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Absolute Calibration Limited

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Calibration performed by the Organisations at the locations specified below

Locations covered by the organisation and their relevant activities

Laboratory location:

Location details		Activity	Location code
Address 14 Murrills Estate Portchester Hampshire PO16 9RD	**Contact** Mr Darren Kingswell Tel: +44 (0) 2392 321712 Fax: +44 (0) 2392 210034 Email: calit@absolute-cal.co.uk Website: www.absolute-cal.co.uk	Calibration: Electrical Humidity Pressure Temperature	Portchester

Site activities performed away from the location listed above:

Location details		Activity	Location code
Customers' sites or premises 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.	**Contact** Mr Darren Kingswell Tel: +44 (0) 2392 321712 Fax: +44 (0) 2392 210034 Email: calit@absolute-cal.co.uk Website: www.absolute-cal.co.uk	Calibration: Electrical Humidity Pressure Temperature	Site Calibration

CALIBRATION AND MEASUREMENT CAPABILITY (CMC)

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL CALIBRATION				
DC RESISTANCE Measurement, *Specific Values*	100 μΩ 1 mΩ 10 mΩ 100 mΩ 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ	4.0 μΩ/Ω 0.30 μΩ/Ω 0.30 μΩ/Ω 0.36 μΩ/Ω 0.093 μΩ/Ω 0.093 μΩ/Ω 0.093 μΩ/Ω 0.092 μΩ/Ω 0.11 μΩ/Ω 0.22 μΩ/Ω 0.61 μΩ/Ω 1.8 μΩ/Ω 4.5 μΩ/Ω 5.3 μΩ/Ω	Using direct current comparator bridge. The CMCs are for 4-terminal resistors suitable for oil immersion at 20 °C. The uncertainties may be increased for other types of resistor.	**Portchester**
Measurement, *Other values*	80 mΩ to 800 mΩ 0.80 Ω to 107.5 Ω 107.5 Ω to 1.34 kΩ 1.34kΩ to 10.75 kΩ 10.75 kΩ to 12 kΩ 12 kΩ to 63 kΩ 63 kΩ to 134 kΩ 134 kΩ to 1.075 MΩ 1.075 MΩ to 13.4 MΩ 13.4 MΩ to 630 MΩ 630 MΩ to 1.075 GΩ 1.075 GΩ to 2 GΩ 2 GΩ to 20 GΩ 20 GΩ to 200 GΩ 200 GΩ to 2 TΩ	0.36 μΩ/Ω 0.093 μΩ/Ω 0.092 μΩ/Ω 0.11 μΩ/Ω 0.17 μΩ/Ω 0.17 μΩ/Ω 0.22 μΩ/Ω 0.61 μΩ/Ω 1.9 μΩ/Ω 4.5 μΩ/Ω 5.3 μΩ/Ω 0.025% 0.062% 0.10 % 0.12 %	See note above	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
DC RESISTANCE (continued)				**Portchester**
Generation, *Specific values*			Known values of resistance for application to DC resistance measuring devices.	
	100 MΩ, 300 MΩ, 1 GΩ 3 GΩ 10 GΩ	0.30 % 0.45 % 0.35 %	Applied Voltage 10 V	
	30 GΩ, 100 GΩ, 300 GΩ 1 TΩ 3 TΩ	0.35 % 0.70 % 0.75 %	Applied Voltage 100 V	
	100 MΩ, 300 MΩ, 1.0 GΩ 3 GΩ 10 GΩ, 30 GΩ, 100 GΩ, 300 GΩ	0.30 % 0.45 % 0.35 %	Applied Voltage 500 V	
	1 TΩ 3 TΩ	0.70 % 0.75 %	Applied Voltage 500 V Applied Voltage 1000 V	
AC RESISTANCE				
Generation	*40 Hz to 1592 Hz* 0.1 Ω 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ	 0.030 % 10 μΩ/Ω 6.0 μΩ/Ω 8.0 μΩ/Ω 7.0 μΩ/Ω 6.0 μΩ/Ω	Known AC resistance values for application to resistance measuring instruments. Measurement of suitable resistors of the same nominal values may also be undertaken but the uncertainties may be increased.	
DC VOLTAGE				
Standard Cell Values	1.018 V	3.5 μV/V	By comparison with DC voltage reference standards. The CMCs can be realised with cells only if they have their own temperature-controlled enclosure of suitable thermal stability.	
