

# Schedule of Accreditation

issued by

## United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

 <b>0654</b> Accredited to ISO/IEC 17025:2017	<b>Calibration, Maintenance and Repair Ltd</b>	
	Issue No: 045 Issue date: 03 October 2025	
	11 Frensham Road Norwich NR3 2BT	Contact: Mr P K Clark Tel: +44 (0)1603 279557 Fax: +44 (0)1603 278008 E-Mail: support@cmrcalibrate.co.uk Website: www.cmrcalibrate.co.uk

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

#### Site activities performed away from the locations listed above:

Location details	Activity	Location code
The customers' site or premises must be suitable for the nature of the particular calibrations undertaken and will be the subject of contract review arrangements between the laboratory and the customer.	Electrical Calibration	S



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Calibration and Measurement Capability (CMC)

Measured Quantity Instrument or Gauge	Range	Expanded Measurement 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.				
<b>ELECTRICAL MEASUREMENTS</b>			Calibrations are performed as a direct comparison against a reference standard	A
<b>DC VOLTAGE</b>				
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 $\mu$ V 1.4 $\mu$ V 6.6 $\mu$ V 44 $\mu$ V 630 $\mu$ V 8.0 mV	For the calibration of measuring instruments	
	1 kV to 2 kV 2 kV to 3 kV 3 kV to 4 kV 4 kV to 5 kV	0.45 % + 7.0 V 0.45 % + 8.0 V 0.45 % + 9.0 V 0.45 % + 11 V		
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 $\mu$ V 2.0 $\mu$ V 10 $\mu$ V 98 $\mu$ V 1.3 mV 14 mV	For instruments with a voltage output	
	1 kV to 2 kV 2 kV to 3 kV 3 kV to 4 kV 4 kV to 5 kV	0.67 % + 9.0 V 0.67 % + 11 V 0.67 % + 14 V 0.67 % + 16 V		
<b>DC RESISTANCE</b>				A
Sourcing - Spot Values	1 $\Omega$ 1.9 $\Omega$ 10 $\Omega$ 19 $\Omega$ 100 $\Omega$  190 $\Omega$ 1 k $\Omega$ 1.9 k $\Omega$ 10 k $\Omega$ 19 k $\Omega$  100 k $\Omega$ 190 k $\Omega$ 1 M $\Omega$ 1.9 M $\Omega$  10 M $\Omega$ 19 M $\Omega$ 100 M $\Omega$	110 $\mu\Omega$ 210 $\mu\Omega$ 270 $\mu\Omega$ 540 $\mu\Omega$ 1.2 m $\Omega$  2.5 m $\Omega$ 8.7 m $\Omega$ 17 m $\Omega$ 81 m $\Omega$ 170 m $\Omega$  1.1 $\Omega$ 2.4 $\Omega$ 16 $\Omega$ 48 $\Omega$  460 $\Omega$ 1.1 k $\Omega$ 12 k $\Omega$	For the calibration of measuring instruments	



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Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty ( $k = 2$ )	Remarks	Location Code
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<b>DC RESISTANCE</b> (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 100 GΩ	250 μΩ 2.0 mΩ 14 mΩ 140 mΩ 1.0 Ω  22 Ω 0.71 % 1.0 %	For instruments with a resistance output	
<b>DC CURRENT</b>				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 20 A to 30 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 570 mA  25 mA 580 mA	For the calibration of measuring instruments           Current clamp calibration using a multi turn coil	



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<b>DC CURRENT</b> (continued)				A
Measurement	0 $\mu$ A to 10 $\mu$ A 10 $\mu$ A to 100 $\mu$ A 100 $\mu$ A to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A 1 A to 2 A 2 A to 10 A 10 A to 20 A 20 A to 30 A	2.0 nA 4.0 nA 34 nA 340 nA 5.0 $\mu$ A 150 $\mu$ A 2.4 mA 25 mA 330 mA 490 mA	For instruments which generate current	
<b>AC VOLTAGE</b>				A
Generation	1 Hz to 10 Hz 10 $\mu$ V to 10 mV 10 mV to 100 mV 100 mV to 1 V 1 V to 7 V	60 $\mu$ V 270 $\mu$ V 1.9 mV 9.2 mV	For the calibration of measuring instruments	
	<b>10 <math>\mu</math>V to 2.2 mV</b> 10 Hz to 20 Hz 20 Hz to 40 Hz 40Hz to 500 Hz 500 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	5.3 $\mu$ V 4.9 $\mu$ V 4.9 $\mu$ V 4.9 $\mu$ V 4.9 $\mu$ V 4.9 $\mu$ V 5.2 $\mu$ V 7.1 $\mu$ V 14 $\mu$ V 27 $\mu$ V 30 $\mu$ V		
	<b>2.2 mV to 22 mV</b> 10 Hz to 20 Hz 20 Hz to 40 Hz 40Hz to 500 Hz 500 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	11 $\mu$ V 7.1 $\mu$ V 6.9 $\mu$ V 6.9 $\mu$ V 6.9 $\mu$ V 6.9 $\mu$ V 10 $\mu$ V 19 $\mu$ V 38 $\mu$ V 59 $\mu$ V 92 $\mu$ V		



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



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<b>AC VOLTAGE (continued)</b>				A
Generation (continued)	<b>220 V to 1100 V</b> 55 Hz to 1 kHz	110 mV	For measuring instruments	
	1 kV to 2 kV 50 Hz to 60 Hz	0.67 % + 12 V		
	2 kV to 3 kV 50 Hz to 60 Hz	0.67 % + 16 V		
	3 kV to 4 kV 50 Hz to 60 Hz	0.67 % + 20 V		
	4 kV to 5 kV 50 Hz to 60 Hz	0.67 % + 24 V		
Measurement	<b>30 <math>\mu</math>V to 10 mV</b> 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 100 kHz to 1 MHz	8.0 $\mu$ V 5.0 $\mu$ V 6.0 $\mu$ V 13 $\mu$ V 60 $\mu$ V 160 $\mu$ V	For instruments with a voltage output	
	<b>10 mV to 100 mV</b> 1 Hz to 40 Hz 40 Hz to 1 kHz 1kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	15 $\mu$ V 13 $\mu$ V 20 $\mu$ V 38 $\mu$ V 100 $\mu$ V 360 $\mu$ V 2.3 mV		
	<b>100mV to 1V</b> 1 Hz to 40 Hz 40 Hz to 1 kHz 1kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	140 $\mu$ V 120 $\mu$ V 200 $\mu$ V 390 $\mu$ V 970 $\mu$ V 3.6 mV 24 mV		
	<b>1 V to 10 V</b> 1 Hz to 40 Hz 40 Hz to 1 kHz 1kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	2.0 mV 1.0 mV 2.0 mV 4.0 mV 10 mV 36 mV 240 mV		
	<b>10V to 100V</b> 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	38 mV 36 mV 37 mV 51 mV 150 mV 480 mV		



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<b>VOLTAGE</b> (continued) Measurement (continued)	<b>100V to 1 kV</b> 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	520 mV 490 mV 720 mV 1.4 V 3.5 V	For instruments with a voltage output.	A
	1 kV to 2 kV 30 Hz to 200 Hz 2 kV to 3 kV 30 Hz to 200 Hz 3 kV to 4 kV 30 Hz to 200 Hz 4 kV to 5 kV 30 Hz to 200 Hz	0.45 % + 8.0 V 0.45 % + 11 V 0.45 % + 13 V 0.45 % + 16 V		
<b>AC CURRENT</b> Generation	<b>10 µA to 220 µA</b> 55 Hz to 400 Hz 400 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	38 nA 38 nA 88 nA 360 nA	For the calibration of measuring instruments	A
	<b>220 µA to 2.2 mA</b> 55 Hz to 400 Hz 400 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	320 nA 320 nA 660 nA 3.6 µA		
	<b>2.2 mA to 22 mA</b> 55 Hz to 400 Hz 400 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	29 µA 29 µA 55 µA 290 µA		
	<b>22 mA to 220 mA</b> 55 Hz to 400 Hz 400 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	3.0 µA 3.0 µA 5.7 µA 34 µA		
	<b>220 mA to 2.2 A</b> 55 Hz to 400 Hz 400 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	660 µA 660 µA 1.3 mA 18 mA		
	<b>10 Hz to 1 kHz</b> 2 A to 3 A 3 A to 5 A 5 A to 10 A	7.0 mA 9.0 mA 14 mA		
	<b>10 A to 20 A</b> 50 Hz to 400 Hz 400 Hz to 1 kHz	310 mA 290 mA		
	<b>20 A to 30 A</b> 50 Hz to 400 Hz 400 Hz to 1 kHz	430 mA 420 mA		



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AC CURRENT (continued) Generation (continued)           Measurement	<b>30 A to 40 A</b> 50 Hz to 400 Hz 400 Hz to 1 kHz	560 mA 540 mA		A
	<b>40 A to 50 A</b> 50 Hz to 400 Hz 400 Hz to 1 kHz	680 mA 670 mA		
	<b>10 Hz to 100 Hz</b> 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	
	<b>20 nA to 10 µA</b> 20 Hz to 45 Hz 45 Hz to 1 kHz	23 nA 14 nA	For instruments which generate current	
	<b>10 µA to 100 µA</b> 20 Hz to 45 Hz 45 Hz to 1 kHz	210 nA 110 nA		
	<b>100 µA to 1 mA</b> 20 Hz to 45 Hz 45 Hz to 20 kHz 20 kHz to 50 kHz	2.0 µA 1.0 µA 5.0 µA		
	<b>1 mA to 10 mA</b> 20 Hz to 45 Hz 45 Hz to 20 kHz 20 kHz to 50 kHz	20 µA 9.0 µA 51 µA		
	<b>10 mA to 100 mA</b> 20 Hz to 45 Hz 45 Hz to 20 kHz 20 kHz to 50 kHz	200 µA 95 µA 510 µA		
	<b>100 mA to 1 A</b> 20 Hz to 45 Hz 45 Hz to 20 kHz 20 kHz to 50 kHz	2.0 mA 1.0 mA 12 mA		
	<b>1 A to 10 A</b> 50 Hz to 400 Hz 400 Hz to 1 kHz	180 mA 140 mA		
	<b>10 A to 20 A</b> 50 Hz to 400 Hz 400 Hz to 1 kHz	270 mA 250 mA		
	<b>20 A to 30 A</b> 50 Hz to 400 Hz 400 Hz to 1 kHz	370 mA 360 mA		



