



PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:

Aerospace Metrology & Electromechanical Calibration Ltd.

Met Cal House, Fisher Street, Newcastle-Upon-Tyne NE6 4LT, UK

(Hereinafter called the Organization) and hereby declares that Organization is accredited in accordance with the recognized International Standard:

ISO/IEC 17025:2017

This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (as outlined by the joint ISO-ILAC-IAF Communiqué dated April 2017):

Acoustic, Chemical, Dimensional, Electrical, Mass, Force and Weighing Device, Mechanical, Optical Measurements, Thermodynamic, and Time and Frequency
(As detailed in the supplement)

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Tracy Szerszen
President

Initial Accreditation Date:

June 19, 2019

Issue Date:

May 10, 2022

Expiration Date:

May 10, 2024

Accreditation No.:

106685

Certificate No.:

L22-337

Perry Johnson Laboratory
Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: www.pjlabs.com



Certificate of Accreditation: Supplement

Aerospace Metrology & Electromechanical Calibration Ltd.

Met-Cal House, Fisher Street, Newcastle-upon-Tyne, NE6 4LT, UK
 Contact Name: Stephan Oxborough Phone: 191-262-2266

Accreditation is granted to the facility to perform the following calibrations:

Acoustic

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Acoustical Calibrators Fixed Points ^{FO}	94 dB at 1 kHz	0.16 dB	Class 1 SLM by comparison BS EN IEC 60942:2018
	104 dB at 1 kHz		
	114 dB at 1 kHz		
Sound level meters 74dB Nominal ^{FO}	125 Hz	0.3 dB	Sound Calibrator GenRad Type Omnicall ASP 152
	250 Hz		
	500 Hz		
	1 kHz		
	2 kHz		
	4 kHz		
Sound level meters 84dB Nominal ^{FO}	125 Hz	0.3 dB	Sound Calibrator GenRad Type Omnicall ASP 152
	250 Hz		
	500 Hz		
	1 kHz		
	2 kHz		
	4 kHz		
Sound level meters 94dB Nominal ^{FO}	125 Hz	0.3 dB	Sound Calibrator GenRad Type Omnicall ASP 152
	250 Hz		
	500 Hz		
	1 kHz		
	2 kHz		
	4 kHz		
Sound level meters 104dB Nominal ^{FO}	125 Hz	0.3 dB	Sound Calibrator GenRad Type Omnicall ASP 152
	250 Hz		
	500 Hz		
	1 kHz		
	2 kHz		
	4 kHz		
Sound level meters 114dB Nominal ^{FO}	125 Hz	0.3 dB	Sound Calibrator GenRad Type Omnicall ASP 152
	250 Hz		
	500 Hz		
	1 kHz		
	2 kHz		
	4 kHz		



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Chemical

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pH Meters, Fixed points ^{FO}	4 pH	0.002 pH	NIST pH Buffers, Fluke 5500A, Omega HH376 thermometer BS 1647-2:1984
	7 pH	0.002 pH	
	10 pH	0.002 pH	
Conductivity Meters ^{FO}	84 μ S/cm	0.35 % of Reading + 1 μ S	NIST Conductivity solutions ASP 193
	1 413 μ S/cm	0.35 % of Reading + 1 μ S	
	5 000 μ S/cm	0.35 % of Reading + 1 μ S	
	12 880 μ S/cm	0.35 % of Reading + 1 μ S	
	80 000 μ S/cm	0.35 % of Reading + 1 μ S	
TDS Meters ^{FO}	1 382 mg/L (ppm)	0.35 % of Reading + 1 mg/L	NIST TDS Solution ASP 203
	Gas Detector ^{FO}	Carbon Monoxide 308 ppm	5 % of Reading
Hydrogen sulphide 52.66 ppm	5 % of Reading		
Methane 2.6 %	5 % of Reading		
Oxygen 15.3 %	5 % of Reading		
Nitrogen Balanced	5 % of Reading		
Carbon monoxide 100 ppm	5 % of Reading		
Hydrogen sulphide 25 ppm	5 % of Reading		
Methane 2.2 %	5 % of Reading		
Oxygen 18 %	5 % of Reading		
Nitrogen > 79.78 %	5 % of Reading		
Alcolmeters ^{FO}	Ethanol 0.35 mg/L BrAC	0.01 mg/L	Lion AlcoCal 2AL gas ASP 164
	Nitrogen Balance		
Kinematic Viscosity ^{FO} Ford No.5 Shell 6 Zahn No.4 Zahn No.5	1 169 mm ² /s at 20 °C	0.2 % mm ² /s (cSt)	Paragon Scientific Reference viscosity Standard ASTM D1200 - 10(2018) ASTM D4212 - 16 BS EN ISO 2431:2019 ASTM D 5125 BS 3900-F15:1995, ISO 11503:1995 AFNOR NF-T-30014 BS 3900-F15:1995, ISO 11503:1995 DIN 53 211
	809.4 mm ² /s at 25 °C	\pm 0.19 % mm ² /s (cSt)	



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Kinematic Viscosity ^{FO} DIN 4 mm ISO 6 mm Ford No.5 Shell 5 Shell 6 Zahn No.3 Zahn No.4 Zahn No.5	649.1 mm ² /s at 20 °C	0.17 % mm ² /s (cSt)	Paragon Scientific Reference viscosity Standard ASTM D1200 - 10(2018) ASTM D4212 - 16 BS EN ISO 2431:2019 ASTM D 5125 BS 3900-F15:1995, ISO 11503:1995 AFNOR NF-T-30014 BS 3900-F15:1995, ISO 11503:1995 DIN 53 211
	457.5 mm ² /s at 25 °C	0.17 % mm ² /s (cSt)	
Kinematic Viscosity ^{FO} DIN 4 mm ISO 5 mm ISO 6 mm Ford No.4 Ford No.5 Shell 4 Shell 5 Shell 6 Zahn No.2 Zahn No.3 Zahn No.4	326.1 mm ² /s at 20 °C	0.17% mm ² /s (cSt)	
	235 mm ² /s at 25 °C	0.17% mm ² /s (cSt)	
Kinematic Viscosity ^{FO} DIN 4 mm ISO 4 mm ISO 5 mm Ford No.2 Ford No.3 Ford No.4 Shell 3.5 Shell 4 Shell 5 Zahn No.2 Zahn No.3	161.1 mm ² /s at 20 °C	0.15 % mm ² /s (cSt)	
	119.4 mm ² /s at 25 °C	0.15 % mm ² /s (cSt)	
Kinematic Viscosity ^{FO} ISO 4 mm Ford No.2 Ford No.3 Shell 2.5 Shell 3 Shell 3.5 Shell 4 Zahn No.2	84.75 mm ² /s at 20 °C	0.15 % mm ² /s (cSt)	
	64.70 mm ² /s at 25 °C	0.14 % mm ² /s (cSt)	



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Kinematic Viscosity ^{FO} ISO 3 mm ISO 4 mm Ford No.2 Shell 2.5 Shell 3 Shell 3.5 Zahn No.1 Zahn No.2	43.25 mm ² /s at 20 °C	0.14 % mm ² /s (cSt)	Paragon Scientific Reference viscosity Standard ASTM D1200 - 10(2018) ASTM D4212 - 16 BS EN ISO 2431:2019 ASTM D 5125 BS 3900-F15:1995, ISO 11503:1995 AFNOR NF-T-30014 BS 3900-F15:1995, ISO 11503:1995 DIN 53 211
	34.03 mm ² /s at 25 °C	0.14 % mm ² /s (cSt)	

Dimensional

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Outside Micrometer ^{FO}	Up to 304.8 mm	1.0 μ m + (5 x length in μ m)	Gauge Blocks Grade 1 Length Bars BS 870:2008 ASP 074
Vernier Caliper ^{FO}	Up to 609.6 mm	(0.007 mm + 6L) μ m	Gauge Blocks Grade 1 Length Bars BS 887:2008 ASP 078
Vernier Depth Gauge ^{FO}	Up to 609.6 mm	(0.007 mm + 6L) μ m	Gauge Blocks Grade 1 Length Bars BS 6365:2008 ASP 085
Depth Micrometers ^{FO}	Up to 300 mm	1 μ m + (5 x length in μ m)	Gauge Blocks Grade 1 BS 6468:2008 ASP 076
Dial Gauge ^{FO}	Up to 10 mm	(0.005 mm + 6L) μ m	Universal Measuring Machine BS 907:2008 ASP 075
Ring Gauge ^F	Up to 50 mm	1.5 μ m	Universal Measuring Machine BS 4064:1966 BS 4065:1966 ASP 214



