

Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

 <p>UKAS CALIBRATION 0286</p> <p>Accredited to ISO/IEC 17025:2005</p>	<h3>Optical Test & Calibration Limited</h3> <p>Issue No: 030 Issue date: 17 April 2012</p>	
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<p>Calibration performed at the above address only</p>		

DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks
FIBRE OPTIC CALIBRATION			
OPTICAL POWER METERS			
Absolute responsivity of fibre optic power meters with FC/PC connectors	Wavelength and Power levels: <i>850 nm</i> - 10 dBm and - 20 dBm - 23 dBm <i>1300 nm</i> - 10 dBm - 20 dBm and - 23 dBm <i>1550 nm</i> - 10 dBm - 20 dBm and - 23 dBm	 0.10 dB (2.3 %) 0.11 dB (2.5 %) 0.080 dB (1.7 %) 0.070 dB (1.6 %) 0.070 dB (1.5 %) 0.070 dB (1.6 %)	Wavelengths quoted are ± 1 nm 850 nm, multimode fibre 1300 nm, 1550 nm single mode fibre
Linearity of response of fibre optic power meters with FC/PC connectors	<i>850 nm</i> - 10 dBm to - 40 dBm - 40 dBm to - 70 dBm <i>1300 nm</i> - 5 dBm to - 50 dBm - 50 dBm to - 70 dBm <i>1550 nm</i> + 5 dBm to - 65 dBm - 65 dBm to - 70 dBm	 0.050 dB (1.0 %) 0.070 dB (1.9 %) 0.040 dB (1.0 %) 0.040 dB (1.1 %) 0.040 dB (1.0 %) 0.040 dB (1.2 %)	850 nm, multimode fibre 1300 nm 1550 nm single mode fibre
OPTICAL ATTENUATORS			
Insertion loss	<i>850 nm</i> <i>1300 nm</i> <i>1550 nm</i>	0.11 dB (2.0 %) 0.060 dB (1.4 %) 0.060 dB (1.4 %)	Fitted with FC/PC connectors
Attenuation setting	<i>850 nm:</i> 0 dB to - 35 dB - 35 dB to - 60 dB <i>1300 nm:</i> 0 dB to - 65 dB	0.070 dB (1.0 %) 0.10 dB (2.1 %) 0.050 dB (1.0 %)	Excluding insertion loss



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OPTICAL ATTENUATORS (cont'd)			
Attenuation setting (cont'd)	1550 nm: 0 dB to - 70 dB	0.050 dB (1.0 %)	
Repeatability of attenuation setting	850 nm, 1300 nm and 1550 nm 0 dB to - 65 dB	0.040 dB (1.0 %)	
OPTICAL TIME DOMAIN REFLECTOMETERS (OTDRs) (Single mode fibre)			
Loss scale deviation	1300 nm (nominal) 1550 nm (nominal) 1625 nm (nominal)	0.025 dB/dB 0.050 dB/dB 0.050 dB/dB	Results reported with standard adjacent to and remote from the UUT (typically at 7 km and 20 km respectively)
Length scale:			Measured by comparison to single mode fibre physical standards.
Zero location offset		0.30 m	Wavelengths: 1300 nm, 1550 nm and 1625 nm.
Distance scale factor	6.5 km	0.80 m	
Distance scale deviation	6.5 km	0.12 m/km	
Locational readout error		0.12 m	
			Pulse duration 3 ns to 20 μ s Maximum nominal power 25 mW, minimum nominal power 1 mW
Centre wavelength	1200 nm to 1700 nm	1.0 nm	Pulsed source with RMS spectral width of less than 25 nm
Spectral width	< 0.1 nm 0.1 nm to 6 nm 6 nm to 24.9 nm	0.20 nm 0.60 nm 1.0 nm	
CW FIBRE OPTIC LIGHT SOURCES			
Output power	600 nm to 1700 nm: - 5 dBm to - 55 dBm except where the following wavelength conditions are met: 850 nm \pm 1 nm: - 5 dBm to - 55 dBm 1300 nm \pm 1 nm - 5 dBm to - 55 dBm 1550 nm \pm 1 nm + 5 dBm to - 55 dBm	0.30 dB (7.0 %) 0.10 dB (2.0 %) 0.050 dB (1.3 %) 0.050 dB (1.3 %)	CW source with RMS spectral width of less than 25 nm



