

Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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



0654

Accredited to
ISO/IEC 17025:2005

Calibration, Maintenance and Repair Ltd

Issue No: 030

Issue date: 20 February 2018

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Calibration performed at the above address only

DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks
ELECTRICAL MEASUREMENTS			
DC VOLTAGE			
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 500 V 500 V to 1 kV	3.0 μ V 4.0 μ V 17 μ V 180 μ V 2.0 mV 9.0 mV 24 mV	
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 μ V 2.0 μ V 10 μ V 98 μ V 1.3 mV 14 mV	
DC RESISTANCE			
Generation	0 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 k Ω 1 k Ω to 10 k Ω 10 k Ω to 100 k Ω 100 k Ω to 1 M Ω 1 M Ω to 10 M Ω 10 M Ω to 33 M Ω 33 M Ω to 110 M Ω 110 M Ω to 330 M Ω 330 M Ω to 1.1 G Ω	2.0 m Ω 5.0 m Ω 31 m Ω 310 m Ω 3.0 Ω 37 Ω 2.0 k Ω 11 k Ω 60 k Ω 1 M Ω 17 M Ω	



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ELECTRICAL MEASUREMENTS (cont'd) DC RESISTANCE (cont'd) Resistance continued Measurement	0 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 k Ω 1 k Ω to 10 k Ω 10 k Ω to 100 k Ω 100 k Ω to 1 M Ω 1 M Ω to 10 G Ω 10 G Ω to 1 T Ω	250 $\mu\Omega$ 2.0 m Ω 14 m Ω 140 m Ω 1.0 Ω 22 Ω 0.71 % 1.0 %	
DC CURRENT Generation Measurement	0 μ A to 1 μ A 1 μ A to 10 μ A 10 μ A to 100 μ A 100 μ A 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 0 μ A to 10 μ A 10 μ A to 100 μ A 100 μ 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	31 nA 32 nA 46 nA 180 nA 1.0 μ A 15 μ A 280 μ A 1.0 mA 4.0 mA 6.0 mA 12 mA 25 mA 580 mA 2.0 nA 4.0 nA 34 nA 340 nA 5.0 μ A 150 μ A 2.4 mA 25 mA	Current clamp calibration using a multi turn coil
AC VOLTAGE Generation	10 μ V to 10 mV 1 Hz to 50 Hz 50 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 500 kHz	60 μ V 10 μ V 5.0 μ V 19 μ V 55 μ V 360 μ V	



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ELECTRICAL MEASUREMENTS (cont'd)			
AC VOLTAGE (cont'd)			
Generation (cont'd)	10 mV to 100 mV 1Hz to 50Hz 50 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 500 kHz	270 μ V 28 μ V 29 μ V 51 μ V 130 μ V 850 μ V	
	100 mV to 1 V 1 Hz to 50 Hz 50 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 500 kHz	1.9 mV 260 μ V 300 μ V 413 μ V 960 μ V 9.8 mV	
	1 V to 7 V 1Hz to 50Hz	9.2 mV	
	1 V to 10 V 50 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	4.0 mV 4.0 mV 5.0 mV 12 mV	
	10 V to 100 V 50 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	24 mV 37 mV 43 mV 290 mV	
	100 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 μ V to 10 mV 1 Hz to 40 Hz 40 Hz to 1kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 1 MHz	8.0 μ V 5.0 μ V 6.0 μ V 13 μ V 60 μ V 160 μ V	