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Thread Plug Gauge ^F	Up to 30 mm	2.5 μ m	Universal Measuring Machine, Thread Measuring Cylinders BS 919-1:2007 BS 919-2:2007 BS 919-3:2007 BS 919-4:2007 ASP 215
Paint Thickness Gauge ^{FO}	Up to 2 500 μ m	2 μ m	Thickness Shims BS EN ISO 2808:2019 ASP 145
Height Gauge ^F	Up to 1 000 mm	Length measurement error: 10 + (30 x length in μ m)	Gauge Blocks Grade 1 BS EN ISO 13225:2012 BS 1643:2008 ASP 198
Setting Rod ^F	1 mm to 1 200 mm	1 μ m + (8 x length in μ m)	Reference Setting Rod(s), ASP 088
Track Gauge ^F	Up to 1.7 m	3 mm	Gauge Blocks Grade 1 Laser Distance Meter ASP 186
Digital Protractors' ^F	Up to 200 mm	0.014 °	Precision Angle Gauge Set ASP 195
Gauge Blocks ^F	0.1 mm to 10 mm	0.1 mm	Master Gauge Block Set BS EN ISO 3650:1999 ASP 218
	10 mm to 25 mm	0.13 mm	
	30, 40, 50 mm	0.17 mm	
	60, 70, 75 mm	0.21 mm	
	80, 90, 100 mm	0.25 mm	
Steel Rule ^F	Up to 2 000 mm	15 + (20 x length in μ m)	Horizontal Benchtop Optical Comparator BS 4372:1968 ASP 110
Durometer Scale A,C & D ^{FO}	Up to 100 Duro	0.1 Duro	Gauge Blocks Grade 1 ASP 187 BS ISO 48-4:2018
Thickness Gauge ^{FO}	Up to 50 mm	(2.37 + 0.8L) μ m	Gauge Blocks Grade 1 ASP 219
Bore Micrometer ^{FO}	2 mm to 50 mm	3.0 μ m	Ring Master ASP 092
	Above 50 mm to 100 mm	4.0 μ m	



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Measuring Tape ^F	Up to 50 m	(10 mm + 6L) μ m	Laser Distance Meter SOP12_20141022[1] tape measures
Pi Tape ^F	Up to 2 m	(10 mm + 6L) μ m	Surface Table SOP23_20141022[1] pi tape
Depth Micrometer ^{FO}	Up to 1 000 mm	(0.000 7 mm + 6L) μ m	Gauge Blocks Grade 1 BS 6468:2008 ASP 076
Inside Micrometer ^{FO}	Up to 1 000 mm	(0.000 7 mm + 6L) μ m	Ring Master BS 959:2008 ASP 079
Thread Measuring Cylinders ^F	Up to 5 mm	0.002 mm	Universal Measuring Machine BS 5590:1978
Height Master ^F	Up to 1 000 mm	1.2 μ m	Gauge Blocks Grade 1, Length Bars BS EN ISO 13225:2012 ASP 198
Test Indicator ^{FO}	0.001 mm to 5 mm	1 μ m	Gauge Blocks Grade 1, Height Master BS 2795:1981 ASP 077
Cylindrical Plug Gauge ^F	1 mm to 50 mm diameter	0.5 μ m	Universal Measuring Machine BS 1044-1:2008 ASP 082
Optical Comparator X Axis Linearity Y axis Linearity W ^{FO}	Up to 300 mm	1 μ m	Glass Scales ASP 211
Feeler Gauge ^{FO}	0.03 mm to 0.9 mm	3 μ m	Universal Measuring Machine BS 957:2008 ASP 132
Extensometer ^{FO}	4 mm to 16.7 mm	0.02 mm	Micrometer/ Comparator BS ISO 5893:2019
	16.7 mm to 800 mm	0.24 %	
Optical Comparator Angularity ^{FO}	0 ° to 180 °	0.1 °	Angle Blocks ASP 211
Optical Comparator Magnification ^{FO}	10X	0.03 %	Glass Standard ASP 211
	20X	0.03 %	
	50X	0.04 %	



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Ultrasonic Thickness Gauge ^{FO}	0 mm to 200 mm	25 μ m	Gauge Blocks Grade 1 ASP 181
Laser Distance Meter ^F	0 m to 10 m	3 mm	Reference Laser distance meter ASP 180
Microscopes ^{FO}	200 mm to 100 mm	4.5 μ m	Glass Scale ASP 225
Micrometer Master ^F	0.5 in to 10 in	(28 + 5L) μ in	Universal Measuring Machine ASP 080
Bevel Protractors ^F	BS 1685:2008 0 ° to 360 °	6 min of arc	Precision Angle Gauge Set BS 1685:2008 ASP 093
Length Bars ^F	Up to 900 mm	1.0 μ m + (8 x length in m)	Universal Measuring Machine BS 1790:1961 BS 5317:1976

Electrical

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Equipment to Measure DC Voltage ^F	Up to 220 mV	8 μ V/V + 0.6 μ V	Fluke 5700A EURAMET_cg-15_v_2.0 ASP 001
	220 mV to 2.2 V	7 μ V/V + 1 μ V	
	2.2 V to 22 V	7 μ V/V + 6.5 μ V	
	22 V to 220 V	8 μ V/V + 80 μ V	
	220 V to 1 100 V	9 μ V/V + 0.5 mV	
Equipment to Measure DC Voltage ^F	1 mV to 330 mV	0.006 % of reading + 3 μ V	Fluke 5500A. ASP 001
	330 mV to 3.3 V	0.005 % of reading + 5 μ V	
	3.3 V to 33 V	0.005 % of reading + 50 μ V	
	33 V to 330 V	0.005 5 % of reading + 500 μ V	
	330V to 1 020 V	0.005 5 % of reading + 1 500 μ V	
Equipment to Output DC Voltage ^F	Up to 120 mV	5 μ V/V + 0.36 μ V	Agilent 3458A Opt 002 ASP 002
	120 mV to 1.2 V	4 μ V/V + 0.3 μ V	
	1.2 V to 12 V	4 μ V/V + 0.5 μ V	
	12 V to 120 V	6 μ V/V + 36 μ V	
	120 V to 1 kV	6 μ V/V + 0.1 mV	



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Equipment to Measure AC Voltage (At the listed frequencies)			
10 Hz to 20 Hz	0.22 mV to 2.2 mV	550 μ V/V + 4.5 μ V	Fluke 5700A EURAMET_cg-15_v_2.0 ASP 005
20 Hz to 40 Hz	0.22 mV to 2.2 mV	210 μ V/V + 4.5 μ V	
40 Hz to 20 kHz	0.22 mV to 2.2 mV	105 μ V/V + 4.5 μ V	
20 kHz to 50 kHz	0.22 mV to 2.2 mV	370 μ V/V + 4.5 μ V	
50 kHz to 100 kHz	0.22 mV to 2.2 mV	850 μ V/V + 7 μ V	
100 kHz to 300 kHz	0.22 mV to 2.2 mV	1 100 μ V/V + 13 μ V	
300 kHz to 500 kHz	0.22 mV to 2.2 mV	1 700 μ V/V + 25 μ V	
500 kHz to 1 MHz	0.22 mV to 2.2 mV	3 400 μ V/V + 25 μ V	
Equipment to Measure AC Voltage (At the listed frequencies) ^F			
10 Hz to 20 Hz	2.2 mV to 22 mV	550 μ V/V + 5 μ V	Fluke 5700A ASP 005
20 Hz to 40 Hz	2.2 mV to 22 mV	210 μ V/V + 5 μ V	
40 kHz to 20 kHz	2.2 mV to 22 mV	105 μ V/V + 5 μ V	
20 kHz to 50 kHz	2.2 mV to 22 mV	370 μ V/V + 5 μ V	
50 kHz to 100 kHz	2.2 mV to 22 mV	850 μ V/V + 7 μ V	
100 kHz to 300 kHz	2.2 mV to 22 mV	1 100 μ V/V + 12 μ V	
300 kHz to 500 kHz	2.2 mV to 22 mV	1 700 μ V/V + 25 μ V	
500 kHz to 1 MHz	2.2 mV to 22 mV	3 400 μ V/V + 25 μ V	
Equipment to Measure AC Voltage (At the listed frequencies) ^F			
10 Hz to 20 Hz	22 mV to 220 mV	550 μ V/V + 13 μ V	Fluke 5700A EURAMET_cg-15_v_2.0 ASP 005
20 Hz to 40 Hz	22 mV to 220 mV	210 μ V/V + 8 μ V	
40 kHz to 20 kHz	22 mV to 220 mV	105 μ V/V + 8 μ V	
20 kHz to 50 kHz	22 mV to 220 mV	320 μ V/V + 8 μ V	
50 kHz to 100 kHz	22 mV to 220 mV	850 μ V/V + 25 μ V	
100 kHz to 300 kHz	22 mV to 220 mV	1 100 μ V/V + 25 μ V	
300 kHz to 500 kHz	22 mV to 220 mV	1 700 μ V/V + 35 μ V	
500 kHz to 1 MHz	22 mV to 220 mV	3 400 μ V/V + 80 μ V	