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<b>AC CURRENT</b> (continued) Measurement (continued)	<b>30 A to 40 A</b> 50 Hz to 400 Hz 400 Hz to 1 kHz	480 mA 470 mA		A
	<b>40 A to 50 A</b> 50 Hz to 400 Hz 400 Hz to 1 kHz	590 mA 580 mA		A
<b>FREQUENCY</b>  Generation	0.5 Hz to 5.4 GHz	2.1 in $10^9$	For the calibration of measuring instruments May be reported as events per unit time	A
	1 kHz to 27 GHz	0.24 $\mu$ Hz/Hz	For instruments outputting frequency	
Measurement	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 instruments with frequency outputs. May be reported as events per unit time	A
<b>TIME and FREQUENCY</b>  Elapsed time  Single event  Revolutions Per Minute			Mechanical timers / stop watches	A
	10 s to 12 hrs	0.23 s		
	60 RPM to 1000 RPM 1000 RPM to 30000 RPM 30000 RPM to 96000 RPM	0.37 RPM 1.6 RPM 23 RPM		



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<b>CAPACITANCE</b>				A
Measurement For capacitance sources	<b>1 kHz</b> 0.1 pF to 1 pF 1 pF to 10 pF 10 pF to 100 pF 100 pF to 1000 pF  <b>1 MHz</b> 0.1 pF to 1 pF 1 pF to 10 pF 10 pF to 100 pF 100 pF to 1000 pF	0.0052 pF 0.014 pF 0.11 pF 1.1 pF  0.0031 pF 0.014 pF 0.11 pF 1.3 pF	For capacitance sources	
Simulated For capacitance meters	<b>10 Hz to 10 kHz</b> 220 pF to 400 pF 400 pF to 1.1 nF  <b>10 Hz to 3 kHz</b> 1.1 nF to 3.3 nF  <b>10 Hz to 1 kHz</b> 3.3 nF to 11 nF 11 nF to 33 nF  <b>10 Hz to 1 kHz</b> 33 nF to 110 nF 110 nF to 330 nF  <b>10 Hz to 600 Hz</b> 330 nF to 1.1 μF  <b>10 Hz to 300 Hz</b> 1.1 μF to 3.3 μF  <b>10 Hz to 150 Hz</b> 3.3 μF to 11 μF  <b>10 Hz to 120 Hz</b> 11 μF to 33 μF  <b>10 Hz to 80 Hz</b> 33 μF to 110 μF	13 pF 16 pF  27 pF  39 pF 180 pF  380 pF 1.0 nF  5.0 nF  12 nF  39 nF  140 nF  610 nF		



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<b>CAPACITANCE</b> (continued)				A
For capacitance meters	<b>0 Hz to 50 Hz</b> 110 $\mu$ F to 330 $\mu$ F	2.0 $\mu$ F		
	<b>0 Hz to 20 Hz</b> 330 $\mu$ F to 1.1 mF	6.0 $\mu$ F		
	<b>0 Hz to 6 Hz</b> 1.1 mF to 3.3 mF	2.0 $\mu$ F		
	<b>0 Hz to 2 Hz</b> 3.3 mF to 11 mF	60 $\mu$ F		
	<b>0 Hz to 0.6 Hz</b> 11 mF to 33 mF	280 $\mu$ F		
	<b>0 Hz to 0.2 Hz</b> 33 mF to 110 mF	1.0 mF		
<b>CALIBRATION OF INSULATION TESTERS</b>				A
Insulation Resistance	10 k $\Omega$ to 20 k $\Omega$ 20 k $\Omega$ to 40 k $\Omega$ 40 k $\Omega$ to 100 k $\Omega$ 100 k $\Omega$ to 200 k $\Omega$ 200 k $\Omega$ to 1 M $\Omega$ 1 M $\Omega$ to 2 M $\Omega$ 2 M $\Omega$ to 10 M $\Omega$ 10 M $\Omega$ to 20 M $\Omega$ 20 M $\Omega$ to 200 M $\Omega$ 200 M $\Omega$ to 1 G $\Omega$ 1 G $\Omega$ to 2 G $\Omega$ 2 G $\Omega$ to 10 G $\Omega$	46 $\Omega$ 93 $\Omega$ 230 $\Omega$ 460 $\Omega$ 2.3 k $\Omega$ 7.0 k $\Omega$ 35 k $\Omega$ 120 k $\Omega$ 1.2 M $\Omega$ 5.8 M $\Omega$ 23 M $\Omega$ 120 M $\Omega$	Up to 1100 V	
Insulation test voltage Nominal	50 to 400 V 400 to 1 kV	6.1 V 18 V	The test voltage will normally be measured with a 1 mA load.	
Continuity Resistance	0.2 $\Omega$ to 30 $\Omega$ 30 $\Omega$ to 100 $\Omega$ 100 $\Omega$ to 200 $\Omega$ 200 $\Omega$ to 500 $\Omega$ 500 $\Omega$ to 1 k $\Omega$ 1 k $\Omega$ to 2 k $\Omega$ 2 k $\Omega$ to 5 k $\Omega$ 5 k $\Omega$ to 10 k $\Omega$	80 m $\Omega$ 310 m $\Omega$ 0.67 $\Omega$ 1.70 $\Omega$ 2.60 $\Omega$ 4.80 $\Omega$ 17 $\Omega$ 26 $\Omega$		



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<b>Temperature indicators, calibration by electrical simulation</b>				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		
<b>Calibration of Oscilloscopes</b>				A
Voltage deflection	1 mV to 25 mV 25 mV to 110 mV 110 mv to 2.2 V 2.2 V to 6.6 V	120 µV 370 µV 6.5 mV 19 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	63 µV 120 µV 1.3 mV 6.5 mV 76 mV	Into 1 MΩ	
Edge verification – Amplitude	4.5 mV to 10 mV 10 mV to 100 mV 100 mV to 1 V 1 V to 2.5 V	2.5 mV 4.4 mV 28 mV 82 mV	Into 50 Ω 1 kHz to 10 kHz	
Time markers	20 ns to 50 ns 50 ns to 500 ns 500 ns to 5 µs 5 µs to 50 µs 50 µs to 500 µs 500 µs to 20 ms 20 ms to 500 ms 500 ms to 5 s	1.5 ps 15 ps 150 ps 1.50 ns 15.0 ns 580 ns 15 µs 380 µs		
Rise time	1 kHz to 2 MHz 2 MHz to 10 MHz	300 ps 350 ps		



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<b>OSCILLOSCOPES (Continued)</b>				A
Bandwidth Level flatness 50 kHz ref Nominal 3 V	To 100 MHz To 300 MHz To 600 MHz To 1.1 GHz	130 mV 160 mV 250 mV 300 mV	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.	
<b>ACCELEROMETRY</b>				
Accelerometer calibration Charge	Sensitivity range: 0.3 pC/g to 1000 pC/g (0.03 pC/ms <sup>2</sup> to 100 pC/ms <sup>2</sup> ) 1 Hz to 2 Hz 2 Hz to 5 Hz 5 Hz to 5 kHz 5 kHz to 10 kHz	3.0 % 1.2 % 0.85 % 0.90 %	Uncertainties for accelerometry sensitivity calibrations at ambient temperature applies for masses up to 40 grams.  Nominal acceleration ms <sup>-2</sup> : 1 Hz: 0.10 3 Hz: 0.20 4 Hz to 10 kHz: 0.3 to 100.0	
Devices with integral electronics	Sensitivity range: 0.04 pC/g to 0.3 pC/g (0.004 pC/ms <sup>2</sup> to 0.03 pC/ms <sup>2</sup> ) 20 Hz to 10 kHz	3.0 %	Nominal acceleration 0.3 ms <sup>-2</sup> to 100.0 ms <sup>-2</sup> :	
Voltage (mV/ms <sup>2</sup> )	0.03 mV/ms <sup>2</sup> to 1000 mV/ms <sup>2</sup> 1 Hz to 2 Hz 2 Hz to 5 Hz 5 Hz to 5 kHz 5 kHz to 10 kHz	2.0 % 0.83 % 0.85 % 0.90 %	Nominal acceleration ms <sup>-2</sup> : 1 Hz: 0.10 3 Hz: 0.20 4 Hz to 10 kHz: 0.3 to 100.0	
Resistive/Capacitive	0.004 mV/ms <sup>2</sup> to 0.03 mV/ms <sup>2</sup> 20 Hz to 10 kHz	3.0 %		
	0.01 mV/ms <sup>2</sup> to 100 mV/ms <sup>2</sup> 1 Hz to 2 Hz 2 Hz to 5 Hz 5 Hz to 5 kHz 5 kHz to 10 kHz	2.0 % 0.83 % 0.85 % 0.90 %	Nominal acceleration ms <sup>-2</sup> : 1 Hz: 0.10 3 Hz: 0.20 4 Hz to 10 kHz: 0.3 to 100.0	
<b>Vibration</b>	10 Hz to 5 kHz		Reference to transfer standard Accelerometer	
Acceleration Velocity Displacement Velocity transducers	0.1g to 10 g 3 mm/s to 2000 mm/s 0.2µm to 100 mm 5 Hz to 10 kHz 1.5 mm/s to 3000 mm/s	0.40 % 0.40 % 0.40 % 0.90 %		



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2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