Zener References	1.018 V 10 V	3.5 μV/V 0.23 μV/V		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
DC VOLTAGE (continued)				
Specific Values	0.1 V 1 V 10 V 100 V 1 kV	0.70 μV/V 0.53 μV/V 0.49 μV/V 0.53 μV/V 0.78 μV/V	By comparison with DC voltage reference standards using voltage dividers.	
Other Values	0 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100V to 1 kV 1 kV to 10 kV 10 kV to 30 kV 30 kV to 50 kV	0.6 μV 0.81 μV 0.57 μV/V 0.61 μV/V 2.5 μV/V 0.034 % + 0.41 V 0.038 % + 1.0 V 0.038 % + 10 V	By comparison with DC voltage reference standards using voltage dividers where appropriate.	
DC CURRENT	1 pA to 10 pA 10 pA to 100 pA 100 pA to 100 nA 100 nA to 1 μA 1 μA to 10 μA 10 μA to 200 μA 200 μA to 2 mA 2 mA to 20 mA 20 mA to 100 mA 100 mA to 1 A 1 A to 10 A 10 A to 100 A	2.60 % 1.20 % 0.26 % 0.13 % 24 μA/A + 0.12 nA 11 μA/A + 0.50 nA 11 μA/A + 5.0 nA 12 μA/A + 50 nA 24 μA/A + 0.58 μA 30 μA/A 40 μA/A 50 μA/A	For measurement of current sources or for application to current measuring instruments.	**Portchester**
	100 A to 1000 A	0.50 % to 0.70 %	For calibration of current clamps and similar devices using multi-turn coil method.	
Specific values	100 μA 1 mA 10 mA 100 mA	5.9 μA/A 5.7 μA/A 5.7 μA/A 5.7 μA/A	Generation of known direct currents for calibration of Wavetek 4950 Multifunction Transfer Standards	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC VOLTAGE			Derived by means of AC/DC transfer techniques.	**Portchester**
Generation	*10 Hz to 31 Hz*			
	1 V to 10 V	0.011 % + 0.35 mV		
	10 V to 100 V	0.012 % + 6.0 mV		
	100 V to 1000 V	0.017 % + 20 mV		
	31 Hz to 330 Hz			
	0 mV to 1 mV	0.23 % + 6.0 μV		
	1 mV to 10 mV	0.035 % + 6.5 μV		
	10 mV to 100 mV	0.014 % + 15 μV		
	100 mV to 1 V	0.0065 % + 35 μV		
	1 V to 10 V	0.0063 % + 350 μV		
	10 V to 100 V	0.0075 % + 2.3 mV		
	100 V to 1000 V	0.017 % + 25 mV		
	330 Hz to 10 kHz			
	0 mV to 1 mV	0.23 % + 6.0 μV		
	1 mV to 10 mV	0.035 % + 6.2 μV		
	10 mV to 100 mV	0.015 % + 15 μV		
	100 mV to 1 V	0.0055 % + 35 μV		
	1 V to 10 V	0.0053 % + 350 μV		
	10 V to 100 V	0.0065 % + 1.3 mV		
	100 V to 1000 V	0.012 % + 25 mV		
	10 kHz to 33 kHz			
	0 mV to 1 mV	0.25 % + 6.0 μV		
	1 mV to 10 mV	0.050 % + 6.5 μV		
	10 mV to 100 mV	0.025 % + 15 μV		
	100 mV to 1 V	0.0055 % + 35 μV		
	1 V to 10 V	0.0053 % + 350 μV		
	10 V to 100 V	0.0065 % + 1.3 mV		
	100 V to 1000 V	0.012 % + 25 mV		
	30 kHz to 100 kHz			
	0 mV to 1 mV	0.26 % + 6.0 μV		
	1 mV to 10 mV	0.070 % + 6.5 μV		
	10 mV to 100 mV	0.052 % + 15 μV		
	100 mV to 1 V	0.011 % + 35 μV		
	1 V to 10 V	0.011 % + 350 μV		
	10 V to 100 V	0.016 % + 3.5 mV		
	100 V to 700 V	0.012 % + 50 mV		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC VOLTAGE (continued)				**Portchester**
Generation (continued)	*100 kHz to 330 kHz*			
	0 mV to 1 mV	0.30 % + 6.0 μV		
	1 mV to 10 mV	0.080 % + 7.0 μV		
	10 mV to 100 mV	0.065 % + 200 μV		
	100 mV to 1 V	0.035 % + 35 μV		
	1 V to 10 V	0.031 % + 350 μV		
	300 kHz to 1 MHz			
	1 V to 10 V	0.18 % + 5.0 mV		
Measurement			Derived by means of AC/DC transfer techniques.	