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Equipment to Measure AC Voltage (At the listed frequencies) ^F			
10 Hz to 20 Hz	220 mV to 2.2 V	500 μ V/V + 80 μ V	Fluke 5700A EURAMET_cg-15_v_2.0 ASP 005
20 Hz to 40 Hz	220 mV to 2.2 V	160 μ V/V + 25 μ V	
40 kHz to 20 kHz	220 mV to 2.2 V	75 μ V/V + 6 μ V	
20 kHz to 50 kHz	220 mV to 2.2 V	120 μ V/V + 16 μ V	
50 kHz to 100 kHz	220 mV to 2.2 V	250 μ V/V + 70 μ V	
100 kHz to 300 kHz	220 mV to 2.2 V	430 μ V/V + 130 μ V	
300 kHz to 500 kHz	220 mV to 2.2 V	1 050 μ V/V + 350 μ V	
500 kHz to 1 MHz	220 mV to 2.2 V	2 200 μ V/V + 850 μ V	
Equipment to Measure AC Voltage (At the listed frequencies) ^F			
10 Hz to 20 Hz	2.2 V to 22 V	500 μ V/V + 800 μ V	Fluke 5700A EURAMET_cg-15_v_2.0 ASP 005
20 Hz to 40 Hz	2.2 V to 22 V	160 μ V/V + 250 μ V	
40 kHz to 20 kHz	2.2 V to 22 V	75 μ V/V + 60 μ V	
20 kHz to 50 kHz	2.2 V to 22 V	120 μ V/V + 160 μ V	
50 kHz to 100 kHz	2.2 V to 22 V	250 μ V/V + 350 μ V	
100 kHz to 300 kHz	2.2 V to 22 V	500 μ V/V + 1 500 μ V	
300 kHz to 500 kHz	2.2 V to 22 V	1 250 μ V/V + 4 300 μ V	
500 kHz to 1 MHz	2.2 V to 22 V	2 700 μ V/V + 8 500 μ V	
Equipment to Measure AC Voltage (At the listed frequencies) ^F			
10 Hz to 20 Hz	22 V to 220 V	500 μ V/V + 8 mV	Fluke 5700A EURAMET_cg-15_v_2.0 ASP 005
20 Hz to 40 Hz	22 V to 220 V	160 μ V/V + 2.5 mV	
40 kHz to 20 kHz	22 V to 220 V	80 μ V/V + 0.8 mV	
20 kHz to 50 kHz	22 V to 220 V	220 μ V/V + 3.5 mV	
50 kHz to 100 kHz	22 V to 220 V	500 μ V/V + 8 mV	
100 kHz to 300 kHz	22 V to 220 V	1 500 μ V/V + 90 mV	
300 kHz to 500 kHz	22 V to 220 V	4 700 μ V/V + 90 mV	
500 kHz to 1 MHz	22 V to 220 V	11 500 μ V/V + 190 mV	



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Equipment to Measure AC Voltage (At the listed frequencies) ^F			
15 Hz to 50 Hz	220 V to 1 100 V	400 μ V/V + 16 mV	Fluke 5700A EURAMET_cg-15__v_2.0 ASP 005
50 Hz to 1 kHz	220 V to 1 100 V	80 μ V/V + 3.5 mV	
Equipment to Measure AC Voltage (At the listed frequencies) ^F			
40 Hz to 1 kHz	220 V to 1 100 V	90 μ V/V + 4 mV	Fluke 5700A w/ 5725A EURAMET_cg-15__v_2.0 ASP 005
1 kHz to 20 kHz	220 V to 1 100 V	165 μ V/V + 6 mV	
20 kHz to 30 kHz	220 V to 1 100 V	600 μ V/V + 11 mV	
30 kHz to 50 kHz	220 V to 750 V	600 μ V/V + 11 mV	
50 kHz to 100 kHz	220 V to 750 V	2 300 μ V/V + 45 mV	
Equipment to Measure AC Voltage (At the listed frequencies) ^F			
10 Hz to 45 Hz	1 mV to 33 mV	0.35 % of reading + 20 μ V	Fluke 5500A ASP 001
45 Hz to 10 kHz	1 mV to 33 mV	0.15 % of reading + 20 μ V	
10 kHz to 20 kHz	1 mV to 33 mV	0.2 % of reading + 20 μ V	
20 kHz to 50 kHz	1 mV to 33 mV	0.25 % of reading + 20 μ V	
50 kHz to 100 kHz	1 mV to 33 mV	0.35 % of reading + 33 μ V	
100 kHz to 500 kHz	1 mV to 33 mV	1 % of reading + 60 μ V	
Equipment to Measure AC Voltage (At the listed frequencies) ^F			
10 Hz to 45 Hz	33 mV to 330 mV	0.25 % of reading + 50 μ V	Fluke 5500A ASP 001
45 Hz to 10 kHz	33 mV to 330 mV	0.05 % of reading + 20 μ V	
10 kHz to 20 kHz	33 mV to 330 mV	0.1 % of reading + 20 μ V	
20 kHz to 50 kHz	33 mV to 330 mV	0.16 % of reading + 40 μ V	
50 kHz to 100 kHz	33 mV to 330 mV	0.24 % of reading + 170 μ V	
100 kHz to 500 kHz	33 mV to 330 mV	0.7 % of reading + 330 μ V	
Equipment to Measure AC Voltage (At the listed frequencies) ^F			
10 Hz to 45 Hz	330 mV to 3.3 V	0.15 % of reading + 250 μ V	Fluke 5500A ASP 001
45 Hz to 10 kHz	330 mV to 3.3 V	0.03 % of reading + 60 μ V	
10 kHz to 20 kHz	330 mV to 3.3 V	0.08 % of reading + 60 μ V	
20 kHz to 50 kHz	330 mV to 3.3 V	0.14 % of reading + 300 μ V	
50 kHz to 100 kHz	330 mV to 3.3 V	0.24 % of reading + 1 700 μ V	
100 kHz to 500 kHz	330 mV to 3.3 V	0.5 % of reading + 3 300 μ V	



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Equipment to Measure AC Voltage (At the listed frequencies) ^F			Fluke 5500A ASP 001
10 Hz to 45 Hz	3.3 V to 33 V	0.15 % of reading + 2 500 μ V	
45 Hz to 10 kHz	3.3 V to 33 V	0.04 % of reading + 600 μ V	
10 kHz to 20 kHz	3.3 V to 33 V	0.08 % of reading + 2 600 μ V	
20 kHz to 50 kHz	3.3 V to 33 V	0.19 % of reading + 5 000 μ V	
50 kHz to 100 kHz	3.3 V to 33 V	0.19 % of reading + 5 000 μ V	
100 kHz to 500 kHz	3.3 V to 33 V	0.24 % of reading + 17 000 μ V	
Equipment to Measure AC Voltage (At the listed frequencies) ^F			Fluke 5500A ASP 001
45 Hz to 1 kHz	33 V to 330 V	0.05 % of reading + 6.6 mV	
1 kHz to 10 kHz	33 V to 330 V	0.08 % of reading + 15 mV	
10 kHz to 20 kHz	33 V to 330 V	0.09 % of reading + 33 mV	
Equipment to Measure AC Voltage (At the listed frequencies) ^F			Fluke 5500A ASP 001
45 Hz to 1 kHz	330 V to 1020 V	0.05 % of reading + 80 mV	
1 kHz to 5 kHz	330 V to 1020 V	0.2 % of reading + 100 mV	
5 kHz to 10 kHz	330 V to 1020 V	0.09 % of reading + 500 mV	
Equipment to Output AC Voltage (At the listed frequencies) ^F			Agilent 3458A Opt 002 ASP 006
1 Hz to 40 Hz	10 μ V to 12 mV	0.03 % of Reading + 3 μ V	
40 Hz to 1 kHz	10 μ V to 12 mV	0.02 % of Reading + 1.1 μ V	
1 kHz to 20 kHz	10 μ V to 12 mV	0.03 % of Reading + 1.1 μ V	
20 kHz to 50 kHz	10 μ V to 12 mV	0.1 % of Reading + 1.1 μ V	
50 kHz to 100 kHz	10 μ V to 12 mV	0.5 % of Reading + 1.1 μ V	
100 kHz to 300 kHz	10 μ V to 12 mV	4 % of Reading + 2 μ V	
Equipment to Output AC Voltage (At the listed frequencies) ^F			Agilent 3458A Opt 002 ASP 006
1 Hz to 40 Hz	12 mV to 120 mV	0.007 % of Reading + 4 μ V	
40 Hz to 1 kHz	12 mV to 120 mV	0.007 % of Reading + 2 μ V	
1 kHz to 20 kHz	12 mV to 120 mV	0.014 % of Reading + 2 μ V	
20 kHz to 50 kHz	12 mV to 120 mV	0.03 % of Reading + 2 μ V	
50 kHz to 100 kHz	12 mV to 120 mV	0.08 % of Reading + 2 μ V	
100 kHz to 300 kHz	12 mV to 120 mV	0.3 % of Reading + 10 μ V	
300 kHz to 1 MHz	12 mV to 120 mV	1 % of Reading + 10 μ V	
1 MHz to 2 MHz	12 mV to 120 mV	1.5 % of Reading + 10 μ V	



