.4 mA 2.3 mA 22 mA 92 mA 11 mA 16 mA 0.38 mA 36 mA 42 mA 720 mA 110 mA 430 mA 450 mA 610 mA 2.1 A 2.3 A 4.1 A 4.6 A	Calibration of current clamps using a multi turn coil	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
Values and uncertainties listed below are applicable for the calibration of both measuring instruments and for instruments with an output. The method used is by direct comparison against laboratory references unless otherwise stated in the remarks column.				
AC CURRENT				
Measurement	100 Hz to 5 kHz 0 □A to 100 □A 100 □A to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A	0.11 µA 0.60 µA 5.9 µA 59 µA 0.33 mA		
FREQUENCY				B
Generation	10 MHz	3.2 in 10^9	Reference	
Measurement	10 Hz to 100 kHz 100 kHz to 1 MHz 1 MHz to 10 MHz 10 MHz to 50 MHz 50 MHz to 600 MHz 600 MHz to 6 GHz	16 mHz 170 mHz 1.7 Hz 17 Hz 4.8 Hz 35 Hz		
Generation	1 Hz to 10 Hz 10 Hz to 100 Hz 100 Hz to 20 MHz	2.3 ppm 1.2 ppm 0.012 ppm	May be reported as events per unit time	
Elapsed time			Mechanical timers / stop watches	
Single event	10 s to 12 hrs	0.23 s		
Revolutions Per Minute				
Simulation	6 RPM to 600 RPM 600 RPM to 6000 RPM 6000 RPM to 120000 RPM	0.064 RPM 0.065 RPM 0.066 RPM	Optical	
CAPACITANCE				B
Simulated generation	*1 kHz* 220 pF to 400 pF 400 pF to 1.1 nF 1.1 nF to 3.3 nF 3.3 nF to 11 nF 11 nF to 33 nF 33 nF to 110 nF 110 nF to 330 nF	 14 pF 18 pF 31 pF 44 pF 110 pF 330 pF 990 pF		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
Values and uncertainties listed below are applicable for the calibration of both measuring instruments and for instruments with an output. The method used is by direct comparison against laboratory references unless otherwise stated in the remarks column.				
CAPACITANCE (cont'd) Simulated generation (cont'd)	*100 Hz* 0.33 µF to 1.1 µF 1.1 µF to 3.3 µF 3.3 µF to 11 µF 11 µF to 33 µF 33 µF to 110 µF 110 µF to 330 µF 330 µF to 1.1 mF 1.1 mF to 3.3 mF 3.3 mF to11 mF 11 mF to 33 mF 33 mF to 110 mF	 4.4 nF 13 nF 44 nF 190 nF 700 nF 2.1 µF 7.0 µF 21 µF 70 µF 320 µF 1.5 mF		B

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
Values and uncertainties listed below are applicable for the calibration of both measuring instruments and for instruments with an output. The method used is by direct comparison against laboratory references unless otherwise stated in the remarks column.				
CALIBRATION OF INSULATION TESTERS				B
Insulation Resistance	100 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1 GΩ	2.0 kΩ 32 kΩ 510 kΩ 7.0 MΩ	Up to 1350 V	
Insulation test voltage Nominal	50 V 100 V 250 V 500 V 1 kV	1.0 V 2.0 V 3.0 V 4.0 V 7.0 V	The test voltage will normally be measured with a 1 mA load.	
Continuity Resistance	0 Ω to 1 Ω 1 Ω to 50 Ω 50 Ω to 100 Ω 100 Ω to 200 Ω	58 mΩ 100 mΩ 120 mΩ 140 mΩ		
Temperature indicators, calibration by electrical simulation				B
Type E thermocouple	-250 °C to -100 °C -100 °C to -25 °C -25 °C to +350 °C 350 °C to 650 °C 650 °C to 1000 °C	0.62 °C 0.20 °C 0.18 °C 0.20 °C 0.26 °C	Including reference junction compensation	
Type J thermocouple	-210 °C to -100 °C -100 °C to -30 °C -30 °C to +150 °C 150 °C to 760 °C 760 °C to 1200 °C	0.34 °C 0.23 °C 0.18 °C 0.21 °C 0.28 °C	Including reference junction compensation	
Type k thermocouple	-200 °C to -100 °C -100 °C to -25 °C -25 °C to +120 °C 120 °C to 1000 °C 1000 °C to 1370 °C	0.41 °C 0.23 °C 0.21 °C 0.31 °C 0.47 °C	Including reference junction compensation	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
Values and uncertainties listed below are applicable for the calibration of both measuring instruments and for instruments with an output. The method used is by direct comparison against laboratory references unless otherwise stated in the remarks column.				