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ELECTRICAL MEASUREMENTS (cont'd)			
AC VOLTAGE (cont'd)			
Measurement (cont'd)	10 mV to 100 mV	15 μ V	
	1 Hz to 40 Hz	13 μ V	
	40 Hz to 1kHz	20 μ V	
	1kHz to 20 kHz	38 μ V	
	20 kHz to 50 kHz	100 μ V	
	50 kHz to 100 kHz	360 μ V	
	100 kHz to 300 kHz	2.3 mV	
	300 kHz to 1 MHz		
	100mV to 1V	140 μ V	
	1 Hz to 40 Hz	120 μ V	
	40 Hz to 1kHz	200 μ V	
	1kHz to 20 kHz	390 μ V	
	20 kHz to 50 kHz	970 μ V	
	50 kHz to 100 kHz	3.6 mV	
	100 kHz to 300 kHz	24 mV	
	300 kHz to 1 MHz		
	1 V to 10 V	2.0 mV	
	1 Hz to 40 Hz	1.0 mV	
	40 Hz to 1 kHz	2.0 mV	
	1kHz to 20 kHz	4.0 mV	
	20 kHz to 50 kHz	10 mV	
	50 kHz to 100 kHz	36 mV	
	100 kHz to 300 kHz	240 mV	
	300 kHz to 1 MHz		
	10V to 100V	38 mV	
	1 Hz to 40 Hz	36 mV	
	40 Hz to 1kHz	37 mV	
	1kHz to 20 kHz	51 mV	
	20 kHz to 50 kHz	150 mV	
	50 kHz to 100 kHz	480 mV	
	100kHz to 300 kHz		
	100V to 1 kV	520 mV	
	1 Hz to 40 Hz	490 mV	
	40 Hz to 1 kHz	720 mV	
	1 kHz to 20 kHz	1.4 V	
	20 kHz to 50 kHz	3.5 V	
	50 kHz to 100 kHz		



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ELECTRICAL MEASUREMENTS (cont'd)			
AC CURRENT			
Generation	<i>45Hz to 1kHz</i> 100 nA to 30 μ A 30 μ A to 100 μ A 100 μ A to 1 mA 1 mA to 10 mA 10 mA to 100mA 100 mA to 1 A 1 A to 2 A 2 A to 3 A 3 A to 5 A 5 A to 10 A <i>10 Hz to 100 Hz</i> 10 A to 32 A 16 A to 160 A 160 A to 1000 A	170 nA 270 nA 1.7 μ A 7.0 μ A 70 μ A 710 μ A 1.5 mA 7.0 mA 9.0 mA 14 mA 9.0 mA 35 mA 580 mA	Calibration of current clamps using a multi turn coil
Measurement	20 nA to 10 μ A <i>20 Hz to 45 kHz</i> <i>45 Hz to 1 kHz</i> 10 μ A to 100 μ A <i>20 Hz to 45 kHz</i> <i>45 Hz to 1 kHz</i> 100 μ A to 1 mA <i>20 Hz to 45 kHz</i> <i>45 Hz to 20 kHz</i> <i>20 kHz to 50 kHz</i> 1 mA to 10 mA <i>20 Hz to 45 kHz</i> <i>45 Hz to 20 kHz</i> <i>20 kHz to 50 kHz</i> 10 mA to 100 mA <i>20Hz to 45Hz</i> <i>45Hz to 20kHz</i> <i>20kHz to 50kHz</i> 100 mA to 1 A <i>20Hz to 45Hz</i> <i>45Hz to 20kHz</i> <i>20kHz to 50kHz</i>	23 nA 14 nA 210 nA 110 nA 2.0 μ A 1.0 μ A 5.0 μ A 20 μ A 9.0 μ A 51 μ A 200 μ A 95 μ A 510 μ A 2.0 mA 1.0 mA 12 mA	



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ELECTRICAL MEASUREMENTS (cont'd)			
FREQUENCY			
Generation	0.5 Hz to 5.4 GHz	2.1 in 10^9	May be reported as events per unit time
Measurement	1 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 27 GHz	35 μ Hz 0.40 Hz 0.24 ppm	
Generation	0.5 Hz to 5.4 GHz 5.4 GHz to 20 GHz	2.1 in 10^9 4.0 MHz	May be reported as events per unit time
Measurement	1 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 27 GHz	35 μ Hz 0.40 Hz 0.24 ppm	
Elapsed time Single event	10 s to 12 hrs	0.23 s	Mechanical timers / stop watches
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			
Measurement	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	
	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 generation	10 Hz to 10 kHz 220 pF to 400 pF 400 pF to 1.1 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 μ F	5.0 nF	