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 Contact Name: Stephen Oxborough Phone: 191-262-2266

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Equipment to Output AC Voltage (At the listed frequencies) ^F			
1 Hz to 40 Hz	120 mV to 1.2 V	0.007 % of Reading + 40 μ V	Agilent 3458A Opt 002 ASP 006
40 Hz to 1 kHz	120 mV to 1.2 V	0.007 % of Reading + 20 μ V	
1 kHz to 20 kHz	120 mV to 1.2 V	0.014 % of Reading + 20 μ V	
20 kHz to 50 kHz	120 mV to 1.2 V	0.03 % of Reading + 20 μ V	
50 kHz to 100 kHz	120 mV to 1.2 V	0.08 % of Reading + 20 μ V	
100 kHz to 300 kHz	120 mV to 1.2 V	0.3 % of Reading + 100 μ V	
300 kHz to 1 MHz	120 mV to 1.2 V	1 % of Reading + 100 μ V	
Equipment to Output AC Voltage (At the listed frequencies) ^F			
1 Hz to 40 Hz	1.2 V to 12 V	0.007 % of Reading + 0.4 mV	Agilent 3458A Opt 002 ASP 006
40 Hz to 1 kHz	1.2 V to 12 V	0.007 % of Reading + 0.2 mV	
1 kHz to 20 kHz	1.2 V to 12 V	0.014 % of Reading + 0.2 mV	
20 kHz to 50 kHz	1.2 V to 12 V	0.03 % of Reading + 0.2 mV	
50 kHz to 100 kHz	1.2 V to 12 V	0.08 % of Reading + 0.2 mV	
100 kHz to 300 kHz	1.2 V to 12 V	0.3 % of Reading + 1 mV	
300 kHz to 1 MHz	1.2 V to 12 V	1 % of Reading + 1 mV	
1 MHz to 2 MHz	1.2 V to 12 V	1.5 % of Reading + 1 mV	
Equipment to Output AC Voltage (At the listed frequencies) ^F			
1 Hz to 40 Hz	12 V to 120 V	0.02 % of Reading + 4 mV	Agilent 3458A Opt 002 ASP 006
40 Hz to 1 kHz	12 V to 120 V	0.02 % of Reading + 2 mV	
1 kHz to 20 kHz	12 V to 120 V	0.02 % of Reading + 2 mV	
20 kHz to 50 kHz	12 V to 120 V	0.035 % of Reading + 2 mV	
50 kHz to 100 kHz	12 V to 120 V	0.12 % of Reading + 2 mV	
100 kHz to 300 kHz	12 V to 120 V	0.4 % of Reading + 10 mV	
300 kHz to 1 MHz	12 V to 120 V	1.5 % of Reading + 10 mV	
Equipment to Output AC Voltage (At the listed frequencies) ^F			
1 Hz to 40 Hz	120 V to 700 V	0.04 % of Reading + 40 mV	Agilent 3458A Opt 002 ASP 006
40 Hz to 1 kHz	120 V to 700 V	0.04 % of Reading + 20 mV	
1 kHz to 20 kHz	120 V to 700 V	0.06 % of Reading + 20 mV	
20 kHz to 50 kHz	120 V to 700 V	0.12 % of Reading + 20 mV	
50 kHz to 100 kHz	120 V to 700 V	0.3 % of Reading + 20 mV	



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Equipment to Measure AC Voltage (At the listed frequencies) ^F			
Equipment to Output AC Voltage 40 Hz to 60 Hz	300 V to 3 000 V	0.2 % of Reading + 1.2 V	Time Electronics 5075 ASP 006
Equipment to Measure DC Current ^F	Up to 220 μ A	50 μ A/A + 8 nA	Fluke 5700A EURAMET_cg-15__v_2.0 ASP 003
	220 μ A to 2.2 mA	50 μ A/A + 8 nA	
	2.2 mA to 22 mA	50 μ A/A + 80 nA	
	22 mA to 220 mA	60 μ A/A + 0.8 μ A	
	220 mA to 2.2 A	80 μ A/A + 25 μ A	Fluke 5700A w/ 5725A ASP 003
2.2 A to 11A	360 μ A/A + 480 μ A		
Equipment to Measure DC Current ^F	Up to 3.3 mA	0.013 % of reading + 0.05 μ A	Fluke 5500A ASP 003
	3.3 mA to 33 mA	0.01 % of reading + 0.25 μ A	
	33 mA to 330 mA	0.01 % of reading + 3.3 μ A	
	330 mA to 2.2 A	0.03 % of reading + 44 μ A	
	2.2 A to 11 A	0.06 % of reading + 330 μ A	
Equipment to Measure DC Power (at the listed amperage) ^{FO}			
3.3 mA to 9 mA	109 μ W to 9.18 W	0.04 % of reading	Fluke 5500A ASP 001 ASP 003
9 mA to 33 mA	297 μ W to 33.66 W	0,03 % of reading	
33 mA to 90 mA	1 089 μ W to 91.8 W	0.04 % of reading	
90 mA to 330 mA	2.97 mW to 336.6 W	0.03 % of reading	
0.33 A to 0.9 A	10.89 mW to 918 W	0.08 % of reading	
0.9 A to 2.2 A	29.7 mW to 2 244 W	0.06 % of reading	
2.2 A to 4.5 A	72.6 mW to 4 590 W	0.12 % of reading	
4.5 A to 11 A	148.5 mW to 11 220 W	0.09 % of reading	



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Equipment to Output DC Current ^F	Up to 120 nA	30 ppm + 40 pA	Agilent 3458A Opt 002 ASP 004
	120 nA to 1.2 μ A	20 μ A/A + 40 pA	
	1.2 μ A to 12 μ A	20 μ A/A + 100 pA	
	12 μ A to 120 μ A	20 μ A/A + 0.8 nA	
	120 μ A to 1.2 mA	20 μ A/A + 5 nA	
	1.2 mA to 12 mA	20 μ A/A + 50 nA	
	12 mA to 120 mA	35 μ A/A + 0.5 μ A	
	120 mA to 1.05 A	110 μ A/A + 10 μ A	
Equipment to Measure AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	9 μ A to 220 μ A	700 μ A/A + 25 nA	Fluke 5700A EURAMET_cg-15_v_2.0 ASP 007
20 Hz to 40 Hz	9 μ A to 220 μ A	350 μ A/A + 20 nA	
40 Hz to 1 kHz	9 μ A to 220 μ A	140 μ A/A + 16 nA	
1 kHz to 5 kHz	9 μ A to 220 μ A	600 μ A/A + 40 nA	
5 kHz to 10 kHz	9 μ A to 220 μ A	1 600 μ A/A + 80 nA	
Equipment to Measure AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	220 μ A to 2.2 mA	700 μ A/A + 40 nA	Fluke 5700A EURAMET_cg-15_v_2.0 ASP 007
20 Hz to 40 Hz	220 μ A to 2.2 mA	350 μ A/A + 35 nA	
40 Hz to 1 kHz	220 μ A to 2.2 mA	140 μ A/A + 35 nA	
1 kHz to 5 kHz	220 μ A to 2.2 mA	600 μ A/A + 400 nA	
5 kHz to 10 kHz	220 μ A to 2.2 mA	1 600 μ A/A + 800 nA	
Equipment to Measure AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	2.2 mA to 22 mA	700 μ A/A + 0.4 μ A	Fluke 5700A ASP 007 EURAMET_cg-15_v_2.0
20 Hz to 40 Hz	2.2 mA to 22 mA	350 μ A/A + 0.35 μ A	
40 Hz to 1 kHz	2.2 mA to 22 mA	140 μ A/A + 0.35 μ A	
1 kHz to 5 kHz	2.2 mA to 22 mA	600 μ A/A + 4 μ A	
5 kHz to 10 kHz	2.2 mA to 22 mA	1 600 μ A/A + 8 μ A	



