


Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

| | | |
|--|--|--|
|  0316 Accredited to ISO/IEC 17025:2017 | Cuthbertson & Laird Instruments Ltd, Trading as Cuthbertson Laird Group Issue No: 043 Issue date: 26 August 2021 | |
| | Parkburn Court Burnbank Hamilton Scotland ML3 0QQ | Contact: Mr P Greenshields Tel: +44 (0)1698-829711 Fax: +44 (0)1698-828363 E-Mail: hamilton@cuthbertsonlaird.co.uk Website: www.cuthbertsonlaird.co.uk |

Calibration performed by the Organisations at the locations specified below

Locations covered by the organisation and their relevant activities

Laboratory locations:

| Location details | Activity | Location code |
|--|----------------------------|---------------|
| Address Parkburn Court Burnbank Hamilton Scotland ML3 0QQ Local contact Mr P Greenshields | Dimensional and Electrical | A |

Site activities performed away from the locations listed above:

| Location details | Activity | Location code |
|--|-------------|---------------|
| At customer's premises The customer's 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. | Dimensional | B |



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Calibration and Measurement Capability (CMC)

| Measured Quantity Instrument or Gauge | Range | Expanded Measurement Uncertainty ($k = 2$) | Remarks | Location Code |
|---|--|--|---|------------------|
| DIMENSIONAL CALIBRATIONS | RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED | | | |
| LENGTH | | | NOTES 1 All linear calibrations may be given in inch units. | |
| Plain Plug Gauges (Parallel) | 1 to 50 diameter 50 to 100 100 to 200 200 to 300 | 0.80 1.5 2.0 3.0 | on diameter. | A |
| Length Gauges, Flat and Spherical Ended (excluding Length Bars) | 25 to 1000 | 1.0 + (8.0 x length in m) | Comparison to gauge blocks using a length measuring machine. | A |
| ANGLE | | | 2 The uncertainty quoted is for the departure from flatness, straightness, parallelism or squareness, i.e., the distance separating the two parallel planes which just enclose the surface under consideration. | |
| Squares Blade Type | 50 to 300 300 to 450 | 3.0 on squareness 5.0 See Note 2 | BS 939:2007 Comparison to master square. | A |
| MEASURING INSTRUMENTS AND MACHINES | | | | |
| Micrometers | | | Comparison to length standards | |
| External | 0 to 1000 | Heads 2.0 between any two points | BS 870:2008 | A |
| Internal Micrometers | 0 to 900 | Setting and extension rods | BS 959:2008 | A |
| Depth Micrometers | 0 to 300 | 1.0 + (8.0 x length in m) | BS 6468:2008 | A |
| Vernier, dial and digital type gauges | | | Comparison to length standards. | A |
| Calliper | 0 to 1000 | Overall performance 10 + (30 x length in m) | As BS 887:2008 | |
| Height | 0 to 1000 | Overall performance 10 + (10 x length in m) | ISO13225:2012 and BS 1643:2008 | |
| Depth | 0 to 600 | Overall performance 10 + (30 x length in m) | As BS 6365:2008 | |



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| MEASURING INSTRUMENTS AND MACHINES (continued) | | | | |
| Dial Gauges and Dial Test Indicators | 0 to 50 | 1.0 | BS 907:2008 and BS 2795:1981 using a length measuring machine. | A |
| Surface Plates Granite Cast Iron | 160 x 100 to 4000 x 4000 Flatness of working surface: Local variation of working surface: | 1.5 + (0.80 x diagonal in m) See Note 2 2.7 | BS 817:2008 and above using an electronic level and variation gauge. | A and B |
| Feeler Gauges | 0.025 to 1.0 | 2.0 | BS 957:2008 using a length measuring machine. | A |
| ELECTRICAL CALIBRATIONS | | | | |
| DC RESISTANCE Specific values | | | | A |
| Measurement | 10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω 100 M Ω 1 G Ω 10 G Ω 100 G Ω 1 T Ω | 14 $\mu\Omega/\Omega$ 9.6 $\mu\Omega/\Omega$ 8.0 $\mu\Omega/\Omega$ 8.8 $\mu\Omega/\Omega$ 9.6 $\mu\Omega/\Omega$ 24 $\mu\Omega/\Omega$ 110 $\mu\Omega/\Omega$ 440 $\mu\Omega/\Omega$ 0.40 % 0.59 % 2.0 % 1.4 % | Using digital multimeter. | |
| Other values Measurement | 0 Ω to 1 Ω 1 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 100 M Ω 100 M Ω to 1 G Ω | 41 $\mu\Omega/\Omega$ 41 $\mu\Omega/\Omega$ 40 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 29 $\mu\Omega/\Omega$ 130 $\mu\Omega/\Omega$ 450 $\mu\Omega/\Omega$ 0.40 % | Using digital multimeter. | A |