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ELECTRICAL MEASUREMENTS (cont'd) CAPACITANCE (cont'd) Simulated generation (cont'd)	<i>10 Hz to 300 Hz</i> 1.1 μ F to 3.3 μ F <i>10 Hz to 150 Hz</i> 3.3 μ F to 11 μ F <i>10 Hz to 120 Hz</i> 11 μ F to 33 μ F <i>10 Hz to 80 Hz</i> 33 μ F to 110 μ F <i>0 Hz to 50 Hz</i> 110 μ F to 330 μ F <i>0 Hz to 20 Hz</i> 330 μ F to 1.1 mF <i>0 Hz to 6 Hz</i> 1.1 mF to 3.3 mF <i>0 Hz to 2 Hz</i> 3.3 mF to 11 mF <i>0 Hz to 0.6 Hz</i> 11 mF to 33 mF <i>0 Hz to 0.2 Hz</i> 33 mF to 110 mF	12 nF 39 nF 140 nF 610 nF 2.0 μ F 6.0 μ F 2.0 μ F 60 μ F 280 μ F 1.0 mF	
CALIBRATION OF INSULATION TESTERS Insulation Resistance Insulation test voltage Nominal Continuity Resistance	100 k Ω to 1 M Ω 1 M Ω to 10 M Ω 10 M Ω to 100 M Ω 100 M Ω to 1 G Ω 50 V 100 V 250 V 500 V 1 kV 0 Ω to 1 Ω 1 Ω to 50 Ω 50 Ω to 100 Ω 100 Ω to 200 Ω	2.0 k Ω 32 k Ω 510 k Ω 7.0 M Ω 1.0 V 2.0 V 3.0 V 4.0 V 7.0 V 58 m Ω 100 m Ω 120 m Ω 140 m Ω	Up to 1350 V The test voltage will normally be measured with a 1 mA load.



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ELECTRICAL MEASUREMENTS (cont'd)			
Temperature indicators, calibration by electrical simulation			
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			
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			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.
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 %	



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ACCELEROMETRY Accelerometer calibration			Uncertainties for accelerometry sensitivity calibrations at ambient temperature apply for masses up to 40 grams.
Charge	Sensitivity range: 0.3 pC/g to 1000 pC/g (0.03 pC/ms ² to 100 pC/m ²) 1 Hz to 2 Hz 2 Hz to 5 Hz 5 Hz to 5 kHz 5 kHz to 10 kHz	3.0 % 1.2 % 0.80 % 0.90 %	Nominal acceleration ms ⁻² : 2 Hz: 0.10 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 1 Hz to 2 Hz 2 Hz to 5 Hz 5 Hz to 5 kHz 5 kHz to 10 kHz	2.0 % 0.83 % 0.86 % 0.90 %	Nominal acceleration ms ⁻² : 1 Hz: 0.10 3 Hz: 0.20 4 Hz to 10 kHz: 0.31 to 1.0
	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 1 Hz to 2 Hz 2 Hz to 5 Hz 5 Hz to 5 kHz 5 kHz to 10 kHz	2.0 % 0.83 % 0.86 % 0.90 %	Nominal acceleration ms ⁻² : 1 Hz: 0.10 3 Hz: 0.20 4 Hz to 10 kHz: 0.31 to 1.0
Transducer at any temperature from - 60 °C to + 180 °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.



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ACCELERATION TRANSDUCERS - SHOCK CALIBRATION <u>Piezoelectric and Piezoresistive and voltage types</u> Transducer at nominal 23 °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. Calibration of charge sensitivity by comparison with a reference (precision grade) transducer
Vibration meters and analysers Shock and Impulse hammers 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	<i>Frequency 10 Hz to 1 kHz</i> Range 0.1 ms ² to 1 ms ² Half Sine Wave <i>Frequency 500 Hz to 20 kHz</i> Applied Force 0.2 N to 450 N 0.1 Joule to 1.0 Joule	5.0 % 4.0 % 0.015 Joule	Calibrations can be given in Joule or Newton Metre units.
END			