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Equipment to Measure AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	22 mA to 220 mA	700 μ A/A + 4 μ A	Fluke 5700A EURAMET_cg-15_v_2.0 ASP 007
20 Hz to 40 Hz	22 mA to 220 mA	350 μ A/A + 3.5 μ A	
40 Hz to 1 kHz	22 mA to 220 mA	140 μ A/A + 3.5 μ A	
1 kHz to 5 kHz	22 mA to 220 mA	600 μ A/A + 40 μ A	
5 kHz to 10 kHz	22 mA to 220 mA	1 600 μ A/A + 80 μ A	
Equipment to Measure AC Current (At the listed frequencies) ^F			
20 Hz to 1 kHz	220 mA to 2.2 A	650 μ A/A + 35 μ A	Fluke 5700A EURAMET_cg-15_v_2.0 ASP 007
1 kHz to 5 kHz	220 mA to 2.2 A	750 μ A/A + 80 μ A	
5 kHz to 10 kHz	220 mA to 2.2 A	8 500 μ A/A + 160 μ A	
Equipment to Measure AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	2.2 A to 11 A	460 μ A/A + 170 μ A	Fluke 5700A w/ 5725A EURAMET_cg-15_v_2.0 ASP 007
20 Hz to 40 Hz	2.2 A to 11 A	950 μ A/A + 380 μ A	
40 Hz to 1 kHz	2.2 A to 11 A	3 600 μ A/A + 750 μ A	
Equipment to Measure AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	29 μ A to 330 μ A	0.15 μ A + 0.25 % of reading	Fluke 5500A ASP 007
20 Hz to 45 Hz	29 μ A to 330 μ A	0.15 μ A + 0.125 % of reading	
45 Hz to 1 kHz	29 μ A to 330 μ A	0.15 μ A + 0.125 % of reading	
1 kHz to 5 kHz	29 μ A to 330 μ A	0.15 μ A + 0.4 % of reading	
5 kHz to 10 kHz	29 μ A to 330 μ A	0.15 μ A + 1.25 % of reading	
Equipment to Measure AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	0.33 mA to 3.3 mA	0.2 % of reading + 0.3 μ A	Fluke 5500A ASP 007
20 Hz to 45 Hz	0.33 mA to 3.3 mA	0.1 % of reading + 0.3 μ A	
45 Hz to 1 kHz	0.33 mA to 3.3 mA	0.1 % of reading + 0.3 μ A	
1 kHz to 5 kHz	0.33 mA to 3.3 mA	0.2 % of reading + 0.3 μ A	
5 kHz to 10 kHz	0.33 mA to 3.3 mA	0.6 % of reading + 0.3 μ A	



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Equipment to Measure AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	3.3 mA to 33 mA	0.2 % of reading + 3 μ A	Fluke 5500A ASP 007
20 Hz to 45 Hz	3.3 mA to 33 mA	0.1 % of reading + 3 μ A	
45 Hz to 1 kHz	3.3 mA to 33 mA	0.09 % of reading + 3 μ A	
1 kHz to 5 kHz	3.3 mA to 33 mA	0.2 % of reading + 3 μ A	
5 kHz to 10 kHz	3.3 mA to 33 mA	0.6 % of reading + 3 μ A	
Equipment to Measure AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	33 mA to 330 mA	0.2 % of reading + 30 μ A	Fluke 5500A ASP 007
20 Hz to 45 Hz	33 mA to 330 mA	0.1 % of reading + 30 μ A	
45 Hz to 1 kHz	33 mA to 330 mA	0.09 % of reading + 30 μ A	
1 kHz to 5 kHz	33 mA to 330 mA	0.2 % of reading + 30 μ A	
5 kHz to 10 kHz	33 mA to 330 mA	0.6 % of reading + 30 μ A	
Equipment to Measure AC Current (At the listed frequencies) ^F			
10 Hz to 45 Hz	0.33 A to 2.2 A	0.2 % of reading + 300 μ A	Fluke 5500A ASP 007
20 Hz to 45 Hz	0.33 A to 2.2 A	0.1 % of reading + 300 μ A	
45 Hz to 1 kHz	0.33 A to 2.2 A	0.75 % of reading + 300 μ A	
Equipment to Measure AC Current (At the listed frequencies) ^F			
45 Hz to 65 Hz	2.2 A to 11 A	0.06 % of reading + 2 000 μ A	Fluke 5500A ASP 007
65 Hz to 500 Hz	2.2 A to 11 A	0.1 % of reading + 2 000 μ A	
500 Hz to 1 kHz	2.2 A to 11 A	0.33 % of reading + 2 000 μ A	



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Equipment to Measure AC Power (At the listed frequencies) ^F	109 μ W to 297 μ W	0.4 % of reading	Fluke 5500A ASP 005 ASP 007
	297 μ W to 109 μ W	0.25 % of reading	
	1.09 mW to 2.97 mW	0.35 % of reading	
	2.97 mW to 10.9 mW	0.25 % of reading	
	10.9 mW to 297 mW	0.25 % of reading	
	297 mW to 726 mW	0.15 % of reading	
	726 mW to 1.485W	0.25 % of reading	
	1.485 W to 3.63 W	0.15 % of reading	
	3.63 W to 9.18 W	0.35 % of reading	
	9.18 W to 33.66 W	0.25 % of reading	
	33.66 W to 918 W	0.35 % of reading	
	918 W to 336.6 W	0.25 % of reading	
	336.6 W to 918 W	0.25 % of reading	
	918 W to 2 244 W	0.15 % of reading	
2 244 W to 4 590 W	0.2 % of reading		
4 590 W to 11 220 W	0.15 % of reading		
Equipment to Output AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	100 pA to 120 μ A	0.4 % of Reading + 30 nA	Agilent 3458A Opt 002 ASP 008
20 Hz to 45 Hz	100 pA to 120 μ A	0.15 % of Reading + 30 nA	
45 Hz to 100 Hz	100 pA to 120 μ A	0.06 % of Reading + 30 nA	
100 Hz to 5 kHz	100 pA to 120 μ A	0.06 % of Reading + 30 nA	
Equipment to Output AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	120 μ A to 1.2 mA	0.4 % of Reading + 0.2 μ A	Agilent 3458A Opt 002 ASP 008
20 Hz to 45 Hz	120 μ A to 1.2 mA	0.15 % of Reading + 0.2 μ A	
45 Hz to 100 Hz	120 μ A to 1.2 mA	0.06 % of Reading + 0.2 μ A	
100 Hz to 5 kHz	120 μ A to 1.2 mA	0.03 % of Reading + 0.2 μ A	
5 kHz to 20 kHz	120 μ A to 1.2 mA	0.06 % of Reading + 0.2 μ A	
20 kHz to 50 kHz	120 μ A to 1.2 mA	0.4 % of Reading + 0.4 μ A	
50 kHz to 100 kHz	120 μ A to 1.2 mA	0.55 % of Reading + 1.5 μ A	



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Equipment to Output AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	1.2 mA to 12 mA	0.4 % of Reading + 2 μ A	Agilent 3458A Opt 002 ASP 008
20 Hz to 45 Hz	1.2 mA to 12 mA	0.15 % of Reading + 2 μ A	
45 Hz to 100 Hz	1.2 mA to 12 mA	0.06 % of Reading + 2 μ A	
100 Hz to 5 kHz	1.2 mA to 12 mA	0.03 % of Reading + 2 μ A	
5 kHz to 20 kHz	1.2 mA to 12 mA	0.06 % of Reading + 2 μ A	
20 kHz to 50 kHz	1.2 mA to 12 mA	0.4 % of Reading + 4 μ A	
50 kHz to 100 kHz	1.2 mA to 12 mA	0.55 % of Reading + 15 μ A	
Equipment to Output AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	12 mA to 120 mA	0.4 % of Reading + 20 μ A	Agilent 3458A Opt 002 ASP 008
20 Hz to 45 Hz	12 mA to 120 mA	0.15 % of Reading + 20 μ A	
45 Hz to 100 Hz	12 mA to 120 mA	0.06 % of Reading + 20 μ A	
100 Hz to 5 kHz	12 mA to 120 mA	0.03 % of Reading + 20 μ A	
5 kHz to 20 kHz	12 mA to 120 mA	0.06 % of Reading + 20 μ A	
20 kHz to 50 kHz	12 mA to 120 mA	0.4 % of Reading + 40 μ A	
50 kHz to 100 kHz	12 mA to 120 mA	0.55 % of Reading + 150 μ A	
Equipment to Output AC Current (At the listed frequencies) ^F			
10 Hz to 20 Hz	120 mA to 1.05 A	0.4 % of Reading + 0.2 mA	Agilent 3458A Opt 002 ASP 008
20 Hz to 45 Hz	120 mA to 1.05 A	0.16 % of Reading + 0.2 mA	
45 Hz to 100 Hz	120 mA to 1.05 A	0.08 % of Reading + 0.2 mA	
100 Hz to 5 kHz	120 mA to 1.05 A	0.1 % of Reading + 0.2 mA	
5 kHz to 20 kHz	120 mA to 1.05 A	0.3 % of Reading + 0.2 mA	
20 kHz to 50 kHz	120 mA to 1.05 A	1 % of Reading + 0.4 mA	