**Calibration, Maintenance and Repair Ltd**  
Issue No: 045 Issue date: 03 October 2025

**Calibration performed by the Organisation at the locations specified**

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<b>ACCELEROMETRY</b> (continued)				A
Climatic chamber range	-60 °C to 100 °C 100 °C to 180 °C	1.7 °C 3.2 °C	For accelerometer calibration.	
Transducer at any temperature between: -60 °C to +100 °C:	0.03 mV/ms <sup>2</sup> to 1000 mV/ms <sup>2</sup>		At a nominal 1 g <sub>n</sub> This uncertainty applies for masses up to 60 grams, larger masses can be calibrated but at greater uncertainties.	
100 °C to +180 °C:	20 Hz to 630 Hz 0.03 mV/ms <sup>2</sup> to 1000 mV/ms <sup>2</sup>	3.3 % 4.5 %		
Portable calibrators	Frequency 160 Hz 10 ms <sup>2</sup> 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 %		
<b>DISTORTION THD</b>	20 Hz to 20 kHz 10 mV to 750 V 0 % to 1 % 1 % to 100 %	0.20 % distortion 0.47 % distortion	Bandpass filter between 20 Hz and 50 kHz	



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<b>ACCELERATION TRANSDUCERS - SHOCK CALIBRATION</b>				A
<u>Piezoelectric and Piezoresistive and voltage types</u>				
Transducer at nominal 23 °C	Sensitivity 0.001 pC/ms <sup>2</sup> to 100 pC/ms <sup>2</sup> 0.001 mV/ms <sup>2</sup> to 10 mV/ms <sup>2</sup> Within the range of: 2 ms <sup>2</sup> to 1000 ms <sup>2</sup>	3.0 %	Calibration of charge sensitivity by comparison with a reference (precision grade) transducer The transducer to be calibrated must have a mass of no more than 40 grams.	
Vibration meters and analysers	<i>Frequency 10 Hz to 1 kHz</i> Range 0.1 ms <sup>2</sup> to 1 ms <sup>2</sup>	2.0 %		
Shock and Impulse hammers	Half Sine Wave <i>Frequency 500 Hz to 20 kHz</i> Force 0.2 N to 450 N			
Sensitivity	pC/N	3.3 %	Sensitivity measured in pC/N or mV/N dependant on hammer type	
	mV/N	3.3 %		
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 Meter units.	
<b>HELICOPTER BLADE BALANCING TEST SETS</b>				
Strobe frequency	1 Hz to 50 Hz 50 Hz to 100 Hz 100 Hz to 150 Hz 150 Hz to 200 Hz	1.2 Hz 1.4 Hz 1.6 Hz 1.7 Hz		
<b>MASS</b>	500 g 200 g 100 g	9 mg 7 mg 7 mg	Calibrated using Borda substitution method.	A
<b>NON-AUTOMATIC WEIGHING MACHINES</b>	100 g 200 g 500 g	19 mg 19 mg 20 mg	Weights are available in OIML Class: M1 from 1 g to 500 g  Calibration method in line with the requirements of Euramet gauge cg-18	



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<b>Gateshead Laboratory</b>				
<b>ELECTRICAL</b>				
DC VOLTAGE Generation	0 mV to 50 mV 50 mV to 100 mV 100 mV to 220 mV 0.22 V to 0.5 V 0.5 to 1 V 1 V to 2.2 V 2.2 V to 5 V 5 V to 11 V 11 V to 22 V 22 V to 50 V 50 V to 100 V 100 V to 220 V 220 V to 500 V 500 V to 1100 V	1.1 $\mu$ V 1.4 $\mu$ V 2.5 $\mu$ V 4.9 $\mu$ V 9.4 $\mu$ V 20 $\mu$ V 47 $\mu$ V 0.10 mV 0.20 mV 0.54 mV 1.0 mV 2.3 mV 6.5 mV 14 mV		B
Measurement	0 mV 0 mV to 50 mV 50 mV to 100 mV 100 mV to 200 mV 200 mV to 500 mV 500 mV to 1 V 1 V to 2 V 2 V to 5 V 5 V to 10 V 10 V to 20 V 20 V to 50 V 50 V to 100 V 100 V to 200 V 200 V to 500 V 500 V to 1050 V	0.65 $\mu$ V 0.86 $\mu$ V 1.1 $\mu$ V 2.0 $\mu$ V 2.1 $\mu$ V 3.6 $\mu$ V 7.0 $\mu$ V 18 $\mu$ V 34 $\mu$ V 69 $\mu$ V 0.30 mV 0.53 mV 1.1 mV 2.8 mV 5.5 mV		



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DC RESISTANCE Sourcing - Spot Values	0 $\Omega$ 1 $\Omega$ 1.9 $\Omega$ 10 $\Omega$ 19 $\Omega$ 100 $\Omega$ 190 $\Omega$ 1 k $\Omega$ 1.9 k $\Omega$ 10 k $\Omega$ 19 k $\Omega$ 100 k $\Omega$ 190 k $\Omega$ 1 M $\Omega$ 1.9 M $\Omega$ 10 M $\Omega$ 19 M $\Omega$ 100 M $\Omega$	58 $\mu\Omega$ 0.13 m $\Omega$ 0.24 m $\Omega$ 0.38 m $\Omega$ 0.68 m $\Omega$ 2.3 m $\Omega$ 4.4 m $\Omega$ 17 m $\Omega$ 33 m $\Omega$ 0.16 $\Omega$ 0.31 $\Omega$ 1.8 $\Omega$ 3.5 $\Omega$ 27 $\Omega$ 53 $\Omega$ 0.53 k $\Omega$ 1.2 k $\Omega$ 15 k $\Omega$		B
DC RESISTANCE Sourcing - Range values	0 $\Omega$ to 11 $\Omega$ 11 $\Omega$ to 33 $\Omega$ 33 $\Omega$ to 110 $\Omega$ 110 $\Omega$ to 330 $\Omega$ 330 $\Omega$ to 1.1 k $\Omega$  1.1 k $\Omega$ to 3.3 k $\Omega$ 3.3 k $\Omega$ to 11 k $\Omega$ 11 k $\Omega$ to 33 k $\Omega$ 33 k $\Omega$ to 110 k $\Omega$  110 k $\Omega$ to 330 k $\Omega$ 330 k $\Omega$ to 1.1 M $\Omega$ 1.1 M $\Omega$ to 3.3 M $\Omega$ 3.3 M $\Omega$ to 11 M $\Omega$ 11 M $\Omega$ to 33 M $\Omega$  33 M $\Omega$ to 110 M $\Omega$ 110 M $\Omega$ to 330 M $\Omega$ 330 M $\Omega$ to 1.1 G $\Omega$	0.51 m $\Omega$ 1.1 m $\Omega$ 3.6 m $\Omega$ 11 m $\Omega$ 36 m $\Omega$  110 m $\Omega$ 0.36 m $\Omega$ 1.1 $\Omega$ 3.6 $\Omega$  12 $\Omega$ 41 $\Omega$ 230 $\Omega$ 1.7 k $\Omega$ 9.6 k $\Omega$  64 k $\Omega$ 1.1 M $\Omega$ 19 M $\Omega$		B



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DC RESISTANCE Measurement	0 Ω 0 Ω to 0.5 Ω 0.5 Ω to 1 Ω 1 Ω to 2 Ω 2 Ω to 5 Ω 5 Ω to 10 Ω 10 Ω to 20 Ω 20 Ω to 50 Ω 50 Ω to 100 Ω 100 Ω to 200 Ω 0.2 kΩ to 0.5 kΩ 0.5 kΩ to 1 kΩ 1 kΩ to 2 kΩ 2 kΩ to 5 kΩ 5 kΩ to 10 kΩ 10 kΩ to 20 kΩ 20 kΩ to 50 kΩ 50 kΩ to 100 kΩ 100 kΩ to 200 kΩ 0.2 MΩ to 0.5 MΩ 0.5 MΩ to 1 MΩ 1 MΩ to 2 MΩ 2 MΩ to 5 MΩ 5 MΩ to 10 MΩ 10 MΩ to 20 MΩ 20 MΩ to 50 MΩ 50 MΩ to 100 MΩ 100 MΩ to 1 GΩ	7.5 μΩ 13 μΩ 21 μΩ 43 μΩ 92 μΩ 0.14 mΩ 0.25 mΩ 0.58 mΩ 1.1 mΩ 2.2 mΩ 5.5 mΩ 11 mΩ 21 mΩ 57 mΩ 0.11 Ω 0.22 Ω 0.62 Ω 1.1 Ω 2.2 Ω 7.8 Ω 13 Ω 26 Ω 0.18 kΩ 0.26 kΩ 0.52 kΩ 14 kΩ 19 kΩ 0.34 MΩ		B
DC CURRENT Generation	0 μA to 50 μA 50 μA to 100 μA 100 μA to 220 μA 0.22 mA to 0.5 mA 0.5 mA to 1 mA 1 mA to 2.2 mA 2.2 mA to 5 mA 5 mA to 10 mA 10 mA to 22 mA 22 mA to 50 mA 50 mA to 100 mA 100 mA to 220 mA 0.22 A to 0.5 A 0.5 A to 1 A 1 A to 2.2 A  2.2 A to 3 A 3 A to 11 A 11 A to 20.5 A	12 nA 13 nA 19 nA 37 nA 71 nA 0.15 μA 0.37 μA 0.71 μA 1.5 μA 4.2 μA 8.2 μA 18 μA 65 μA 0.12 mA 0.24 mA  1.3 mA 6.4 mA 24 mA		B