Temperature indicators, calibration by electrical simulation (cont'd)				
Type N thermocouple	-200 °C to -100 °C -100 °C to -25 °C -25 °C to +120 °C 120 °C to 410 °C 410 °C to 1300 °C	0.48 °C 0.28 °C 0.25 °C 0.23 °C 0.33 °C	Including reference junction compensation	
Type R thermocouple	0 °C to 250 °C 250 °C to 400 °C 400 °C to 1000 °C 1000 °C to 1767 °C	0.76 °C 0.46 °C 0.43 °C 0.50 °C	Including reference junction compensation	
Type S thermocouple	0 °C to 250 °C 250 °C to 1000 °C 1000 °C to 1400 °C 1400 °C to 1767 °C	0.66 °C 0.48 °C 0.47 °C 0.57 °C	Including reference junction compensation	
Type T thermocouple	-250 °C to -150 °C -150 °C to 0 °C 0 °C to 120 °C 120 °C to 400 °C	0.80 °C 0.30 °C 0.21 °C 0.18 °C	Including reference junction compensation	
Resistance thermometer Pt 100 Generation: simulation	-200 °C to -80 °C -80 °C to 0 °C 0 °C to 100 °C 100 °C to 300 °C 300 °C to 400 °C 400 °C to 630 °C 630 °C to 800 °C	0.058 °C 0.058 °C 0.081 °C 0.10 °C 0.12 °C 0.14 °C 0.27 °C		
Pt100 Measure: simulation	-200 °C to 0 °C 0 °C to 850 °C	0.0069 °C 0.020 °C		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
Values and uncertainties listed below are applicable for the calibration of both measuring instruments and for instruments with an output. The method used is by direct comparison against laboratory references unless otherwise stated in the remarks column.				
Calibration of Oscilloscopes				B
Voltage deflection	1 mV to 25 mV 25 mV to 110 mV 110 mV to 2.2 V 2.2 V to 6 V	0.29 % + 76 µV 0.29 % + 250 µV 0.29 % + 3.6 mV 0.29 % + 9.0 mV	Into 50 Ω	
	1 mV to 25 mV 25 mV to 110 mV 110 mV to 2.2 V 2.2 V to 11 V 11 V to 130 V	0.12 % + 61 µV 0.12 % + 68 µV 0.12 % + 800 µV 0.12 % + 4.0 mV 0.12 % + 40 mV	Into 1 MΩ	
Time markers	2 ns to 500 ns 500 ns to 500 µs 500 µs to 50 ms 50 ms to 5 s	0.082 % + 0.20 ps 0.082 % + 0.50 ns 0.058 % + 50 ns 0.59 % + 0.25 ms		
PRESSURE Pneumatic Pressure (gauge)			Methods consistent with EURAMET CG17. Absolute pressures can be generated within these gauge pressure ranges. This will attract an additional uncertainty of 10 Pa.	
Calibration of pressure indicating instruments and gauges	- 95 kPa to -10 kPa -10 kPa to -1.5 kPa 1.5 kPa to 10 kPa 10 kPa to 20 kPa 20 kPa to 2.5 MPa 2.5 MPa to 14 MPa	84 ppm 87 ppm + 0.77 Pa 61 ppm + 0.77 Pa 65 ppm 55 ppm 73 ppm	Sensors with an electrical output can be calibrated	
Hydraulic Pressure (gauge)				
Calibration of pressure indicating instruments and gauges	0.6 MPa to 6 MPa 6 MPa to 120 MPa	97 ppm 74 ppm		
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 $0.0036\ \%\cdot p + (0.12\cdot 10^{-6}\cdot p\cdot 10^{-6}) + 4.0$ 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.