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Equipment to Measure Resistance ^F	0 Ω	50 $\mu\Omega/\Omega$	Fluke 5700A EURAMET_cg-15__v_2.0 ASP 009
	1 Ω	95 $\mu\Omega/\Omega$	
	1.9 Ω	95 $\mu\Omega/\Omega$	
	10 Ω	28 $\mu\Omega/\Omega$	
	19 Ω	27 $\mu\Omega/\Omega$	
	100 Ω	17 $\mu\Omega/\Omega$	
	190 Ω	17 $\mu\Omega/\Omega$	
	1 k Ω	13 $\mu\Omega/\Omega$	
	1.9 k Ω	13 $\mu\Omega/\Omega$	
	10 k Ω	12 $\mu\Omega/\Omega$	
	19 k Ω	12 $\mu\Omega/\Omega$	
	100 k Ω	14 $\mu\Omega/\Omega$	
	190 k Ω	14 $\mu\Omega/\Omega$	
	1 M Ω	20 $\mu\Omega/\Omega$	
	1.9 M Ω	21 $\mu\Omega/\Omega$	
	10 M Ω	40 $\mu\Omega/\Omega$	
	19 M Ω	47 $\mu\Omega/\Omega$	
100 M Ω	110 $\mu\Omega/\Omega$		



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Equipment to Measure Resistance ^F	0 Ω to 11 Ω	0.012 % of reading + 0.008 Ω	Fluke 5500A ASP 009
	11 Ω to 33 Ω	0.012 % of reading + 0.015 Ω	
	33 Ω to 110 Ω	0.009 % of reading + 0.015 Ω	
	110 Ω to 330 Ω	0.009 % of reading + 0.015 Ω	
	330 Ω to 1.1k Ω	0.009 % of reading + 0.06 Ω	
	1.1 k Ω to 3.3 k Ω	0.009 % of reading + 0.06 Ω	
	3.3 k Ω to 11 k Ω	0.009 % of reading + 0.6 Ω	
	11 k Ω to 33 k Ω	0.009 % of reading + 0.6 Ω	
	33 k Ω to 110 k Ω	0.011 % of reading + 6 Ω	
	110 k Ω to 330 k Ω	0.012 % of reading + 6 Ω	
	330 k Ω to 1.1 M Ω	0.015 % of reading + 55 Ω	
	1.1 M Ω to 3.3 M Ω	0.015 % of reading + 55 Ω	
	3.3 M Ω to 11 M Ω	0.06 % of reading + 550 Ω	
	11 M Ω to 33 M Ω	0.1 % of reading + 550 Ω	
	33 M Ω to 110 M Ω	0.5 % of reading + 5 500 Ω	
110 M Ω to 330 M Ω	0.5 % of reading + 16 500 Ω		
Equipment to Measure DC Resistance ^F	10 $\mu\Omega$ to 12 Ω	15 $\mu\Omega/\Omega$ + 5 $\mu\Omega/\Omega$ of range	Agilent 3458A Opt 002 ASP 010
	12 Ω to 120 Ω	12 $\mu\Omega/\Omega$ + 5 $\mu\Omega/\Omega$ of range	
	120 Ω to 1.2 k Ω	10 $\mu\Omega/\Omega$ + 0.5 $\mu\Omega/\Omega$ of range	
	1.2 k Ω to 12 k Ω	10 $\mu\Omega/\Omega$ + 0.5 $\mu\Omega/\Omega$ of range	
	12 k Ω to 120 k Ω	10 $\mu\Omega/\Omega$ + 0.5 $\mu\Omega/\Omega$ of range	
	120 k Ω to 1.2 M Ω	15 $\mu\Omega/\Omega$ + 2 $\mu\Omega/\Omega$ of range	
	1.2 M Ω to 12 M Ω	50 $\mu\Omega/\Omega$ + 10 $\mu\Omega/\Omega$ of range	
	12 M Ω to 120 M Ω	500 $\mu\Omega/\Omega$ + 10 $\mu\Omega/\Omega$ of range	
	120 M Ω to 1.2 G Ω	5 000 $\mu\Omega/\Omega$ + 10 $\mu\Omega/\Omega$ of range	



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Met-Cal House, Fisher Street, Newcastle-upon-Tyne, NE6 4LT, UK
 Contact Name: Stephen Oxborough Phone: 191-262-2266

Accreditation is granted to the facility to perform the following calibrations:

Electrical

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Equipment to Measure Capacitance 50 Hz to 1 000 Hz ^{FO}	0.33 nF to 0.5 nF	0.5 % of reading + 0.01 nF	Fluke 5500A ASP 012
	0.5 nF to 1.1 nF	0.5 % of reading + 0.01 nF	
	1.1 nF to 3.3 nF	0.5 % of reading + 0.01 nF	
	3.3 nF to 11 nF	0.5 % of reading + 0.01 nF	
	11 nF to 33 nF	0.25 % of reading + 0.1 nF	
	33 nF to 110 nF	0.25 % of reading + 0.1 nF	
	110 nF to 330 nF	0.25 % of reading + 0.3 nF	
	0.33 μ F to 1.1 μ F	0.25 % of reading + 1 nF	
	1.1 μ F to 3.3 μ F	0.35 % of reading + 3 nF	
	3.3 μ F to 11 μ F	0.35 % of reading + 10 nF	
	11 μ F to 33 μ F	0.4 % of reading + 30 nF	
	33 μ F to 110 μ F	0.5 % of reading + 100 nF	
	110 μ F to 330 μ F	0.7 % of reading + 300 nF	
330 μ F to 1.1 mF	1 % of reading + 300 nF		
Voltage Measurement ^F	2 V	0.025 % + 40 μ V	Keithley 6517B Electrometer ASP 127
	20 V	0.025 % + 300 μ V	
	200 V	0.06 % + 3 mV	
Current Measured ^F	20 pA	1 % + 3 fA	
	200 pA	1 % + 5 fA	
	2 nA	0.2 % + 300 fA	
	20 nA	0.2 % + 500 fA	
	200 nA	0.2 % + 5 pA	
	2 μ A	0.1 % + 100 pA	
	20 μ A	0.1 % + 500 pA	
	200 μ A	0.1 % + 5 nA	
	2 mA	0.1 % + 100 nA	
	20 mA	0.1 % + 500 nA	



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Equipment to Output Capacitance 50 Hz to 100 kHz ^F	0.001 pF to 1 mF	0.05 % + 0.000 01 pF	Eucol U2817A Precision LCR Bridge ASP 118
	1 mF to 3 mF	0.05 % + 0.001 5 mF	
Equipment to Output Resistance 50 Hz to 100 kHz ^F	0.001 Ω to 100 M Ω	0.005 % + 0.000 005 Ω	
Equipment to Output Inductance 50 Hz to 100 kHz ^F	100 μ H to 100 kH	0.05 % + 0.05 μ H	
Resistance Measurement ^F	2 M Ω	0.125 % + 10 Ω	Keithley 6517B Electrometer ASP 127
	20 M Ω	0.125 % + 100 Ω	
	200 M Ω	0.15 % + 1 k Ω	
	2 G Ω	0.225 % + 10 k Ω	
	20 G Ω	0.225 % + 100 k Ω	
	200 G Ω	0.35 % + 1 M Ω	
	2 T Ω	0.35 % + 10 M Ω	
	20 T Ω	1.025 % + 100 M Ω	
Voltage Source ^F	100 V	0.15 % + 10 mV	
	1 000 V	0.15 % + 100 mV	
Coulombs Measurement ^F	2 nC	0.4 % + 50 fC	
	20 nC	0.4 % + 500 fC	
	200 nC	0.4 % + 5 pC	
	2 μ C	0.4 % + 50 pC	
Equipment to Measure/Output High Voltage ^{FO}			
DC	1 kV to 150 kV	0.25 %	HV divider ROSS VMD4+VMP200 ASP 179
AC at 50 Hz	1 kV to 150 kV	1 %	
Equipment to Output High Current ^{FO}			
50 Hz	10 A to 500 A	0.04 %	Reference CT H.W.Sullivan 46211 ASP 056
DC	10 A to 300 A	0.3 %	Precision Shunt AMECaL 300A ASP 100