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DC CURRENT (continued) Generation	20 A to 30 A 30 A to 110 A 110 A to 200 A 200 A to 550 A 550 A to 1025 A	150 mA 500 mA 930 mA 2.5 A 4.7 A	Current clamp calibration using a multi turn coil	B
Measurement	0 $\mu$ A to 5 $\mu$ A 5 $\mu$ A to 10 $\mu$ A 10 $\mu$ A to 20 $\mu$ A 20 $\mu$ A to 50 $\mu$ A 50 $\mu$ A to 100 $\mu$ A 100 $\mu$ A to 200 $\mu$ A 0.2 mA to 0.5 mA 0.5 mA to 1 mA 1 mA to 2 mA 2 mA to 5 mA 5 mA to 10 mA 10 mA to 20 mA 20 mA to 50 mA 50 mA to 100 mA 100 mA to 200 mA 0.2 A to 0.5 A 0.5 A to 1 A 1 A to 2 A 2 A to 5 A 5 A to 10 A 10 A to 20 A 20 A to 30 A	0.57 nA 0.63 nA 1.2 nA 1.1 nA 1.4 nA 2.9 nA 9.1 nA 13 nA 26 nA 0.11 $\mu$ A 0.18 $\mu$ A 0.35 $\mu$ A 3.7 $\mu$ A 6.8 $\mu$ A 14 $\mu$ A 0.14 mA 0.19 mA 0.39 mA 1.5 mA 2.8 mA 14 mA 20 mA		
AC VOLTAGE Generation	<b>0.22 mV to 0.5 mV</b> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz	5.8 $\mu$ V 5.8 $\mu$ V 5.8 $\mu$ V 5.8 $\mu$ V 5.8 $\mu$ V 5.8 $\mu$ V 5.8 $\mu$ V 9.3 $\mu$ V 17 $\mu$ V 35 $\mu$ V 46 $\mu$ V		B



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AC VOLTAGE Generation (continued)	<p><b>0.5 mV to 1 mV</b> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz</p> <p><b>1 mV to 2.2 mV</b> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz</p> <p><b>2.2 mV to 5 mV</b> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz</p> <p><b>5 mV to 10 mV</b> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz</p>	<p>5.9 <math>\mu</math>V 5.8 <math>\mu</math>V 5.8 <math>\mu</math>V 5.8 <math>\mu</math>V 5.8 <math>\mu</math>V 5.8 <math>\mu</math>V 5.8 <math>\mu</math>V 9.3 <math>\mu</math>V 17 <math>\mu</math>V 35 <math>\mu</math>V 47 <math>\mu</math>V</p> <p>6.0 <math>\mu</math>V 5.8 <math>\mu</math>V 5.8 <math>\mu</math>V 5.8 <math>\mu</math>V 5.8 <math>\mu</math>V 5.8 <math>\mu</math>V 5.9 <math>\mu</math>V 10 <math>\mu</math>V 18 <math>\mu</math>V 35 <math>\mu</math>V 48 <math>\mu</math>V</p> <p>7.8 <math>\mu</math>V 7.1 <math>\mu</math>V 7.0 <math>\mu</math>V 7.0 <math>\mu</math>V 7.0 <math>\mu</math>V 7.0 <math>\mu</math>V 7.4 <math>\mu</math>V 11 <math>\mu</math>V 19 <math>\mu</math>V 36 <math>\mu</math>V 54 <math>\mu</math>V</p> <p>10 <math>\mu</math>V 7.5 <math>\mu</math>V 7.1 <math>\mu</math>V 7.1 <math>\mu</math>V 7.1 <math>\mu</math>V 7.1 <math>\mu</math>V 8.4 <math>\mu</math>V 14 <math>\mu</math>V 23 <math>\mu</math>V 40 <math>\mu</math>V 72 <math>\mu</math>V</p>		B



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AC VOLTAGE Generation (continued)	<p><b>10 mV to 22 mV</b>            10 Hz to 20 Hz            20 Hz to 40 Hz            40 Hz to 100 Hz            100 Hz to 1 kHz            1 kHz to 10 kHz            10 kHz to 20 kHz            20 kHz to 50 kHz            50 kHz to 100 kHz            100 kHz to 200 kHz            200 kHz to 500 kHz            500 kHz to 1 MHz</p> <p><b>22 mV to 50 mV</b>            10 Hz to 20 Hz            20 Hz to 40 Hz            40 Hz to 100 Hz            100 Hz to 1 kHz            1 kHz to 10 kHz            10 kHz to 20 kHz            20 kHz to 50 kHz            50 kHz to 100 kHz            100 kHz to 200 kHz            200 kHz to 500 kHz            500 kHz to 1 MHz</p> <p><b>50 mV to 100 mV</b>            10 Hz to 20 Hz            20 Hz to 40 Hz            40 Hz to 100 Hz            100 Hz to 1 kHz            1 kHz to 10 kHz            10 kHz to 20 kHz            20 kHz to 50 kHz            50 kHz to 100 kHz            100 kHz to 200 kHz            200 kHz to 500 kHz            500 kHz to 1 MHz</p> <p><b>100 mV to 220 mV</b>            10 Hz to 20 Hz            20 Hz to 40 Hz            40 Hz to 100 Hz            100 Hz to 1 kHz            1 kHz to 10 kHz            10 kHz to 20 kHz            20 kHz to 50 kHz            50 kHz to 100 kHz            100 kHz to 200 kHz            200 kHz to 500 kHz            500 kHz to 1 MHz</p>	<p>17 <math>\mu</math>V            9.3 <math>\mu</math>V            7.6 <math>\mu</math>V            7.6 <math>\mu</math>V            7.6 <math>\mu</math>V            7.6 <math>\mu</math>V            13 <math>\mu</math>V            26 <math>\mu</math>V            37 <math>\mu</math>V            57 <math>\mu</math>V            0.13 mV</p> <p>39 <math>\mu</math>V            18 <math>\mu</math>V            13 <math>\mu</math>V            13 <math>\mu</math>V            13 <math>\mu</math>V            13 <math>\mu</math>V            24 <math>\mu</math>V            62 <math>\mu</math>V            72 <math>\mu</math>V            0.11 mV            0.24 mV</p> <p>72 <math>\mu</math>V            30 <math>\mu</math>V            17 <math>\mu</math>V            17 <math>\mu</math>V            17 <math>\mu</math>V            17 <math>\mu</math>V            43 <math>\mu</math>V            0.11 mV            0.13 mV            0.21 mV            0.43 mV</p> <p>0.15 mV            62 <math>\mu</math>V            30 <math>\mu</math>V            30 <math>\mu</math>V            30 <math>\mu</math>V            30 <math>\mu</math>V            92 <math>\mu</math>V            0.23 mV            0.28 mV            0.46 mV            0.92 mV</p>		B



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AC VOLTAGE Generation (continued)	<p><b>220 mV to 0.5 V</b>            10 Hz to 20 Hz            20 Hz to 40 Hz            40 Hz to 100 Hz            100 Hz to 1 kHz            1 kHz to 10 kHz            10 kHz to 20 kHz            20 kHz to 50 kHz            50 kHz to 100 kHz            100 kHz to 200 kHz            200 kHz to 500 kHz            500 kHz to 1 MHz</p> <p><b>0.5 V to 1 V</b>            10 Hz to 20 Hz            20 Hz to 40 Hz            40 Hz to 100 Hz            100 Hz to 1 kHz            1 kHz to 10 kHz            10 kHz to 20 kHz            20 kHz to 50 kHz            50 kHz to 100 kHz            100 kHz to 200 kHz            200 kHz to 500 kHz            500 kHz to 1 MHz</p> <p><b>1 V to 2.2 V</b>            10 Hz to 20 Hz            20 Hz to 40 Hz            40 Hz to 100 Hz            100 Hz to 1 kHz            1 kHz to 10 kHz            10 kHz to 20 kHz            20 kHz to 50 kHz            50 kHz to 100 kHz            100 kHz to 200 kHz            200 kHz to 500 kHz            500 kHz to 1 MHz</p> <p><b>2.2 V to 5 V</b>            10 Hz to 20 Hz            20 Hz to 40 Hz            40 Hz to 100 Hz            100 Hz to 1 kHz            1 kHz to 10 kHz            10 kHz to 20 kHz            20 kHz to 50 kHz            50 kHz to 100 kHz            100 kHz to 200 kHz            200 kHz to 500 kHz            500 kHz to 1 MHz</p>	<p>0.37 mV            0.11 mV            52 <math>\mu</math>V            52 <math>\mu</math>V            52 <math>\mu</math>V            52 <math>\mu</math>V            85 <math>\mu</math>V            0.19 mV            0.33 mV            0.83 mV            1.8 mV</p> <p>0.70 mV            0.21 mV            0.10 mV            0.10 mV            0.10 mV            0.10 mV            0.16 mV            0.34 mV            0.58 mV            1.5 mV            3.0 mV</p> <p>1.5 mV            0.46 mV            0.22 mV            0.22 mV            0.22 mV            0.22 mV            0.36 mV            0.72 mV            1.2 mV            3.1 mV            6.2 mV</p> <p>3.7 mV            1.1 mV            0.52 mV            0.52 mV            0.52 mV            0.52 mV            0.85 mV            1.7 mV            4.0 mV            10 mV            20 mV</p>		B



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AC VOLTAGE Generation (continued)	<b>5 V to 10 V</b> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz  <b>10 V to 22 V</b> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz  <b>22 V to 50 V</b> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz  <b>50 V to 100 V</b> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	7.0 mV 2.1 mV 1.0 mV 1.0 mV 1.0 mV 1.0 mV 1.6 mV 3.3 mV 7.2 mV 17 mV 36 mV  15 mV 4.6 mV 2.2 mV 2.2 mV 2.2 mV 2.2 mV 3.6 mV 7.1 mV 15 mV 36 mV 77 mV  37 mV 11 mV 5.8 mV 5.8 mV 5.8 mV 5.8 mV 15 mV 37 mV  70 mV 21 mV 11 mV 11 mV 11 mV 11 mV 29 mV 70 mV		B



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AC VOLTAGE Generation (continued)	<b>100 V to 220 V</b> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz  <b>220 V to 500 V</b> 50 Hz 50 Hz to 500 Hz 500 Hz to 1 kHz  <b>500 V to 1100 V</b> 50 Hz 50 Hz to 500 Hz 500 Hz to 1 kHz	0.15 V 46 mV 23 mV 23 mV 23 mV 23 mV 64 mV 0.15 V  57 mV 57 mV 57 mV  0.12 V 0.12 V 0.12 V		B
AC VOLTAGE Measurement	<b>1 mV to 5 mV</b> 10 Hz to 2 kHz 2 kHz to 10 kHz. 10 kHz to 30 kHz 30 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz  <b>5 mV to 10 mV</b> 10 Hz 10 Hz to 2 kHz 2 kHz to 10 kHz. 10 kHz to 30 kHz 30 kHz to 60 kHz 60 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	3.0 $\mu$ V 3.3 $\mu$ V 3.3 $\mu$ V 18 $\mu$ V 58 $\mu$ V 0.12 mV  3.0 $\mu$ V 4.2 $\mu$ V 4.9 $\mu$ V 5.0 $\mu$ V 36 $\mu$ V 35 $\mu$ V 0.12 mV 0.23 mV		B