	220 μV to 2.2 mV			
	10 Hz to 20 Hz	620 μV/V + 1.6 μV		
	20 Hz to 40 Hz	620 μV/V + 1.6 μV		
	40 Hz to 20 kHz	610 μV/V + 1.6 μV		
	20 kHz to 50 kHz	620 μV/V + 2.4 μV		
	50 kHz to 100 kHz	630 μV/V + 3.0 μV		
	100 kHz to 300 kHz	760 μV/V + 4.9 μV		
	300 kHz to 500 kHz	0.15 % + 9.9 μV		
	500 kHz to 1 MHz	0.51 % + 11 μV		
	2.2 mV to 7 mV			
	10 Hz to 20 Hz	260 μV/V + 1.6 μV		
	20 Hz to 40 Hz	210 μV/V + 1.6 μV		
	40 Hz to 20 kHz	190 μV/V + 1.6 μV		
	20 kHz to 50 kHz	190 μV/V + 2.4 μV		
	50 kHz to 100 kHz	210 μV/V + 3.0 μV		
	100 kHz to 300 kHz	360 μV/V + 4.9 μV		
	300 kHz to 500 kHz	890 μV/V + 9.9 μV		
	500 kHz to 1 MHz	0.39 % + 11 μV		
	7 mV to 22 mV			
	10 Hz to 20 Hz	120 μV/V + 1.6 μV		
	20 Hz to 40 Hz	95 μV/V + 1.6 μV		
	40 Hz to 20 kHz	93 μV/V + 1.6 μV		
	20 kHz to 50 kHz	100 μV/V + 2.4 μV		
	50 kHz to 100 kHz	110 μV/V + 3.0 μV		
	100 kHz to 300 kHz	200 μV/V + 4.9 μV		
	300 kHz to 500 kHz	710 μV/V + 9.9 μV		
	500 kHz to 1 MHz	0.29 % + 11 μV		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC VOLTAGE (continued)				**Portchester**
Measurement (continued)	22 mV to 70 mV			
	10 Hz to 20 Hz	88 μV/V + 1.7 μV		
	20 Hz to 40 Hz	57 μV/V + 1.7 μV		
	40 Hz to 20 kHz	40 μV/V + 1.7 μV		
	20 kHz to 50 kHz	64 μV/V + 2.3 μV		
	50 kHz to 100 kHz	84 μV/V + 2.9 μV		
	100 kHz to 300 kHz	200 μV/V + 4.6 μV		
	300 kHz to 500 kHz	380 μV/V + 9.2 μV		
	500 kHz to 1 MHz	0.14 % + 9.2 μV		
	70 mV to 220 mV			
	10 Hz to 20 Hz	77 μV/V + 1.7 μV		
	20 Hz to 40 Hz	46 μV/V + 1.7 μV		
	40 Hz to 20 kHz	40 μV/V + 1.7 μV		
	20 kHz to 50 kHz	42 μV/V + 2.3 μV		
	50 kHz to 100 kHz	73 μV/V + 2.9 μV		
	100 kHz to 300 kHz	200 μV/V + 4.6 μV		
	300 kHz to 500 kHz	360 μV/V + 9.2 μV		
	500 kHz to 1 MHz	0.14 % + 9.2 μV		
	200 mV to 700 mV			
	10 Hz to 20 Hz	75 μV/V + 1.7 μV		
	20 Hz to 40 Hz	44 μV/V + 1.7 μV		
	40 Hz to 20 kHz	40 μV/V + 1.7 μV		
	20 kHz to 50 kHz	40 μV/V + 2.3 μV		
	50 kHz to 100 kHz	71 μV/V + 2.9 μV		
	100 kHz to 300 kHz	200 μV/V + 4.6 μV		
	300 kHz to 500 kHz	360 μV/V + 9.2 μV		
	500 kHz to 1 MHz	0.14 % + 9.2 μV		
	700 mV to 2.2 V			
	10 Hz to 20 Hz	74 μV/V		
	20 Hz to 40 Hz	43 μV/V		
	40 Hz to 20 kHz	34 μV/V		
	20 kHz to 50 kHz	41 μV/V		
	50 kHz to 100 kHz	68 μV/V		
	100 kHz to 300 kHz	190 μV/V		
	300 kHz to 500 kHz	330 μV/V		
	500 kHz to 1 MHz	0.14 %		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC VOLTAGE (continued)				**Portchester**