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| DC RESISTANCE (continued) | | | | A |
| Generation | | | | |
| Specific values | 10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω 100 M Ω | 420 $\mu\Omega$ 7.2 m Ω 20 m Ω 190 m Ω 2.3 Ω 39 Ω 1.4 k Ω 47 k Ω | Using multifunction calibrator or decade resistance box. | |
| DC VOLTAGE | | | | A |
| Measurement | | | | |
| Specific values | 100 mV 1 V 10 V 100 V 1000 V | 11 $\mu\text{V/V}$ 9.4 $\mu\text{V/V}$ 9.4 $\mu\text{V/V}$ 12 $\mu\text{V/V}$ 12 $\mu\text{V/V}$ | Using digital multimeter. | |
| Other values | 0 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1000 V | 2.5 μV 10 $\mu\text{V/V}$ 9.5 $\mu\text{V/V}$ 12 $\mu\text{V/V}$ 12 $\mu\text{V/V}$ | Using digital multimeter. | |
| | 1 kV to 20 kV 20 kV to 38 kV | 1.3 % 1.2 % | Using high voltage divider. | |
| Generation | 0 mV to 220 mV 220 mV to 2.2 V 2.2 V to 11 V 11 V to 22 V 22 V to 220 V 220 V to 1000 V | 10 $\mu\text{V/V} + 9.0 \mu\text{V}$ 13 $\mu\text{V/V} + 1.4 \mu\text{V}$ 15 $\mu\text{V/V} + 4.6 \mu\text{V}$ 15 $\mu\text{V/V} + 9.2 \mu\text{V}$ 18 $\mu\text{V/V} + 0.12 \text{ mV}$ 18 $\mu\text{V/V} + 0.69 \text{ mV}$ | Using multifunction calibrator. | |
| DC CURRENT | | | | A |
| Measurement | | | | |
| Specific values | 1 μA 10 μA 100 μA 1 mA 10 mA 100 mA 1 A | 45 $\mu\text{A/A}$ 25 $\mu\text{A/A}$ 24 $\mu\text{A/A}$ 24 $\mu\text{A/A}$ 24 $\mu\text{A/A}$ 41 $\mu\text{A/A}$ 87 $\mu\text{A/A}$ | Using digital multimeter. | |



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|---|--|--|---|------------------|
| DC CURRENT (continued) Measurement (continued) Other values | 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 | 320 pA 82 μ A/A 67 μ A/A 46 μ A/A 46 μ A/A 57 μ A/A 120 μ A/A | Using digital multimeter. | A |
| Generation | 0 μ A to 220 μ A 220 μ A to 2.2 mA 2.2 mA to 22 mA 22 mA to 220 mA 220 mA to 2.2 A 2.2 A to 11 A 11 A to 200 A 200 to 550 A 550 to 1000 A | 110 μ A/A + 12 nA 83 μ A/A + 12 nA 19 μ A/A + 12 nA 140 μ A/A + 12 nA 180 μ A/A + 120 nA 0.10 % 200 μ A/A + 0.16 A 0.10 % + 0.50 A 0.10 % + 0.85 A | Using multifunction calibrator. For the calibration of clamp on ammeters and similar devices, using multi-turn method. | A |
| AC VOLTAGE Measurement Specific values | <i>At 1 kHz</i> 10 mV 100 mV <i>40 Hz to 1 kHz</i> 1 V 10 V 100 V 700 V <i>1 kHz to 100 kHz</i> 1 V 10 V 100 V | 190 μ V/V 73 μ V/V 64 μ V/V 65 μ V/V 160 μ V/V 310 μ V/V 620 μ V/V 620 μ V/V 930 μ V/V | Using digital multimeter. | A |
| Other values | <i>At 1 kHz</i> 1 mV to 10 mV 10 mV to 100 mV 100 mV to 1 V <i>40 Hz to 1 kHz</i> 1 V to 10 V 10 V to 100 V 100 V to 700 V 700 V to 1 kV <i>1 kHz to 100 kHz</i> 100 mV to 1 V 1 V to 10 V 10 V to 100 V | 0.090 % 0.020 % 0.020 % 0.020 % 0.022 % 0.035 % 0.23 % 0.064 % 0.064 % 0.10 % | Using digital multimeter. | A |