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### Calibration, Maintenance and Repair Ltd

Issue No: 045 Issue date: 03 October 2025

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<p>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.</p>				
AC VOLTAGE Measurement (continued)	<p><b>10 mV to 50 mV</b>            10Hz            10 Hz to 2 kHz            2 kHz to 10 kHz.            10 kHz to 30 kHz            30 kHz to 100 kHz            100 kHz to 300 kHz            300 kHz to 1 MHz            1 MHz to 2 MHz            2 MHz to 4 MHz            4 MHz to 6 MHz            6 MHz to 8 MHz            8 MHz to 10 MHz</p> <p><b>50 mV to 100 mV</b>            10 Hz            10 Hz to 2 kHz            2 kHz to 10 kHz.            10 kHz to 30 kHz            30 kHz to 100 kHz            100 kHz to 300 kHz            300 kHz to 1 MHz            1 MHz to 2 MHz            2 MHz to 4 MHz            4 MHz to 8 MHz            8 MHz to 10 MHz</p> <p><b>0.1 V to 0.5 V</b>            10Hz            10 Hz to 2 kHz            2 kHz to 10 kHz            10 kHz to 30 kHz            30 kHz to 100 kHz            100 kHz to 300 kHz            300 kHz to 1 MHz            1 MHz to 2 MHz            2 MHz to 4 MHz            4 MHz to 8MHz            8 MHz to 10 MHz</p> <p><b>0.5 V to 1 V</b>            10Hz            10 Hz to 2 kHz            2 kHz to 10 kHz.            10 kHz to 30 kHz            30 kHz to 60 kHz            60 kHz to 100 kHz            100 kHz to 300 kHz            300 kHz to 1 MHz            1 MHz to 2 MHz            2 MHz to 4 MHz            4 MHz to 8 MHz            8 MHz to 10 MHz</p>	<p>6.1 <math>\mu</math>V            5.7 <math>\mu</math>V            7.9 <math>\mu</math>V            14 <math>\mu</math>V            34 <math>\mu</math>V            0.14 mV            0.69 mV            1.1 mV            2.7 mV            5.1 mV            5.2 mV            9.5 mV</p> <p>11            10 <math>\mu</math>V            15 <math>\mu</math>V            27 <math>\mu</math>V            68 <math>\mu</math>V            0.25 mV            1.3 mV            1.9 mV            4.9 mV            10 mV            19 mV</p> <p>50 <math>\mu</math>V            47 <math>\mu</math>V            73 <math>\mu</math>V            0.13 mV            0.34 mV            1.4 mV            6.3 mV            11 mV            26 mV            51 mV            92 mV</p> <p>91 <math>\mu</math>V            90 <math>\mu</math>V            0.14 mV            0.27 mV            0.62 mV            0.68 mV            2.5 mV            12 mV            18 mV            48 mV            0.10 V            0.18 V</p>		B



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AC VOLTAGE Measurement (continued)	<p><b>1 V to 5 V</b> 10Hz 10 Hz to 2 kHz 2 kHz to 10 kHz. 10 kHz to 30 kHz 30 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 MHz to 2 MHz 2 MHz to 4 MHz 4 MHz to 8 MHz 8 MHz to 10 MHz</p> <p><b>5 V to 10 V</b> 10Hz 10 Hz to 2 kHz 2 kHz to 10 kHz. 10 kHz to 30 kHz 30 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 MHz to 2 MHz 2 MHz to 4 MHz 4 MHz to 8 MHz 8 MHz to 10 MHz</p> <p><b>10 V to 50 V</b> 10Hz 10 Hz to 2 kHz 2 kHz to 10 kHz. 10 kHz to 30 kHz 30 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz</p> <p><b>50 V to 100 V</b> 10 Hz to 2 kHz 2 kHz to 10 kHz. 10 kHz to 30 kHz 30 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz</p> <p><b>100 V to 500 V</b> 40 Hz to 10 kHz 10 kHz to 30 kHz 30 kHz to 100 kHz</p> <p><b>500 V to 1000 V</b> 40 Hz to 10 kHz 10 kHz to 30 kHz 30 kHz to 100 kHz</p>	<p>0.49 mV 0.48 mV 0.73 mV 1.3 mV 3.3 mV 14 mV 60 mV 0.10 V 0.26 V 0.49 V 0.90 V</p> <p>0.91 mV 0.90 mV 1.4 mV 2.7 mV 6.3 mV 25 mV 0.12 V 0.18 V 0.48 V 1.0 V 1.8 V</p> <p>6.0 mV 5.6 mV 6.7 mV 16 mV 39 mV 0.22 V 0.88 V</p> <p>11 mV 13 mV 28 mV 71 mV 0.43 V 1.4 V</p> <p>73 mV 0.16 V 0.38 V</p> <p>0.13 V 0.28 V 0.70 V</p>		B



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AC CURRENT Generation	<b>10 <math>\mu</math>A to 50 <math>\mu</math>A</b> 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz  <b>50 <math>\mu</math>A to 100 <math>\mu</math>A</b> 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz  <b>100 <math>\mu</math>A to 220 <math>\mu</math>A</b> 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz  <b>0.22 mA to 0.5 mA</b> 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz  <b>0.5 mA to 1 mA</b> 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz  <b>1 mA to 2.2 mA</b> 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz  <b>2.2 mA to 5 mA</b> 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz  <b>5 mA to 10 mA</b> 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz  <b>10 mA to 22 mA</b> 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	38 nA 26 nA 71 nA 0.16 $\mu$ A  57 nA 30 nA 0.10 $\mu$ A 0.24 $\mu$ A  0.11 $\mu$ A 48 nA 0.19 $\mu$ A 0.47 $\mu$ A  48 nA 47 nA 0.58 $\mu$ A 1.2 $\mu$ A  0.49 $\mu$ A 0.19 $\mu$ A 1.0 $\mu$ A 2.4 $\mu$ A  1.1 $\mu$ A 0.41 $\mu$ A 1.9 $\mu$ A 4.7 $\mu$ A  2.5 $\mu$ A 1.0 $\mu$ A 7.0 $\mu$ A 16 $\mu$ A  4.9 $\mu$ A 1.9 $\mu$ A 10 $\mu$ A 24 $\mu$ A  11 $\mu$ A 4.1 $\mu$ A 19 $\mu$ A 47 $\mu$ A		B



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AC CURRENT Generation (continued)	<p><b>22 mA to 50 mA</b> 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz</p> <p><b>50 mA to 100 mA</b> 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz</p> <p><b>100 mA to 220 mA</b> 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz</p> <p><b>0.22 A to 0.5 A</b> 20 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz</p> <p><b>0.5 A to 1 A</b> 20 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz</p> <p><b>1 A to 2.2 A</b> 20 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz</p> <p><b>2.2 A to 3 A</b> 10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz</p> <p><b>3 A to 11 A</b> 45 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 5 kHz</p> <p><b>11 A to 20.5 A</b> 45 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 5 kHz</p> <p><b>45 Hz to 400 Hz</b> 20 A to 30 A</p>	<p>25 <math>\mu</math>A 11 <math>\mu</math>A 70 <math>\mu</math>A 0.16 mA</p> <p>49 <math>\mu</math>A 21 <math>\mu</math>A 99 <math>\mu</math>A 0.24 mA</p> <p>0.11 mA 46 <math>\mu</math>A 0.19 mA 0.47 mA</p> <p>0.44 mA 0.50 mA 0.62 mA</p> <p>0.87 mA 0.99 mA 1.2 mA</p> <p>1.9 mA 2.2 mA 2.6 mA</p> <p>6.2 mA 2.1 mA 21 mA 87 mA</p> <p>8.0 mA 13 mA 0.38 mA</p> <p>29 mA 36 mA 710 mA</p> <p>150 mA</p>	<p>Calibration of current clamps using a multi turn coil</p>	B



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AC CURRENT Generation (continued)	<b>30 A to 110 A</b> <i>45 Hz to 100 Hz</i>	520 mA	Calibration of current clamps using a multi turn coil	B
	<b>110 A to 200 A</b> <i>100 Hz to 400 Hz</i>	960 mA		
	<b>200 A to 550 A</b> <i>45 Hz to 100 Hz</i>	2.5 A		
	<b>550 A to 1025 A</b> <i>45 Hz to 100 Hz</i>	4.8 A		
Measurement	<b>0 µA to 5 µA</b> <i>10 Hz to 55 Hz</i> <i>55 Hz to 10 kHz</i>	13 nA 25 nA		
	<b>5 µA to 10 µA</b> <i>10 Hz to 55 Hz</i> <i>55 Hz to 10 kHz</i>	24 nA 34 nA		
	<b>10 µA to 20 µA</b> <i>10 Hz to 55 Hz</i> <i>55 Hz to 10 kHz</i>	47 nA 52 nA		
	<b>20 µA to 50µA</b> <i>10 Hz to 2 kHz.</i> <i>2 kHz to 10 kHz</i> <i>10 kHz to 20 kHz</i> <i>20 kHz to 30 kHz</i>	23 nA 35 nA 48 nA 53 nA		
	<b>50 µA to 100 µA</b> <i>10 Hz to 2 kHz.</i> <i>2 kHz to 10 kHz</i> <i>10 kHz to 20 kHz</i> <i>20 kHz to 30 kHz</i>	36 nA 63 nA 88 nA 91 nA		
	<b>100 µA to 200 µA</b> <i>10 Hz to 2 kHz.</i> <i>2 kHz to 10 kHz</i> <i>10 kHz to 30 kHz</i>	67 nA 0.12 µA 0.17 µA		
	<b>0.2 mA to 0.5 mA</b> <i>10Hz to 2 kHz.</i> <i>2 kHz to 10 kHz</i> <i>10 kHz to 30 kHz</i>	0.19 µA 0.32 µA 0.44 µA		
	<b>0.5 mA to 1 mA</b> <i>10 Hz to 2 kHz.</i> <i>2 kHz to 10 kHz</i> <i>10 kHz to 30 kHz</i>	0.34 µA 0.62 µA 0.86 µA		