Measurement (continued)	2 V to 7 V			
	10 Hz to 20 Hz	74 µV/V		
	20 Hz to 40 Hz	44 µV/V		
	40 Hz to 20 kHz	33 µV/V		
	20 kHz to 50 kHz	42 µV/V		
	50 kHz to 100 kHz	86 µV/V		
	100 kHz to 300 kHz	210 µV/V		
	300 kHz to 500 kHz	530 µV/V		
	500 kHz to 1 MHz	0.17 %		
	7 V to 22 V			
	10 Hz to 20 Hz	74 µV/V		
	20 Hz to 40 Hz	45 µV/V		
	40 Hz to 20 kHz	33 µV/V		
	20 kHz to 50 kHz	42 µV/V		
	50 kHz to 100 kHz	81 µV/V		
	100 kHz to 300 kHz	210 µV/V		
	300 kHz to 500 kHz	530 µV/V		
	500 kHz to 1 MHz	0.17 %		
	20 V to 70 V			
	10 Hz to 20 Hz	74 µV/V		
	20 Hz to 40 Hz	47 µV/V		
	40 Hz to 20 kHz	41 µV/V		
	20 kHz to 50 kHz	47 µV/V		
	50 kHz to 100 kHz	100 µV/V		
	100 kHz to 300 kHz	210 µV/V		
	300 kHz to 500 kHz	570 µV/V		
	500 kHz to 1 MHz	0.17 %		
	70 V to 220 V			
	10 Hz to 20 Hz	75 µV/V		
	20 Hz to 40 Hz	48 µV/V		
	40 Hz to 20 kHz	41 µV/V		
	20 kHz to 50 kHz	58 µV/V		
	50 kHz to 100 kHz	100 µV/V		
	100 kHz to 300 kHz	340 µV/V		
	300 kHz to 500 kHz	0.10 %		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC VOLTAGE (continued)				Portchester
Measurement (continued)	200 V to 700 V			
	10 Hz to 20 Hz	79 μV/V		
	20 Hz to 40 Hz	50 μV/V		
	40 Hz to 20 kHz	39 μV/V		
	20 kHz to 50 kHz	160 μV/V		
	50 kHz to 100 kHz	980 μV/V		
	700 V to 1000 V			
	10 Hz to 20 Hz	78 μV/V		
	20 Hz to 40 Hz	50 μV/V		
	40 Hz to 20 kHz	39 μV/V		
	20 kHz to 50 kHz	160 μV/V		
	50 kHz to 100 kHz	980 μV/V		
	1 kV to 8 kV		Using voltage divider.	
	50 Hz	0.50 %		
Specific values (measurement)				

CMCs for specific values of voltage at the frequencies shown, expressed in μV/V (k = 2)

Voltage	10 Hz	20 Hz	40 Hz, 500 Hz, 1 kHz, 10 kHz and 20 kHz	50 kHz	100 kHz	200 kHz	500 kHz	1 MHz
60 mV	150	85	76	76	78	160	180	680
100 mV	120	63	41	38	50	140	140	690
200 mV	120	63	41	38	50	140	140	690
600 mV	120	52	29	30	42	140	160	690
1 V	120	43	16	27	33	120	170	800
2 V	120	43	16	27	33	120	170	800
6 V	120	44	18	25	35	83	200	780
10 V	120	44	21	26	33	83	200	780
20 V	120	44	21	26	33	83	200	780
60 V	120	46	37	36	69	110	300	790
100 V	130	46	37	42	65	120	470	
200 V	130	46	37	42	65	120	470	
600 V	130	78	37	88	820			
1000 V	130	78	48	91	820			

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC CURRENT Generation	*10 Hz to 1 kHz*		Known values of AC current for application to current measuring instruments.	Portchester