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| AC VOLTAGE (continued) Measurement (continued) | <i>At 50 Hz</i> 1 kV to 20 kV 20 kV to 28 kV | 2.1 % 3.0 % | Using high voltage divider. | A |
| Generation | <i>At 1 kHz</i> 22 μ V to 2.2 mV 2.2 mV to 22 mV 22 mV to 220 mV | 0.090 % + 5.8 μ V 0.024 % + 7.0 μ V 0.027 % + 12 μ V | Using multifunction calibrator. | |
| | <i>40 Hz to 20 kHz</i> 220 mV to 2.2 V 2.2 V to 22 V 22 V to 220 V 220 V to 700 V | 0.022 % + 8.0 μ V 0.024 % + 81 μ V 0.036 % + 1.2 mV 0.23 % + 11 mV | | |
| AC CURRENT Measurement Specific Values | <i>At 1 kHz</i> 100 μ A 1 mA | 0.056 % 0.051 % | Using digital multimeter. | A |
| | <i>45 Hz to 1 kHz</i> 10 mA 100 mA 1 A | 0.050 % 0.050 % 0.080 % | | |
| Other values | <i>At 1 kHz</i> 5 μ A to 100 μ A 100 μ A to 1 mA | 0.24 % 0.16 % | Using digital multimeter. | |
| | <i>45 Hz to 1 kHz</i> 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A | 0.16 % 0.16 % 0.18 % | | |
| Generation | <i>At 1 kHz</i> 9 μ A to 220 μ A 220 μ A to 2.2 mA | 0.18 % + 23 nA 0.16 % + 47 nA | Using multifunction calibrator. | |
| | <i>45 Hz to 1 kHz</i> 2.2 mA to 22 mA 22 mA to 220 mA 220 mA to 2.2 A 1 A to 2.2 A 2.2 A to 11 A | 0.16 % + 1.0 μ A 0.18 % + 4.6 μ A 0.16 % + 46 μ A 0.13 % 0.90 % | | |
| | 11 A to 200 A 200 A to 550 A | 0.60 A 1.7 A | For the calibration of clamp on ammeters and similar devices, using multi-turn method. | |



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| FREQUENCY | 1 Hz to 1 MHz 1 MHz to 2.1 GHz | 21 in $10^8 + 2.0$ mHz 21 in 10^8 | Using frequency counter. | A A |
| Tachometer calibration | 10 rpm to 50000 rpm | 1.2 rpm | Using optical technique. | |
| Elapsed time | 0 ms to 390 ms 391 ms to 100 s | 1.0 ms 8.0 ms | Using counter timer. | A |
| 17TH EDITION TYPE EQUIPMENT | | | | A |
| Earth Loop | 0.05 Ω 0.1 Ω 0.22 Ω 0.33 Ω 0.5 Ω 1 Ω 5 Ω 10 Ω 100 Ω 1 k Ω | 10 m Ω 11 m Ω 8.0 m Ω 8.0 m Ω 8.0 m Ω 10 m Ω 30 m Ω 59 m Ω 580 m Ω 5.8 m Ω | Using dedicated calibrator. | |
| RCD testers | | | | A |
| Trip current | <i>At 50 Hz</i> 3 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A 1 A to 3 A | 620 μ A 5.8 mA 59 mA 120 mA | Up to 5 seconds. | |
| Trip Time | <i>At 30 mA, 50 Hz</i> 10 ms to 390 ms 390 ms to 1 s | 1.0 ms 8.1 ms | | |
| Earth leakage current | 0.2 mA to 7.7 mA | 15 μ A | | A |
| PAT Testers Earth bond current | <i>At 50 Hz</i> 100 mA 100 mA to 10 A 10 A to 30 A | 8.0 mA 190 mA 520 mA | | A |
| Earth Bond resistance Nominal values | 0.05 Ω 0.1 Ω 0.22 Ω 0.33 Ω 0.5 Ω 1 Ω 5 Ω 10 Ω 100 Ω 1 k Ω | 7.5 m Ω 7.5 m Ω 7.6 m Ω 7.7 m Ω 8.0 m Ω 9.5 m Ω 30 m Ω 58 m Ω 580 m Ω 5.8 Ω | | A |



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| 17 TH EDITION TYPE EQUIPMENT (continued) | | | | |
| Insulation resistance Nominal source values | 100 kΩ 500 kΩ 1 MΩ 5 MΩ 10 MΩ 20 MΩ 50 MΩ 100 MΩ | 12 kΩ 12 kΩ 12 kΩ 21 kΩ 37 kΩ 72 kΩ 180 kΩ 350 kΩ | | A |
| Load Tests | 3 kVA | 2.5 % | | A |
| Flash tests | At 50 Hz 700 V to 1.9 kV | 1.5 % + 5.0 V | | |
| ELECTRICAL SIMULATION OF TEMPERATURE | | | | |
| Ambient temperature | 17 °C to 23 °C | 0.11 °C | In support of cold junction measurements. | A |
| Temperature simulators and indicators, calibration by electrical simulation | | | | |
| Base metal thermocouples | -200 °C to -100 °C | 0.47 °C | Excluding cold junction compensation. | |
| | 0 °C to +1370 °C | 0.36 °C | Excluding cold junction compensation. | |
| | -200 °C to -100 °C | 0.47 °C | Including cold junction compensation. | |
| Noble metal thermocouples | -100 °C to +1300 °C | 0.38 °C | Including cold junction compensation. | |
| | 0 °C to 1700 °C | 1.8 °C | Excluding cold junction compensation. | |
| | 0 °C to 1700 °C | 1.8 °C | Including cold junction compensation. | |
| 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: $Q[a, b] = [a^2 + b^2]^{1/2}$