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CW FIBRE OPTIC LIGHT SOURCES (cont'd)			
Output power stability of fibre optic light sources	- 5 dBm to - 55 dBm	0.0040 dB (0.10 %)	Wavelength range 600 nm to 1700 nm
Wavelength	600 nm to 1700 nm	0.50 nm	CW source with RMS spectral width of less than 25 nm
Spectral width	< 0.1 nm 0.1 nm to 6 nm 6 nm to 24.9 nm	0.20 nm 0.60 nm 1.0 nm	Minimum optical output power level - 30 dBm
PULSED FIBRE OPTIC LIGHT SOURCES			Pulse duration 3 ns to 20 μ s Maximum nominal power 25 mW, minimum nominal power 1 mW
Centre wavelength	1200 nm to 1700 nm	1.0 nm	Pulsed source with RMS spectral width of less than 25 nm
Spectral width	< 0.1 nm 0.1 nm to 6 nm 6 nm to 24.9 nm	0.20 nm 0.60 nm 1.0 nm	
OPTICAL FIBRES			
Length (single mode fibre)	0.25 m to 1 m 1 m to 16 km	0.0020 m ($0.07 + (3 \times 10^{-5} \times L)$) m Where L is the length of the Fibre Under Test in metres.	Intercomparison with physical standard Time of flight technique Wavelengths: 1300 nm, 1550 nm and 1625 nm
ILLUMINANCE			
for a source colour temperature of 2856 K	1 lux to 10 lux 10 lux to 20 lux 20 lux to 200 lux 200 lux to 1000 lux 1000 lux to 2000 lux 2000 lux to 20 000 lux	2.6 % 4.3 % 3.0 % 2.5 % 3.0 % 8.4 %	Maximum active sensor diameter 60 mm Maximum active sensor diameter 50 mm
Colour temperature	2856 K	1.0 %	Maximum active sensor diameter 60 mm



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ELECTRICAL CALIBRATION			
DC VOLTAGE			
Generation	0 V to 330 mV 330 mV to 3.3 V 3.3 V to 33 V 33 V to 330 V 330 V to 1000 V	13 ppm + 2.1 μ V 7.0 ppm + 3.5 μ V 8.0 ppm + 26 μ V 10 ppm + 210 μ V 10 ppm + 2.1 mV	
Measurement	0 V to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1 kV	9.0 ppm + 1.4 μ V 6.0 ppm + 1.4 μ V 6.0 ppm + 2.0 μ V 7 ppm + 40 μ V 12 ppm + 200 μ V	
DC CURRENT			
Generation	0 μ A to 330 μ A 0.33 mA to 3.3 mA 3.3 mA to 33 mA 33 mA to 330 mA 330 mA to 3 A 3 A to 11 A 11 A to 20 A	80 ppm + 25 nA 44 ppm + 60 nA 43 ppm + 0.40 μ A 61 ppm + 4.0 μ A 190 ppm + 70 μ A 240 ppm + 0.70 mA 710 ppm + 3.0 mA	
Measurement	0 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	9 ppm + 1.1 nA 9 ppm + 7.0 nA 11 ppm + 70 nA 49 ppm + 700 nA 71 ppm + 13 μ A	
DC RESISTANCE			
Generation			
Specific Values	1 m Ω 10 m Ω 100 m Ω 1 Ω	53 ppm 28 ppm 86 ppm 18 ppm	
Other values	0 Ω to 11 Ω 11 Ω to 110 Ω 110 Ω to 1.1 k Ω 1.1 k Ω to 11 k Ω 11 k Ω to 110 k Ω 110 k Ω to 1.1 M Ω 1.1 M Ω to 11 M Ω 11 M Ω to 100 M Ω	72 ppm + 1.2 m Ω 24 ppm + 1.7 m Ω 12 ppm + 2.4 m Ω 11 ppm + 24 m Ω 13 ppm + 240 m Ω 20 ppm + 3.0 Ω 60 ppm + 60 Ω 300 ppm + 4.0 k Ω	