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AC CURRENT Measurement (continued)	<b>1 mA to 2 mA</b> 10 Hz to 2 kHz. 2 kHz to 10 kHz 10 kHz to 30 kHz  <b>2 mA to 5 mA</b> 10 Hz to 2 kHz. 2 kHz to 10 kHz 10 kHz to 30 kHz  <b>5 mA to 10 mA</b> 10 Hz to 2 kHz. 2 kHz to 10 kHz 10 kHz to 30 kHz  <b>10 mA to 20 mA</b> 10 Hz to 2 kHz. 2 kHz to 10 kHz 10 kHz to 30 kHz  <b>20 mA to 50 mA</b> 10 Hz to 2 kHz. 2 kHz to 10 kHz 10 kHz to 30 kHz  <b>50 mA to 100 mA</b> 10 Hz to 2 kHz. 2 kHz to 10 kHz 10 kHz to 30 kHz  <b>100 mA to 200 mA</b> 10 Hz to 2 kHz. 2 kHz to 10 kHz 10 kHz to 30 kHz  <b>0.2 A to 0.5 A</b> 10 Hz to 2 kHz. 2 kHz to 10 kHz 10 kHz to 30 kHz  <b>0.5 A to 1 A</b> 10 Hz to 2 kHz. 2 kHz to 10 kHz 10 kHz to 30 kHz  <b>1 A to 2 A</b> 10 Hz to 2 kHz. 2 kHz to 10 kHz 10 kHz to 30 kHz  <b>2 A to 5 A</b> 10 Hz to 10 kHz	0.66 $\mu$ A 1.2 $\mu$ A 1.7 $\mu$ A  1.9 $\mu$ A 3.2 $\mu$ A 4.4 $\mu$ A  3.4 $\mu$ A 6.2 $\mu$ A 8.6 $\mu$ A  6.6 $\mu$ A 12 $\mu$ A 17 $\mu$ A  19 $\mu$ A 31 $\mu$ A 45 $\mu$ A  34 $\mu$ A 61 $\mu$ A 86 $\mu$ A  66 $\mu$ A 0.12 mA 0.17 mA  0.23 mA 0.36 mA 0.47 mA  0.38 mA 0.66 mA 0.92 mA  0.74 mA 1.3 mA 1.8 mA  5.0 mA		B



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AC CURRENT Measurement (continued)	<b>5 A to 10 A</b> <i>10 Hz to 10 kHz</i>	10 mA		B
	<b>10 A to 20 A</b> <i>10 Hz to 10 kHz</i>	19 mA		
	<b>20 A to 30 A</b> <i>10 Hz to 2 kHz</i> <i>2 kHz to 10 kHz</i>	24 mA 32 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 $\mu$ Hz/Hz 1.2 $\mu$ Hz/Hz 0.012 $\mu$ Hz/Hz	May be reported as events per unit time	
Elapsed time			Mechanical timers / stop watches	
Single event	1 s to 12 hrs	0.05 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	<b>1 kHz</b> 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	12 pF 13 pF 22 pF 34 pF 100 pF 320 pF 970 pF		



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CAPACITANCE (continued) Simulated generation (continued)	<b>100 Hz</b> 0.33 $\mu$ F to 1.1 $\mu$ F 1.1 $\mu$ F to 3.3 $\mu$ F 3.3 $\mu$ F to 11 $\mu$ F 11 $\mu$ F to 33 $\mu$ F 33 $\mu$ F to 110 $\mu$ F 110 $\mu$ F to 330 $\mu$ F 330 $\mu$ F to 1.1 mF 1.1 mF to 3.3 mF 3.3 mF to 11 mF 11 mF to 33 mF 33 mF to 110 mF	3.4 nF 10 nF 34 nF 160 nF 600 nF 1.8 $\mu$ F 5.8 $\mu$ F 18 $\mu$ F 58 $\mu$ F 290 $\mu$ F 1.4 mF		B
Measurement	0 to 0.5 nF 0.5 nF to 1 nF 1 nF to 2 nF 2 nF to 5 nF 5 nF to 10 nF 10 nF to 20 nF 20 nF to 50 nF 50 nF to 100 nF 100 nF to 200 nF 0.2 $\mu$ F to 0.5 $\mu$ F 0.5 $\mu$ F to 1 $\mu$ F 1 $\mu$ F to 2 $\mu$ F 2 $\mu$ F to 5 $\mu$ F 5 $\mu$ F to 10 $\mu$ F 10 $\mu$ F to 20 $\mu$ F 20 $\mu$ F to 50 $\mu$ F 50 $\mu$ F to 100 $\mu$ F 100 $\mu$ F to 200 $\mu$ F 0.2 mF to 0.5 mF 0.5 mF to 1 mF 1 mF to 2 mF 2 mF to 5 mF 5 mF to 10 mF 10 mF to 20 mF 20 mF to 50 mF 50 mF to 100 mF 100 mF to 200 mF	2.0 pF 2.7 pF 5.1 pF 6.1 pF 10 pF 20 pF 35 pF 60 pF 0.12 nF 0.28 nF 0.50 nF 1.1 nF 3.5 nF 5.5 nF 10 nF 45 nF 76 nF 0.15 $\mu$ F 0.45 $\mu$ F 0.76 $\mu$ F 1.5 $\mu$ F 5.0 $\mu$ F 8.7 $\mu$ F 17 $\mu$ F 45 $\mu$ F 87 $\mu$ F 0.17 mF		



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CALIBRATION OF INSULATION TESTERS				B
Insulation Resistance	10 k $\Omega$ to 190 k $\Omega$ 200 k $\Omega$ 400 k $\Omega$ 800 k $\Omega$ 1.9 M $\Omega$ 2 M $\Omega$ 4 M $\Omega$ 8 M $\Omega$ 19 M $\Omega$ 20 M $\Omega$ 40 M $\Omega$ 80 M $\Omega$ 190 M $\Omega$ 200 M $\Omega$ 400 M $\Omega$ 800 M $\Omega$ 1.9 G $\Omega$	5.8 k $\Omega$ 6.1 k $\Omega$ 6.2 k $\Omega$ 6.4 k $\Omega$ 7.0 k $\Omega$ 9.4 k $\Omega$ 15 k $\Omega$ 28 k $\Omega$ 58 k $\Omega$ 0.13 M $\Omega$ 0.24 M $\Omega$ 0.47 M $\Omega$ 0.58 M $\Omega$ 1.8 M $\Omega$ 3.4 M $\Omega$ 6.7 M $\Omega$ 13 M $\Omega$	Up to 1350 V	B
Insulation test voltage Nominal	0 to 10 V 10 V to 100 V 100 V to 1100 V	0.10 V 0.26 V 2.6 V	The test voltage will normally be measured with a 1 mA load.	B
Continuity Resistance	100 m $\Omega$ to 2 $\Omega$ 4 $\Omega$ 8 $\Omega$ 19 $\Omega$ 20 $\Omega$ 40 $\Omega$ 80 $\Omega$ 190 $\Omega$ 200 $\Omega$ 400 $\Omega$ 800 $\Omega$ 1.9 k $\Omega$ 2 k $\Omega$ 4 k $\Omega$ 8 k $\Omega$ 10 k $\Omega$	30 m $\Omega$ 33 m $\Omega$ 35 m $\Omega$ 38 m $\Omega$ 55 m $\Omega$ 0.12 $\Omega$ 0.20 $\Omega$ 0.24 $\Omega$ 0.74 $\Omega$ 1.1 $\Omega$ 2.0 $\Omega$ 2.4 $\Omega$ 8.1 $\Omega$ 11 $\Omega$ 20 $\Omega$ 24 $\Omega$		B



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<b>Temperature indicators, calibration by electrical simulation</b>				By injection of equivalent DC voltages	B
Type K thermocouple	-270 °C to -200 °C	Excluding CJC 1.6 °C	Including CJC 2.8 °C		
	-200 °C to -50 °C	0.10 °C	0.17 °C		
	-50 °C to 1370 °C	0.10 °C	0.13 °C		
Type J thermocouple	-210 °C to -200 °C	0.10 °C	0.23 °C		
	-200 °C to 0 °C	0.10 °C	0.21 °C		
	0 °C to 1200 °C	0.10 °C	0.14 °C		
Type E thermocouple	-270 °C to -200 °C	0.69 °C	0.95 °C		
	-200 °C to 0 °C	0.10 °C	0.13 °C		
	0 °C to 1000 °C	0.10 °C	0.12 °C		
Type T thermocouple	-270 °C to -200 °C	1.1 °C	7.2 °C		
	-200 °C to 0 °C	0.10 °C	0.48 °C		
	0 °C to 400 °C	0.10 °C	0.22 °C		
Type N thermocouple	-270 °C to -200 °C	3.7 °C	4.3 °C		
	-200 °C to -100 °C	0.13 °C	0.18 °C		
	-100 °C to 800 °C	0.10 °C	0.13 °C		
	800 °C to 1300 °C	0.10 °C	0.12 °C		
Type R thermocouple	-50 °C to 0 °C	0.30 °C	0.34 °C		
	0 °C to 150 °C	0.22 °C	0.25 °C		
	150 °C to 400 °C	0.15 °C	0.19 °C		
	400 °C to 1768 °C	0.12 °C	0.17 °C		
Type S thermocouple	-50 °C to 0 °C	0.28 °C	0.31 °C		
	0 °C to 100 °C	0.21 °C	0.24 °C		
	100 °C to 300 °C	0.16 °C	0.20 °C		
	300 °C to 1768 °C	0.13 °C	0.17 °C		
Resistance thermometer (Pt 100)	-200 °C to -80 °C	0.058 °C		By injection of equivalent DC resistance	
	-80 °C to 0 °C	0.058 °C			
	0 °C to 100 °C	0.081 °C			
	100 °C to 300 °C	0.10 °C			
	300 °C to 400 °C	0.12 °C			
	400 °C to 630 °C	0.14 °C			
630 °C to 800 °C	0.27 °C				