	10 μA to 100 μA	0.030 % + 15 nA		
	100 μA to 1 mA	0.025 % + 120 nA		
	1 mA to 10 mA	0.020 % + 1.2 μA		
	10 mA to 100 mA	0.015 % + 12 μA		
	100 mA to 1 A	0.040 % + 120 μA		
	1 A to 10 A	0.060 % + 1.5 mA		
	1 kHz to 5 kHz			
	10 μA to 100 μA	0.040 % + 30 nA		
	100 μA to 1 mA	0.025 % + 120 nA		
	1 mA to 10 mA	0.025 % + 1.2 μA		
	10 mA to 100 mA	0.025 % + 12 μA		
	100 mA to 1 A	0.055 % + 160 μA		
	1 A to 10 A	0.11 % + 1.9 mA		
	5 kHz to 10 kHz			
	1 A to 10 A	0.26 % + 7.0 mA		
	10 kHz to 20 kHz			
	1 A to 10 A	0.85 % + 20 mA		
	30 Hz to 400 Hz			
	10 A to 1000 A	0.20 % to 0.70 %	For calibration of current clamps and similar devices using multi-turn coil method.	
Measurement	*10 Hz to 5 kHz*			
	0 μA to 200 μA	0.035 % + 25 nA		
	200 μA to 2 mA	0.030 % + 0.23 μA		
	2 mA to 20 mA	0.030 % + 2.3 μA		
	20 mA to 200 mA	0.030 % + 23 μA		
	200 mA to 2 A	0.081 % + 0.23 mA		
	40 Hz to 10 kHz			
	5 mA to 10 mA	34 μA/A + 0.12 μA		
	10 mA to 100 mA	34 μA/A + 0.23 μA		
	100 mA to 1 A	38 μA/A + 2.0 μA		
	1 A to 3 A	43 μA/A + 20 μA		
	3 A to 10 A	72 μA/A + 20 μA		
	10 A to 20 A	76 μA/A + 0.20 mA		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
INDUCTANCE				Portchester
Specific Values - Generation	*1 kHz*		Known values of inductance for application to inductance measuring instruments.	
	1 μH	0.0012 μH		
	10 μH	0.010 μH		
	100 μH	0.016 μH		
	1 mH	0.13 μH		
	10 mH	0.78 μH		
	100 mH	8.4 μH		
	1 H	0.12 μH		
	10 H	24 mH		
Specific Values - Measurement	*1 kHz*		Using inductance bridge.	
	1 μH	0.005 μH		
	10 μH	0.011 μH		
	100 μH	0.016 %		
	1 mH	0.014 %		
	10 mH	0.013 %		
	100 mH	0.013 %		
	1 H	0.015 %		
Other Values				
Measurement	*1 kHz*		Using inductance bridge.	
	1 μH to 10 μH	0.45 %		
	10 μH to 100 μH	0.11 %		
	100 μH to 1 mH	0.021 %		
	1 mH to 10 mH	0.016 %		
	10 mH to 100 mH	0.015 %		
	100 mH to 1 H	0.015 %		
	1 H to 10 H	0.24 %		
CAPACITANCE				
Specific Values			Known values of capacitance for application to capacitance measuring instruments.	
Generation	*1 kHz*			
	10 pF	4.0 μF/F		
	100 pF	4.0 μF/F		
	1 nF	4.0 μF/F		
	10 nF	41 μF/F		
	100 nF	41 μF/F		
	1 μF	63 μF/F		
	100 μF	0.050 %		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
CAPACITANCE				**Portchester**
Measurement	*1 kHz*			
	10 pF	9.5 μF/F		
	100 pF	7.7 μF/F		
	1 nF	7.4 μF/F		
	10 nF	41 μF/F		
	100 nF	41 μF/F		
	1 μF	63 μF/F		
	100 μF	0.050 %		
Other Values	*1 kHz and 1592 Hz*			
	1 pF to 10 μF	0.010 %		
	10 μF to 100 μF	0.050 %		
Capacitance Simulation			These values are sourced by simulation.	
	0.4 nF to 1.1 nF 10 Hz to 10 kHz	0.59 % + 12 pF		
	1.1 nF to 3.3nF 10 Hz to 3 kHz	0.59 % + 12 pF		
	3.3 nF to 11 nF 10 Hz to 1 kHz	0.29 % + 15 pF		
	11 nF to 33 nF 10 Hz to 1 kHz	0.29 % + 0.12 nF		
	33 nF to 110 nF 10 Hz to 1 kHz	0.29 % + 0.14 nF		
	110 nF to 330 nF 10 Hz to 1 kHz	0.29 % + 0.40 nF		
	330 nF to 1.1 μF 10 Hz to 600 Hz	0.29 % + 1.4 nF		
	1.1 μF to 3.3 μF 10 Hz to 300 Hz	0.30 % + 3.5 nF		
	3.3 μF to 11 μF 10 Hz to 150 Hz	0.29 % + 15 nF		
	11 μF to 33 μF 10 Hz to 120 Hz	0.49 % + 35 nF		
	33 μF to 110 μF 10 Hz to 80 Hz	0.53 % + 0.15 μF		
	110 μF to 330 μF DC to 50 Hz	0.53 % + 0.35 μF		
	330 μF to 1.1 mF DC to 20 Hz	0.53 % + 1.2 μF		
	1.1 mF to 3.3 mF DC to 6 Hz	0.53 % + 3.5 μF		
	3.3 mF to 11 mF DC to 2 Hz	0.53 % + 12 μF		
	11 mF to 33 mF DC to 0.6 Hz	0.88 % + 35 μF		
	33 mF to 110 mF DC to 0.2 Hz	1.3 % + 0.12 mF		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
FREQUENCY				**Portchester**
Specific Values	1 MHz and 10 MHz	2.6 in 10^{12}	Using off-air reference.	