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Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type B ^{FO}	0 °C to 200 °C	1 °C	Beamex MC5 ASP 031
	200 °C to 500 °C	0.7 °C	
	500 °C to 800 °C	0.5 °C	
	800 °C to 1 820 °C	0.6 °C	
Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type R ^{FO}	-50 °C to 0 °C	1 °C	
	0 °C to 150 °C	0.7 °C	
	150 °C to 1 400 °C	0.5 °C	
	1 400 °C to 1 768 °C	0.6 °C	
Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type S ^{FO}	-50 °C to 0 °C	1 °C	
	0 °C to 50 °C	0.7 °C	
	50 °C to 1 500 °C	0.6 °C	
	1 500 °C to 1 768 °C	0.7 °C	
Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type E ^{FO}	-270 °C to -200 °C	0.02 % of thermovoltage + 4 μ V	Electrical Simulation of Thermocouple Output Using Beamex MC5 to provide mV signals per ITS-90 ASP 031
	-200 °C to 0 °C	0.08 % Reading + 0.07 °C	
	0 °C to 600 °C	0.015 % Reading + 0.07 °C	
	600 °C to 1 000 °C	0.026 % Reading	
Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type J ^{FO}	-210 °C to -200 °C	0.02 % of thermovoltage + 4 μ V	
	-200 °C to 0 °C	0.07 % of Reading + 0.08 °C	
	0 °C to 1 200 °C	0.02 % of Reading + 0.08 °C	
Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type K ^{FO}	-270 °C to -200 °C	0.02 % of thermovoltage + 4 μ V	
	-200 °C to 0 °C	0.01 % RDG + 0.1 °C	
	0 °C to 1 000 °C	0.02 % RDG + 0.1 °C	
	1 000 °C to 1 372 °C	0.03 % RDG	
Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type N ^{FO}	-270 °C to -200 °C	0.02 % of thermovoltage + 4 μ V	
	-200 °C to -100 °C	0.2 % RDG	
	-100 °C to 0 °C	0.05 % RDG + 0.15 °C	
	0 °C to 750 °C	0.01 % RDG + 0.15 °C	
Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type T ^{FO}	750 °C to 1 300 °C	0.03 % RDG	
	-270 °C to -250 °C	0.02 % of thermovoltage + 4 μ V	
Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type U ^{FO}	-250 °C to -200 °C	0.7 °C	
	-200 °C to 0 °C	0.1 % RDG + 0.1 °C	
	0 °C to 400 °C	0.01 % RDG + 0.1 °C	
Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type U ^{FO}	-200 °C to 0 °C	0.1 % RDG + 0.15 °C	
	0 °C to 600 °C	0.01 % RDG + 0.15 °C	



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Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type L ^{FO}	-200 °C to 0 °C 0 °C to 900 °C	0.07 % RDG + 0.13 °C 0.02 % RDG + 0.13 °C	Electrical Simulation of Thermocouple Output Using Beamex MC5 to provide mV signals per ITS-90 ASP 031
Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type C ^{FO}	0 °C to 900 °C 900 °C to 2 000 °C 2 000 °C to 2 315 °C	0.4 °C 0.04 5 % RDG 1.2 °C	
Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type G ^{FO}	0 °C to 70 °C 70 °C to 200 °C 200 °C to 1 600 °C 1 600 °C to 2 000 °C 2 000 °C to 2 315 °C	0.02 % of thermovoltage + 4 μ V 1 °C 0.5 °C 0.7 °C 1 °C	
Temperature Calibration, Indication, and Control Equipment use with Thermocouple Type D ^{FO}	0 °C to 1 000 °C 1 00 °C to 2 000 °C 2 000 °C to 2 315 °C	0.4 °C 0.04 % RDG 1.2 °C	Electrical Simulation of Thermocouple Output Using Beamex MC5 to provide mV signals per ITS-90 ASP 031
PT Sensors	-200 °C to 0 °C 0 °C to 850 °C	0.06 °C 0.025 % RDG + 0.06 °C	



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Accreditation is granted to the facility to perform the following calibrations:

Mass, Force and Weighing Device

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Test Weights ^F	100 g	0.16 mg	Hafner E2 Mass Set with Sartorius MC1 Semi-Micro Bale ASP 227
	50 g	0.1 mg	
	20 g	0.08 mg	
	10 g	0.06 mg	
	5 g	0.05 mg	
	2 g	0.04 mg	
	1 g	0.03 mg	
	500 mg	0.025 mg	
	200 mg	0.02 mg	
	100 mg	0.016 mg	
	50 mg	0.012 mg	
	20 mg	0.01 mg	
	10 mg	0.008 mg	
	5 mg	0.006 mg	
	2 mg	0.006 mg	
1 mg	0.006 mg		



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Test Weights ^F	1 kg	5 mg	KERN F1 Mass Set Sartorius MC1 Semi-Micro Balance ASP 227
	500 g	2.5 mg	
	200 g	1 mg	
	100 g	0.5 mg	
	50 g	0.3 mg	
	20 g	0.25 mg	
	10 g	0.2 mg	
	5 g	0.16 mg	
	2 g	0.12 mg	
	1 g	0.1 mg	
	500 mg	0.08 mg	
	200 mg	0.06 mg	
	100 mg	0.05 mg	
	50 mg	0.04 mg	
	20 mg	0.03 mg	
	10 mg	0.025 mg	
Analytical Balance ^{FO}	1 mg to 100 mg	16 μ g	Hafner E2 Mass Set ASP 037
	100 mg to 1 g	30 μ g	
	1 g to 100 g	160 μ g	
	100 g to 211.111 g	440 μ g	
Electronic Balance ^{FO}	1 mg to 100 mg	0.05 mg	KERN F1 Mass Set ASP 037
	100 mg to 1 g	0.1 mg	
	1 g to 100 g	0.5 mg	
	100 g to 211.111 g	2.5 mg	
Industrial Balances ^{FO}	1 g to 100 g	5 mg	M1 AVERY Mass Set ASP 037
	100 g to 1 kg	50 mg	
	1 kg to 10 kg	0.5 g	
	10 kg to 100 kg	5 g	
	100 kg to 750 kg	37.5 g	



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Mechanical

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Pipettes, Burettes, Dispensers, Dilutors ^{FO}	1 μ L	0.006 μ L	BS EN ISO 8655 (parts 1,2,3,4,5,6) Gravimetric Method with Analytical Balances
	10 μ L	0.006 μ L	
	20 μ L	0.011 μ L	
	50 μ L	0.022 μ L	
	100 μ L	0.05 μ L	
	200 μ L	0.07 μ L	
	500 μ L	0.1 μ L	
	1 mL	0.1 μ L	
	2 mL	0.12 μ L	
	5 mL	0.15 μ L	
Force Gauge ^{FO}	Up to 70 kg	\pm 0.005 % of Reading	M1 standard weights ASP 197
Low differential Pressure Measurement ^{FO}	\pm 3 000 Pa	< 0.1 % of Reading + 0.03 Pa	Furness Controls FCO560 Differential Pressure Calibrator BS EN 837-1:1998 BS EN 837-2:1998 BS EN 837-3:1998
Absolute Pressure ^{FO} Beamex MC5-IS Multifunction Calibrator	800 mbar a to 1 200 mbar a	0.5 mbar	BS EN 837-1:1998 BS EN 837-2:1998 BS EN 837-3:1998
Pneumatic Pressure ^{FO} Pressure chambers including autoclaves	1 bar to 20 bar -1 bar to 20 bar	0.01 % FS + 0.025 % of Reading	
Pressure ^{FO} Beamex MC5-IS Multifunction Calibrator	-1 bar to 700 bar	0.01 % FS + 0.025 % RDG	Budenberg 380G Dead Weight Tester BS EN 837-1:1998 BS EN 837-2:1998 BS EN 837-3:1998



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Accelerometers Piezoelectric Type ^{FO}	High Frequency Test Nominal Peak Acceleration 1 g _n up to 10 g _n (9.81 up to 98 m/s ⁻²) Charge Sensitivity > 0.1 pCg _n (0.01 pC/ms ⁻²) < 1 000 pCg _n (0.01 pC/ms ⁻²) 20 Hz to 5 kHz 5 kHz to 6.3 kHz 6.3 kHz to 10 kHz	1.5 % of Reading 2 % of Reading 2.5 % of Reading	Endevco 28959 BS EN ISO 8041-1:2017
	Low Frequency Test Nominal Peak Acceleration 0.2 g _n up to 2 g _n (1.96 up to 19.6 m/s ⁻²) Charge Sensitivity > 2 pCg _n (0.01 pC/ms ⁻²) < 1 000 pCg _n (0.01 pC/ms ⁻²) 2 Hz to 20 Hz	1.5 % of Reading	
Torque Wrench ^{FO}	Up to 1 500 Nm	1 % of reading	Static Transducer(s) 001T, 007T, Torque Tool Tester 002T BS EN ISO 6789-2:2017
Torque Transducer ^F	Up to 12 Nm	1 % of reading	Hanging Mass ASP 118
Torque Screwdriver ^{FO}	Up to 12 Nm	1 % of reading	Digital Torque Meter 005T BS EN ISO 6789-2:2017
Calibration of Rotational Instruments via contact: Mixer, Centrifuge, Shaker ^{FO}	200 rpm to 99 999 rpm	0.005 % of Reading + 0.3 rpm	Digital Tachometer ASP 028