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DC RESISTANCE (cont'd)			
Measurement	0 mΩ to 1 mΩ 1 mΩ to 10 mΩ 10 mΩ to 100 mΩ 100 mΩ to 1 Ω 1 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ 1 kΩ to 10 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1 G Ω	1.4 μΩ 200 ppm + 1.7 μΩ 220 ppm + 9.0 μΩ 70 ppm + 50 μΩ 10 ppm + 120 μΩ 10 ppm + 900 μΩ 7.0 ppm + 1.8 mΩ 6.0 ppm + 13 mΩ 7 ppm + 120 mΩ 10 ppm + 3.5 Ω 28 ppm + 130 Ω 380 ppm + 1.3 kΩ 3000 ppm + 13 kΩ	
AC VOLTAGE			
Generation	45 Hz to 20 kHz 33 mV to 330 mV 330 mV to 3.3 V 3.3 V to 33 V 33 V to 330 V 20 kHz to 100 kHz 33 mV to 330 mV 330 mV to 3.3 V 3.3 V to 33 V 45 Hz to 10 kHz 330 V to 1000 V 500 kHz 300 mV 3 V	0.0070 % + 10 μV 0.0070 % + 70 μV 0.010 % + 0.70 mV 0.021 % + 7.0 mV 0.030 % + 40 μV 0.041 % + 150 μV 0.043 % + 2.0 mV 0.018 % + 12 mV 0.14 % 0.18 %	
Measurement	40 Hz to 20 kHz 10 mV to 100 mV 100 mV to 1 V 20 kHz to 100 kHz 10 mV to 100 mV 100 mV to 1 V 20 Hz to 100 kHz 1 V to 10 V 10 V to 100 V 50 Hz to 20 kHz 100 V to 700 V	0.013 % + 3.0 μV 0.011 % + 50 μV 0.016 % + 3.0 μV 0.014 % + 60 μV 0.058 % + 600 μV 0.061 % + 6.0 mV 0.055 % + 40 mV	



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AC CURRENT			
Generation	<p><i>33 μA to 330 μA</i> 20 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz</p> <p><i>330 μA to 3.3 mA</i> 20 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz</p> <p><i>3.3 mA to 33 mA</i> 20 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz</p> <p><i>33 mA to 330 mA</i> 20 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz</p> <p><i>330 mA to 3 A</i> 20 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz</p> <p><i>3 A to 11 A</i> 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz</p> <p><i>11 A to 20 A</i> 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz</p>	<p>0.11 % + 0.12 μA 0.070 % + 0.12 μA 0.12 % + 0.18 μA</p> <p>0.090 % + 0.18 μA 0.033 % + 0.22 μA 0.053 % + 0.24 μA</p> <p>0.070 % + 2.4 μA 0.024 % + 2.4 μA 0.030 % + 2.4 μA</p> <p>0.070 % + 24 μA 0.018 % + 24 μA 0.033 % + 60 μA</p> <p>0.090 % + 0.10 mA 0.049 % + 0.10 mA 0.18 % + 1.2 mA</p> <p>0.080 % + 2.4 mA 0.090 % + 2.4 mA 0.71 % + 2.4 mA</p> <p>0.11 % + 6.0 mA 0.14 % + 6.0 mA 0.78 % + 6.0 mA</p>	
Measurement	<p><i>20Hz to 1 kHz</i> 10 μA to 100 μA</p> <p><i>20 Hz to 5 kHz</i> 100 μA to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A</p>	<p>0.035 % + 35 nA</p> <p>0.044 % + 0.24 μA 0.044 % + 2.4 μA 0.045 % + 24 μA 0.18 % + 240 μA</p>	
CAPACITANCE			
Generation	<p>0.2 nF to 0.4 nF 0.4 nF to 1 nF 1 nF to 10 nF 10 nF to 100 nF 100 nF to 1 μF 1 μF to 10 μF 10 to 100 μF 100 μF to 1 mF</p>	<p>1.2 % + 12 pF 0.40 % + 12 pF 0.20 % + 12 pF 0.10 % + 120 pF 0.10 % + 1.2 nF 0.13 % + 12 nF 0.20 % + 120 nF 0.60 % + 1.2 μF</p>	



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FREQUENCY Generation and Measurement	0.5 Hz to 10 Hz 10 Hz to 1 MHz 1 MHz to 1 GHz	16 ppm 2.0 ppm 1.0 ppm	May also be expressed as $1/f$ for periodic time of repetitive events
END			