Other Values	0.001 Hz to 0.01 Hz 0.01 Hz to 10 Hz 10 Hz to 100 MHz 100 MHz to 18 GHz	12 in 10^7 + 1 count 12 in 10^8 + 1 count 12 in 10^9 + 1 count 4.0 in 10^9 + 1 count	Using frequency counter.	
TIME INTERVAL	1 μs to 10 ms 10 ms to 100 ms 0.1 s to 1 s 1 s to 10 s 10 s to 100 s 100 s to 1000 s 1000 s to 10 000 s 10 000 s to 100 000 s	10 ns 30 ns 200 ns 2.0 μs 20 μs 200 μs 2.0 ms 20 ms	Using time interval averaging	
Timers and time interval	1 s to 24 hours	50 ms	Stopwatch Calibration	
TRANSITION TIME (pulse waveforms)	0 ns to 20 ns 20 ns to 200 ns 200 ns to 2 μs	5.5 % + 520 ps 5.5 % + 540 ps 5.5 %	Using fast rise oscilloscope.	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)		Remarks	Location Code
RF BANDWIDTH (oscilloscope calibration)	For input voltages in the range 10 mV p-p to 5 V p-p			Expressed in terms of the frequency at which the - 3dB point is obtained, with respect to a low frequency reference point	Portchester
	50 kHz to 250 MHz	2.5 %		For input VSWR not exceeding 1.3:1	
	250 MHz to 550 MHz	2.6 %			
	50 kHz to 600 MHz	6.0 %		For input VSWR not exceeding 2.5:1	
	600 MHz to 1.6 GHz	6.5 %			
	1.6 GHz to 2.1 GHz	7.5 %		*The uncertainties will be increased for values of VSWR greater than those shown above.*	
Electrical calibration of temperature indicators and simulators		Excluding CJC	Including CJC	By injection or measurement of equivalent DC voltages.	
Types K and N thermocouples	-250 ºC to -200 ºC -200 ºC to -50 ºC -50 ºC to +1370 ºC	1.0 ºC 0.25 ºC 0.12 ºC	1.0 ºC 0.34 ºC 0.26 ºC		
Type T thermocouples	-200 ºC to -100 ºC -100 ºC to 0 ºC 0 ºC to 400 ºC	0.20 ºC 0.12 ºC 0.10 ºC	0.30 ºC 0.26 ºC 0.24 ºC		
Type R thermocouples	0 ºC to 40 ºC 40 ºC to 250 ºC 250 ºC to 1760 ºC	0.8 ºC 0.5 ºC 0.32 ºC	1.3 ºC 1.1 ºC 1.1 ºC		
Type E thermocouples	-50 ºC to +150 ºC 150 ºC to 1000 ºC	0.10 ºC 0.050 ºC	0.24 ºC 0.24 ºC		
Type J thermocouples	-210 ºC to -180 ºC -180 ºC to +100 ºC 100 ºC to +1200 ºC	0.20 ºC 0.10 ºC 0.10 ºC	0.28 ºC 0.26 ºC 0.24 ºC		
Resistance sensors	-200 °C to 0 °C 0 °C to 750 °C 750 °C to 850 °C	0.010 °C 0.040 °C 0.050 °C		Simulation using equivalent DC resistance values.	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
RELATIVE HUMIDITY and DEW POINT				Portchester
Dew point	-20 °C to +90 °C	0.20 °C		
Relative humidity instruments	*10 °C* 20 %rh to 50 %rh *10 °C to 90 °C* 10 %rh to 50 %rh *10 °C to 90 °C* 50 %rh to 95 %rh	0.15 °C 1.2 %rh 0.15 °C 1.5 %rh 0.20 °C 2.0 %rh	Using a working volume of 10 mm within chamber space	
Relative humidity instruments	*5 °C to 60 °C* 5 %rh to 15 %rh 15 %rh to 50 %rh 50 %rh to 75 %rh 75 %rh to 95 %rh	0.19 °C 0.50 %rh 1.0 %rh 1.5 %rh 2.0 %rh	Chamber volume 1.5 litres	
Saturated salt capsules	*At 20 °C* 5 %rh to 50 %rh 50 %rh to 75 %rh 75 %rh to 98 %rh	 1.1 %rh 1.6 %rh 2.1 %rh		
TEMPERATURE				
Resistance thermometers	Triple point of water (0.01 °C) Ice point (0.00 °C)	0.0030 °C 0.0050 °C		
	-70 °C to +250 °C 250 °C to 450 °C 450 °C to 650 °C	0.016 °C 0.030 °C 0.055 °C	By comparison in a fluid bath	
	-90 °C to -40 °C -40 °C to 155 °C 155 °C to 300 °C 300 °C to 500 °C 500 °C to 650 °C	0.087 °C 0.048 °C 0.072 °C 0.076 °C 0.097 °C	By comparison in a dry block	