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Measured Quantity Instrument or Gauge	Range	Expanded Measurement 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.					
<b>Temperature simulators, calibration by electrical measurement</b>				By measurement of equivalent DC voltages	B
Type K thermocouple	-270 °C to -200 °C	Excluding CJC 1.2 °C	Including CJC 2.6 °C		
	-200 °C to -50 °C	0.10 °C	0.17 °C		
	-50 °C to 1370 °C	0.10 °C	0.13 °C		
Type J thermocouple	-210 °C to -200 °C	0.10 °C	0.23 °C		
	-200 °C to 0 °C	0.10 °C	0.21 °C		
	0 °C to 1200 °C	0.10 °C	0.14 °C		
Type E thermocouple	-270 °C to -200 °C	0.54 °C	0.85 °C		
	-200 °C to 0 °C	0.10 °C	0.13 °C		
	0 °C to 1000 °C	0.10 °C	0.12 °C		
Type T thermocouple	-270 °C to -200 °C	0.86 °C	7.2 °C		
	-200 °C to 0 °C	0.10 °C	0.47 °C		
	0 °C to 400 °C	0.10 °C	0.22 °C		
Type N thermocouple	-270 °C to -200 °C	2.9 °C	3.6 °C		
	-200 °C to -100 °C	0.11 °C	0.16 °C		
	-100 °C to 800 °C	0.10 °C	0.13 °C		
	800 °C to 1300 °C	0.10 °C	0.12 °C		
Type R thermocouple	-50 °C to 0 °C	0.24 °C	0.29 °C		
	0 °C to 150 °C	0.17 °C	0.22 °C		
	150 °C to 400 °C	0.12 °C	0.17 °C		
	400 °C to 1768 °C	0.10 °C	0.15 °C		
Type S thermocouple	-50 °C to 0 °C	0.22 °C	0.26 °C		
	0 °C to 100 °C	0.17 °C	0.21 °C		
	100 °C to 300 °C	0.13 °C	0.17 °C		
	300 °C to 1768 °C	0.11 °C	0.16 °C		
Resistance thermometer (Pt 100)	-200 °C to 0 °C 0 °C to 850 °C	0.0086 °C 0.020 °C		By measurement of equivalent DC resistance	



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Measured Quantity Instrument or Gauge	Range	Expanded Measurement 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	Q [0.29 %, 47 $\mu$ V] Q [0.29 %, 48 $\mu$ V] Q [0.29 %, 92 $\mu$ V] Q [0.29 %, 0.21 mV]	Into 50 $\Omega$	
	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	Q [0.12 %, 46 V] Q [0.12 %, 46 $\mu$ V] Q [0.12 %, 51 $\mu$ V] Q [0.12 %, 0.22 mV] Q [0.12 %, 0.47 mV]	Into 1 M $\Omega$	
Time markers	2 ns to 500 ns 500 ns to 500 $\mu$ s 500 $\mu$ s to 50 ms 50 ms to 5 s	Q [0.082 %, 0.12 ps] Q [0.082 %, 0.12 ns] Q [0.058 %, 12 ns] Q [0.59 %, 1.2 $\mu$ s]		
<b>PRESSURE</b>				B
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 -3.5 kPa -3.5 kPa to -1.5 kPa 1.5 kPa to 3.5 kPa 3.5 kPa to 10 kPa 10 kPa to 20 kPa 20 kPa to 2.5 MPa 2.5 MPa to 14 MPa	0.0087 % 0.0097 % Q [0.014 %, 0.50 Pa] Q [0.013 %, 0.50 Pa] 0.0078 % 0.0066 % 0.0063 % 0.0079 %	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	0.011 % 0.010 %		



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Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty ( $k = 2$ )	Remarks	Location Code
<b>ELECTRICAL</b>				
DC VOLTAGE Generation	0 mV to 330 mV 0.33 V to 3.3 V 3.3 to 33 V 33 V to 330 V 330 V to 1020 V	7.8 $\mu$ V 43 $\mu$ V 0.48 mV 7.0 mV 22 mV		S
DC VOLTAGE Measurement	0 mV to 100 mV 100 mV to 200 mV 0.2 V to 1 V 1 V to 2 V 2 V to 10 V 10 V to 20 V 20 V to 100 V 100 V to 200 V 200 V to 500 V 500 V to 1000 V	4.8 $\mu$ V 9.1 $\mu$ V 31 $\mu$ V 62 $\mu$ V 0.31 mV 0.6 mV 4.6 mV 9.1 mV 26 mV 50 mV		
DC RESISTANCE Generation	0 $\Omega$ to 11 $\Omega$ 11 $\Omega$ to 33 $\Omega$ 33 $\Omega$ to 110 $\Omega$ 110 $\Omega$ to 330 $\Omega$ 330 $\Omega$ to 1.1 k $\Omega$  1.1 k $\Omega$ to 3.3 k $\Omega$ 3.3 k $\Omega$ to 11 k $\Omega$ 11 k $\Omega$ to 33 k $\Omega$ 33 k $\Omega$ to 110 k $\Omega$  110 k $\Omega$ to 330 k $\Omega$ 330 k $\Omega$ to 1.1 M $\Omega$ 1.1 M $\Omega$ to 3.3 M $\Omega$ 3.3 M $\Omega$ to 11 M $\Omega$ 11 M $\Omega$ to 33 M $\Omega$  33 M $\Omega$ to 110 M $\Omega$ 110 M $\Omega$ to 330 M $\Omega$ 330 M $\Omega$ to 1.1 G $\Omega$	0.51 m $\Omega$ 1.1 m $\Omega$ 3.6 m $\Omega$ 11 m $\Omega$ 36 m $\Omega$  110 m $\Omega$ 0.36 m $\Omega$ 1.1 $\Omega$ 3.6 $\Omega$  12 $\Omega$ 41 $\Omega$ 230 $\Omega$ 1.7 k $\Omega$ 9.6 k $\Omega$  64 k $\Omega$ 1.1 M $\Omega$ 19 M $\Omega$		
DC RESISTANCE Measurement	0 $\Omega$ to 20 $\Omega$ 20 $\Omega$ to 200 $\Omega$ 0.2 k $\Omega$ to 2 k $\Omega$ 2 k $\Omega$ to 20 k $\Omega$ 20 k $\Omega$ to 200 k $\Omega$ 0.2 M $\Omega$ to 2 M $\Omega$ 2 M $\Omega$ to 20 M $\Omega$ 20 M $\Omega$ to 100 M $\Omega$	1.7 m $\Omega$ 13 m $\Omega$ 0.12 $\Omega$ 1.2 $\Omega$ 21 $\Omega$ 0.37 k $\Omega$ 21 k $\Omega$ 2.3 M $\Omega$		



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Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty ( $k = 2$ )	Remarks	Location Code
DC CURRENT Generation	0 $\mu$ A to 330 $\mu$ A 330 $\mu$ A to 3.3 mA 3.3 mA to 33 mA 33 mA to 330 mA 330 mA to 1.1 A 1.1 A to 3 A 3 A to 11 A 11 A to 20.5 A	62 nA 0.39 $\mu$ A 3.8 $\mu$ A 38 $\mu$ A 0.26 mA 1.3 mA 6.4 mA 24 mA	Current clamp calibration using a multi-turn coil	S
	20 A to 30 A 30 A to 110 A 110 A to 200 A 200 A to 550 A 550 A to 1025 A	150 mA 500 mA 930 mA 2.5 A 4.7 A		
DC CURRENT Measurement	0 $\mu$ A to 100 $\mu$ A 100 $\mu$ A to 210 $\mu$ A 0.1 mA to 1 mA 1 mA to 2.1 mA 2 mA to 10 mA 10 mA to 21 mA 20 mA to 100 mA 100 mA to 210 mA 200 mA to 500 mA 500 mA to 1 A 1 A to 2 A	87 nA 0.13 $\mu$ A 0.62 $\mu$ A 1.0 $\mu$ A 6.2 $\mu$ A 10 $\mu$ A 0.12 mA 0.16 mA 0.53 mA 1.0 mA 2.1 mA	Measurement of current using a shunt	
	2 A to 10 A 10 A to 20 A 20A to 100 A	0.12 A 0.23 A 0.29A		
AC VOLTAGE Generation	<b>1 mV to 33 mV</b> 10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 500 kHz	32 $\mu$ V 9.3 $\mu$ V 9.3 $\mu$ V 11 $\mu$ V 39 $\mu$ V 0.13 mV 0.31 mV		
	<b>33 mV to 330 mV</b> 10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 500 kHz	0.11 mV 56 $\mu$ V 56 $\mu$ V 62 $\mu$ V 0.13 mV 31 mV 0.77 mV		