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Optical

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Measured at fixed geometries of Gloss ^{FO}	20 ° Mirror	5.4 SGU	Gloss Standards
	20 ° High Gloss	0.54 SGU	
	20 ° Semi Gloss	0.66 SGU	
	60 ° Mirror	2.2 SGU	
	60 ° High Gloss	0.54 SGU	
	60 ° Semi Gloss	0.66 SGU	
	85 ° Mirror	1.1 SGU	
	85 ° High Gloss	0.65 SGU	
	85 ° Semi Gloss	0.76 SGU	
	At geometries of 20 °, 60 °, 85 ° 0 GU to 100 GU		0.8 GU
101 GU to 2 000 GU		1.1 GU	
Colour data: CIELAB ^F L a* b* C* h°	0 to 100 - 200 to + 200 - 200 to + 200 - 200 to + 200 - 200 to + 200	L : 0.21 a* : 0.14 b* : 0.14 C* : 0.12 h° : 0.13 Colour data is given for the CIE 2 ° and 10 ° observers and CIE Standard illuminants A, C D65 and D50.	3nh YS3060 Spectrophotometer Ceramic Colour Standards Series 2 ASP 212
	0 to 1	0.000 30	
Colour data: CIE F x, y, u', v' Luminous transmittance Y ^F	0 % Y to 100 % Y	0.78 % for white, 0.29 % for black Colour data is given for the CIE 2 ° and 10 ° observers and CIE Standard Illuminants A, C, D65 and D50.	Sample expanded uncertainties in Hunter L* a*b* space:
Colour data: Hunter ^F L* a* b*	0 to 100 - 200 to + 200 - 200 to + 200	L* : 0.21 a* : 0.14 b* : 0.14	
Refractometers ^{FO}	0 % Brix to 95 % Brix 1.3 n to 1.7 n	0.25 % Brix 0.000 25 n	Reference Refractometer oils and ABBE Refractometer OIML R142



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Colour Temperature Illumination ^o	2 856 K	± 0.8 % of Reading	Gigahertz Optik HCT99D Chroma Meter with CT-4501-4 detector ASP 216
	1 to 10 lux range	± 3.1 % of Reading	
	10 to 20 lux range	± 2.9 % of Reading	
	20 to 200 lux range	± 2.3 % of Reading	
	200 to 1 000 lux range	± 1.9 % of Reading	
	1 000 to 2 000 lux range	± 2.4 % of Reading	
	2 000 to 10 000 lux range	± 3.1 % of Reading	
	10 000 to 20 000 lux range	± 5 % of Reading Within reproducibility uncertainty (no filter)	
Colour ^o	BG 34, nominal x = 0.391 4 / y = 0.392 5	1 % of Reading	
	BG 7, nominal x = 0.264 6 / y = 0.405 7	1 % of Reading	
	OG 530, nominal x = 0.541 7 / y = 0.453 8	1 % of Reading	
	VG 3, nominal x = 0.365 6 / y = 0.527 2	1 % of Reading	
	RG 6, nominal x = 0.686 / y = 0.313 5	2 % of Reading	
	SFK 100,	20 % of Reading	
1 x & y ^o	y = 0.042 6	1 % of Reading of Reading with SFK 101, nominal x = 0.429 9 / y = 0.537 6 2 % of Reading of Reading with SFK 102, nominal x = 0.545 7 / y = 0.451 1 (Reference light source at 2856 K (A) for filter illumination nominal x = 0.447 6 / y = 0.407 4)	



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Thermodynamic

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Temperature controlled, incubators, ovens, environmental chambers, fridges/refrigerators and freezers (inclusive of associated indicators, controllers and recorders) ^{FO}	-50 °C to -20 °C	0.024 °C	2 x PT100 with Cropico 3000, Liquid bath BS EN 60751:2008 Isotech Pegasus Hot Block Calibrator with Type R 935-14-91 ASP 031
	-20 °C to 160 °C	0.026 °C	
	160 °C to 400 °C	0.043 °C	
	400 °C to 1 100 °C	2 °C	
	1 100 °C to 1 200 °C	4 °C	
Temperature controlled autoclaves, media preparators and sterilizers (inclusive of associated indicators, controllers and recorders, all with sensors, within the specified parameters and ranges) ^{FO}	-50 °C to -20 °C	0.024 °C	
	-20 °C to 160 °C	0.026 °C	
	160 °C to 400 °C	0.043 °C	
	400 °C to 1 100 °C	2 °C	
	1 100 °C to 1 200 °C	4 °C	
Incubators, liquid baths environmental chambers digital Indicators with probes resistance thermometers ^{FO}	-50 °C to -20 °C	0.024 °C	
	-20 °C to 160 °C	0.026 °C	
	160 °C to 400 °C	0.043 °C	
	400 °C to 1 100 °C	2 °C	
	1 100 °C to 1 200 °C	4 °C	
Block calibrators ^{FO}	- 50 °C to -20 °C	0.024 °C	PT 100 with Cropico 3000 Type R 935-14-91 Thermocouple with Beamex MC5 ASP 030
	-20 °C to 160 °C	0.026 °C	
	160 °C to 400 °C	0.043 °C	
	400 °C to 1 100 °C	2.0 °C	
	1 100 °C to 1 200 °C	4.0 °C	
Data Loggers (in air chamber) ^{FO}	- 40 °C to 125 °C	0.64 °C	Omega HH376 Data logger RTD Thermometer ASP 032
Cold junction compensation ^{FO}	At ambient temperature Source and measurement	0.026 °C	PT100 with Cropico 3000 & Ice bath ASP 115
Thermistors RTD ^{FO}	- 80 °C to 150°C -200 °C to 850 °C	0.001 °C	Agilent 3458 Opt 002 ESI RS925D BS EN 60751:2008 ASP 036



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Equipment to Output Relative Humidity ^{FO}	2.5 % RH to 100 % RH	0.7 % RH	Vaisala HMP 75
Equipment to Measure Relative Humidity ^{FO}	5 % RH to 95 % RH	1.2 % RH	With General Eastern RHCL-1 In portable chamber at ambient temperature ASP 113
Equipment to Measure Relative Humidity Measurement ^{FO}	11.3 % RH	0.3 % RH	Unsaturated Salt Ampoules Rotronic ASP 046
	35 % RH	0.4 % RH	
	50 % RH	0.6 % RH	
	75.3 % RH	0.7 % RH	
	80 % RH	0.7% RH	
	33 % RH	0.7 % RH	Saturated Salts AZ Corporation ASP 048
75 % RH	0.7 % RH		
Infra-Red (IR) Thermometers ^F	30 °C to 200 °C	1.6 °C	BX-500 ASP 217
	200 °C to 500 °C	2.8 °C	

Time and Frequency

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Frequency generation ^F Racal-Dana 1992 nanosecond universal counter	Up to 1.3 GHz	5×10^{12}	Disciplined GPS standard ASP 053
Frequency measurement ^F Racal-Dana 1992 nanosecond universal counter	Up to 1.3 GHz	5×10^{12}	Disciplined GPS standard ASP 053
Stopwatch ^F	Up to 24 hr	20 ms	Racal-Dana 1992 nanosecond universal counter, Disciplined GPS standard ASP 039
Rotational speed non-contact measurement generation ^F	Up to 100 000 RPM	0.005 % + 0.003 RPM	Racal-Dana 1992 nanosecond universal counter, Disciplined GPS standard ASP 028
Non-contact rotational speed measurement to include centrifuges	Up to 99 999 RPM	0.005 % + 0.3 RPM	Optical Tachometer ASP 028



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Accreditation is granted to the facility to perform the following calibrations:

1. The CMC (Calibration and Measurement Capability) stated for calibrations included on this scope of accreditation represents the smallest measurement uncertainty attainable by the laboratory when performing a more or less routine calibration of a nearly ideal device under nearly ideal conditions. It is typically expressed at a confidence level of 95 % using a coverage factor k (usually equal to 2). The actual measurement uncertainty associated with a specific calibration performed by the laboratory will typically be larger than the CMC for the same calibration since capability and performance of the device being calibrated and the conditions related to the calibration may reasonably be expected to deviate from ideal to some degree.
2. The laboratories range of calibration capability for all disciplines for which they are accredited is the interval from the smallest calibrated standard to the largest calibrated standard used in performing the calibration. The low end of this range must be an attainable value for which the laboratory has or has access to the standard referenced. Verification of an indicated value of zero in the absence of a standard is common practice in the procedure for many calibrations but by its definition it does not constitute calibration of zero capacity.
3. The presence of a superscript F means that the laboratory performs calibration of the indicated parameter at its fixed location. Example: Outside Micrometer^F would mean that the laboratory performs this calibration at its fixed location.
4. The presence of a superscript O means that the laboratory performs calibration of the indicated parameter onsite at customer locations. Example: Outside Micrometer^O would mean that the laboratory performs this calibration onsite at the customer's location.
5. The presence of a superscript FO means that the laboratory performs calibration of the indicated parameter both at its fixed location and onsite at customer locations. Example: Outside Micrometer^{FO} would mean that the laboratory performs this calibration at its fixed location and onsite at customer locations.
6. The term L represents length in inches or millimeters as appropriate to the uncertainty statement.
7. The term "X" preceded by a number represents the number of times a lense system magnifies an image relative to its actual size. CMC stated as "% of magnification" represents the CMC of magnification expressed as a percentage of the total magnification.