	-100 °C to -50 °C -50 °C to +155 °C	0.037 °C 0.030 °C	4 mm and 6 mm dry block reference probes by comparison in a dry block	
Noble Metal thermocouples (Type R only)	+100 °C to +650 °C +650 °C to +1100 °C +1100 °C to +1200 °C	1.00 °C 1.80 °C 2.30 °C	By comparison in a dry block	
Base Metal thermocouples (Type K)	-90 °C to +300 °C +300 °C to +650 °C +650 °C to +1100 °C +1100 °C to +1200 °C	0.30 °C 0.50 °C 1.60 °C 2.30 °C	By comparison in a dry block	
(Type T)	-90 °C to +350 °C	0.30 °C		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
Type J	-40 °C to +300 °C +300 °C to +650 °C +650 °C to +750 °C	0.30 °C 0.50 °C 1.20 °C		Portchester
Type N	-90 °C to +300 °C +300 °C to +650 °C +650 °C to +1100 °C +1100 °C to +1200 °C	0.40 °C 0.50 °C 1.60 °C 2.30 °C		
Calibration of Block calibrators	-100 °C to 155 °C 155 °C to 230 °C 230 °C to 650 °C 650 °C to 1100 °C 1100 °C to 1200 °C	0.042 °C 0.053 °C 0.073 °C 1.8 °C 2.2 °C	using PRT sensors using PRT sensors using PRT sensors using thermocouples using thermocouples	
Calibrations in air chamber	-40 °C to +5 °C 5 °C to 100 °C	0.19 °C 0.25 °C		
Electronic thermometers with sensors	Ranges as for above sensors	as for sensor		
PRESSURE				
Calibration of pressure indicating instruments and gauges			Including calibration of pressure measuring devices with an electrical output	
Gas pressure (absolute)	80 kPa to 115 kPa	10 Pa	Calibration by comparison with a digital pressure standard	
Gas pressure (gauge)				
Calibration of pressure indicating instruments and gauges	-95 kPa to -3.5 kPa -3.5 kPa to 3.5 kPa 3.5 kPa to 50 kPa 50 kPa to 2.5 MPa 2.5 MPa to 6 MPa 6 MPa to 25 MPa	0.010 % 0.040 % +1.5 Pa 0.010 % 0.0080 % 0.050 % + 2.7 kPa 0.050 % + 13 kPa	Absolute pressure calibrations may be undertaken by associated barometric pressure measurement with an additional uncertainty of ± 10 Pa	
Hydraulic pressure (gauge)				
Calibration of pressure indicating instruments and gauges	600 kPa to 6.0 MPa 6.0 MPa to 70 MPa	0.010 % 0.010 %	Calibration by comparison with a deadweight tester using hydraulic oil or alternatively water via a separator which will attract an additional 2.8 kPa measurement uncertainty.	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
CALIBRATION OF 16TH/17TH EDITION TEST EQUIPMENT			Using dedicated calibrator that covers all relevant functions.	**Portchester**
Insulation Resistance	*Test voltages up to 1.1kV*			
	0 MΩ to 5 MΩ	0.12 % + 10 kΩ		
	5 MΩ to 10 MΩ	1.2 % + 10 kΩ		
	10 MΩ to 100 MΩ	1.2 % + 65 kΩ		
	100 MΩ to 1 GΩ	1.2 % + 8.1 MΩ		
	10 GΩ	5.8 %		
	Test voltage 5 kV			
	1 GΩ to 200 GΩ	1.8 %		
Continuity Resistance	0 Ω to 10 Ω	0.29 % + 31 mΩ		
	10 Ω to 100 Ω	0.29 % + 33 mΩ		
	100 Ω to 1 kΩ	0.29 % + 12 mΩ		
	1 kΩ to 5 kΩ	0.29 % + 1.6 Ω		
	5 kΩ to 50 kΩ	0.29 % + 16 Ω		
Continuity Current	0 mA to 320 mA	1.5 % + 0.81 mA		
Insulation Voltage	50 V to 1000 V	1.2 % + 0.93 V		
Loop Resistace	*At 50 Hz*			
	0.05 Ω to 1 kΩ	0.58 % + 5.0 mΩ		
	10 Ω	0.72 %		
	100 Ω	0.58 %		
	1 kΩ	0.58 %		
RCD Current	*At 50 Hz*		For trip times up to 5 s.	