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Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty ( $k = 2$ )	Remarks	Location Code
AC VOLTAGE Generation (continued)	<p><b>0.33 V to 3.3 V</b> 10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 500 kHz</p> <p><b>3.3 V to 33 V</b> 10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz</p> <p><b>33 V to 330 V</b> 50 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz</p> <p><b>330 V to 1020 V</b> 50 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz</p>	<p>1.2 mV 0.58 mV 0.58 mV 0.73 mV 1.1 mV 2.7 mV 9.2 mV</p> <p>12 mV 5.8 mV 5.8 mV 9.2 mV 13 mV 34 mV</p> <p>73 mV 77 mV 0.10 mV 0.12 mV 0.77 mV</p> <p>0.35 V 0.30 V 0.35 mV</p>		S
AC VOLTAGE Measurement	<p><b>2 mV to 20 mV</b> 50 Hz 20 Hz to 50 Hz 50 Hz to 100 Hz 100 Hz to 2 kHz 2 kHz to 10 kHz 10 kHz to 30 kHz</p> <p><b>2 V to 20 V</b> 20 Hz to 50 Hz 50 Hz to 100 Hz 100 Hz to 2 kHz 2 kHz to 10 kHz 10 kHz to 30 kHz</p> <p><b>20 V to 200 V</b> 20 Hz to 50 Hz 50 Hz to 100 Hz 200 Hz to 2 kHz 2 kHz to 10 kHz 20 kHz to 30 kHz</p> <p><b>200 V to 750 V</b> 20 Hz to 50 Hz 50 Hz to 100 Hz 100 Hz to 1 kHz</p>	<p>68 <math>\mu</math>V 0.58 mV 0.19 mV 0.12 mV 0.12 mV 0.15 mV</p> <p>58 mV 19 mV 14 mV 20 mV 28 mV</p> <p>0.58 V 0.19 V 0.14 V 0.20 V 0.29 V</p> <p>2.3 V 0.96 V 0.88 V</p>		



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Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty ( $k = 2$ )	Remarks	Location Code
AC CURRENT Generation	<p><b>29 <math>\mu</math>A to 330 <math>\mu</math>A</b> 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</p> <p><b>0.33 mA to 3.3 mA</b> 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</p> <p><b>3.3 mA to 33 mA</b> 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</p> <p><b>33 mA to 330 mA</b> 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</p> <p><b>330 mA to 1 A</b> 10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz</p> <p><b>1 A to 3 A</b> 10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz</p> <p><b>3 A to 11 A</b> 10 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 5 kHz</p> <p><b>11 A to 20.5 A</b> 10 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 5 kHz</p>	<p>0.77 <math>\mu</math>A 0.58 <math>\mu</math>A 0.49 <math>\mu</math>A 1.2 <math>\mu</math>A 3.1 <math>\mu</math>A</p> <p>7.6 <math>\mu</math>A 4.8 <math>\mu</math>A 3.8 <math>\mu</math>A 7.6 <math>\mu</math>A 19 <math>\mu</math>A</p> <p>69 <math>\mu</math>A 34 <math>\mu</math>A 15 <math>\mu</math>A 31 <math>\mu</math>A 76 <math>\mu</math>A</p> <p>0.69 mA 0.34 mA 0.15 mA 0.39 mA 0.77 mA</p> <p>2.3 mA 0.65 mA 7.7 mA 32 mA</p> <p>6.2 mA 2.1 mA 21 mA 87 mA</p> <p>8.0 mA 13 mA 0.38 A</p> <p>29 mA 36 mA 0.71 A</p>		S



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Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty ( $k = 2$ )	Remarks	Location Code
AC CURRENT Generation (continued)	30 A to 110 A 45 Hz to 400 Hz	0.52 A	Current clamp calibration using a multi-turn coil	S
	110 A to 200 A 45 Hz to 400 Hz	0.96 A		
	200 A to 550 A 45 Hz to 100 Hz	2.5 A		
	550 A to 1025 A 45 Hz to 100 Hz	4.8 A		
AC CURRENT Measurement	<b>20 µA to 200 µA</b> 20 Hz to 50 Hz 50 Hz to 200 Hz 200 Hz to 1 kHz	0.81 µA 0.47 µA 0.93 µA	Measurement of current using a shunt	
	<b>0.2 mA to 2 mA</b> 20 Hz to 50 Hz 50 Hz to 200 Hz 200 Hz to 1 kHz	18 µA 410 µA 410 µA		
	<b>2 mA to 20 mA</b> 20 Hz to 50 Hz 50 Hz to 200 Hz 200 Hz to 1 kHz	82 µA 56 µA 52 µA		
	<b>20 mA to 200 mA</b> 20 Hz to 50 Hz 50 Hz to 200 Hz 200 Hz to 1 kHz	1.5 mA 1.3 mA 1.3 mA		
	<b>0.2 A to 2 A</b> 20 Hz to 50 Hz 50 Hz to 200 Hz 200 Hz to 1 kHz	8.3 mA 5.0 mA 7.2 mA		
	<b>2 A to 10 A</b> 50Hz	0.13 A		
	<b>10 A to 20 A</b> 50 Hz	0.39 A		
	<b>20 A to 100 A</b> 50 Hz	0.32 A		
FREQUENCY Generation	10 Hz to 100 Hz 100 Hz to 1000 Hz 1 kHz to 10 kHz 10 Hz to 50 Hz	28 mHz 0.12 Hz 1.2 Hz 5.8 Hz		



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Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty ( $k = 2$ )	Remarks	Location Code
CAPACITANCE Simulate Generation	<b>1 kHz</b> 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  <b>100 Hz</b> 0.33 $\mu$ F to 1.1 $\mu$ F 1.1 $\mu$ F to 3.3 $\mu$ F 3.3 $\mu$ F to 11 $\mu$ F 11 $\mu$ F to 33 $\mu$ F 33 $\mu$ F to 110 $\mu$ F 110 $\mu$ F to 330 $\mu$ F 330 $\mu$ F to 1.1 mF 1.1 mF to 3.3 mF 3.3 mF to 11 mF 11 mF to 33 mF 33 mF to 110 mF	12 pF 13 pF 22 pF 34 pF 100 pF 320 pF 970 pF  3.4 nF 10 nF 34 nF 160 nF 600 nF 1.8 $\mu$ F 5.8 $\mu$ F 18 $\mu$ F 58 $\mu$ F 290 $\mu$ F 1.4 mF		S
OSCILLOSCOPES Voltage deflection	1 mV to 25 mV 25 mV to 110 mV 110 mV to 2.2 V 2.2 V to 6 V  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	Q [0.29 %, 47 $\mu$ V] Q [0.29 %, 48 $\mu$ V] Q [0.29 %, 92 $\mu$ V] Q [0.29 %, 0.21 mV]  Q [0.12 %, 46 V] Q [0.12 %, 46 $\mu$ V] Q [0.12 %, 51 $\mu$ V] Q [0.12 %, 0.22 mV] Q [0.12 %, 0.47 mV]	Into 50 $\Omega$  Into 10 M $\Omega$	
Time markers	2 ns to 500 ns 500 ns to 500 $\mu$ s 500 $\mu$ s to 50 ms 50 ms to 5 s	Q [0.082 %, 0.12 ps] Q [0.082 %, 0.12 ns] Q [0.058 %, 12 ns] Q [0.59 %, 1.2 $\mu$ s]		
ELECTRICAL SIMULATION OF TEMPERATURE		Including CJC	By injection of equivalent DC voltage	
Type E thermocouple	-200 $^{\circ}$ C to 0 $^{\circ}$ C 0 $^{\circ}$ C to 500 $^{\circ}$ C 500 $^{\circ}$ C to 990 $^{\circ}$ C	0.41 $^{\circ}$ C 0.32 $^{\circ}$ C 0.44 $^{\circ}$ C		
Type J thermocouple	-200 to 0 $^{\circ}$ C 0 $^{\circ}$ C to 500 $^{\circ}$ C 500 $^{\circ}$ C to 1000 $^{\circ}$ C 1000 $^{\circ}$ C to 1200 $^{\circ}$ C	0.43 $^{\circ}$ C 0.36 $^{\circ}$ C 0.46 $^{\circ}$ C 0.51 $^{\circ}$ C		



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Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty ( $k = 2$ )	Remarks	Location Code
ELECTRICAL SIMULATION OF TEMPERATURE (continued)				S
Type K thermocouple	-200 °C to -100 °C -100 °C to 0 °C 0 °C to 100 °C 100 °C to 200 °C 200 °C to 400 °C 400 °C to 600 °C 600 °C to 800 °C 800 °C to 1000 °C 1000 °C to 1200 °C 1200 °C to 1370 °C	0.50 °C 0.39 °C 0.37 °C 0.31 °C 0.35 °C 0.40 °C 0.44 °C 0.48 °C 0.55 °C 0.61 °C		
Type N thermocouple	-200 °C to 0 °C 0 °C to 300 °C 300 °C to 400 °C 400 °C to 1000 °C 1000 to 1300 °C	0.60 °C 0.35 °C 0.36 °C 0.48 °C 0.58 °C		
Type R thermocouple	0 °C to 300 °C 300 °C to 600 °C 600 °C to 900 °C 900 °C to 1200 °C 1200 °C to 1600 °C 1600 °C to 1760 °C	0.95 °C 0.71 °C 0.71 °C 0.71 °C 0.82 °C 0.82 °C		
Type S thermocouple	0 °C to 400 °C 400 °C to 600 °C 600 °C to 800 °C 800 °C to 900 °C 900 °C to 1200 °C 1200 °C to 1600 °C 1600 °C to 1760 °C	0.95 °C 0.83 °C 0.83 °C 0.83 °C 0.83 °C 0.83 °C 0.94 °C		
Type T thermocouple	-200 °C to -150 °C -150 °C to 0 °C 0 °C to 200 °C 200 °C to 390 °C	1.0 °C 0.84 °C 0.41 °C 0.51 °C		
Resistance Thermometer (Pt 100)	-200 °C to 0 °C 0 °C to 100 °C 100 °C to 500 °C 500 °C to 850 °C	0.13 °C 0.16 °C 0.27 °C 0.37 °C	By injection of equivalent DC resistance	
END				



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## 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 measurement uncertainty 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 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 measurement uncertainty is calculated according to the procedures given in the GUM 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 measurement uncertainty in certificates issued under its accreditation.

### Expression of CMCs - symbols and units

It should be noted that the percentage symbol (%) represents the number 0.01. In cases where the measurement uncertainty is stated as a percentage, this is to be interpreted as meaning percentage of the measurand. Thus, for example, a measurement uncertainty of 1.5 % means  $1.5 \times 0.01 \times q$ , where  $q$  is the quantity value.

The notation  $Q[a, b]$  stands for the root-sum-square of the terms between brackets:  $Q[a, b] = [a^2 + b^2]^{1/2}$