	2 mA to 10 mA	1.4 % + 73 µA		
	10 mA to 30 mA	1.4 % + 110 µA		
	30 mA to 100 mA	1.4 % + 0.16 mA		
	100 mA to 300 mA	1.4 % + 0.11 mA		
	300 mA to 1 A	1.4 % + 1.7 mA		
	1 A to 3 A	1.4 % + 3.1 mA		
RCD Trip Time	20 ms to 390 ms	0.69 ms		
	390 ms to 900 ms	8.1 ms		
Earth Bond Current	*At 50 Hz*			
	100 mA to 500 mA	1.7 %		
	500 mA to 10 A	1.7 %		
	10 A to 30 A	1.7 %		
Earth Bond Resistance	*At 50 Hz*			
	0.05 Ω to 1 kΩ	0.58 % + (4.7 to 35) mΩ		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
CALIBRATION OF 16TH/17TH EDITION TEST EQUIPMENT (continued)			Using dedicated calibrator that covers all relevant functions.	**Portchester**
Earth Leakage Current Test	*At 50 Hz* 240 µA, 1 mA and 3 mA	1.7 % + 9.7 µA		
Flash Voltage Test	*At 50 Hz* 500 V to 1000 V (Class 1) 1000 V to 1500 V (Class 1) 2000 V to 3600 V (Class 2)	 4.6 % + 12 V 4.6 % + 17 V 4.6 % + 23 V		
Flash Current Test	*At 50 Hz:* 1 mA to 3 mA	 5.8 % + 17 µA		
AC Voltage Output *At 50 Hz*	100 V to 400 V	2.3 % + (0.20 to 0.28) V		
<u>RELATIVE HUMIDITY</u>				**Site Calibration**
Humidity controlled chambers (including associated indicators, controllers and recorders)	*10 °C to 90 °C* 5.0 %rh to 98 %rh	 2.0 %rh	There may be an additional uncertainty due to the performance of the chamber being calibrated	
<u>TEMPERATURE</u>				
Check wording) Temperature controlled chambers, autoclaves, fridges/refrigerators, freezers, ovens and furnaces (including associated indicators, controllers and recorders)	 -80 °C to -40 °C -40 °C to +150 °C 150 °C to 250 °C 250 °C to 375 °C 375 °C to 600 °C 600 °C to 1100 °C	 1.0 °C 0.15 °C 1.0 °C 2.1 °C 5.2 °C 5.6 °C	Single and multipoint time dependent temperature profiling, also referred to as spatial temperature surveying or mapping	
Temperature indicators with probes	-196 °C -20 °C to +140 °C 140 °C to 600 °C	0.50 °C 0.15 °C 0.21 °C	Using customer's source	
<u>TIME</u>				
Timers and time interval	5 s to 24 hours	1.0 s	Elapsed time measurement.	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL				Site Calibration
TEMPERATURE SIMULATION				
Calibration of temperature indicators for the following sensor types			By injection of equivalent DC voltages or resistances.	
Base metal thermocouple	-250 °C to -200 °C -200 °C to 0 °C 0 °C to 1000 °C 1000 °C to 1370 °C	1.5 °C 0.29 °C 0.12 °C 0.17 °C	Excluding cold junction compensation	
	-250 °C to -200 °C -200 °C to 0 °C 0 °C to 1370 °C	1.5 °C 0.40 °C 0.30 °C	Including cold junction compensation	
Noble metal thermocouple	0 °C to 40 °C 40 °C to 250 °C 250 °C to 1760 °C	1.2 °C 0.70 °C 0.47 °C	Excluding cold junction compensation	
	0 °C to 40 °C 40 °C to 250 °C 250 °C to 1760 °C	1.5 °C 1.2 °C 1.1 °C	Including cold junction compensation	
Resistance sensors	-200 °C to 0 °C 0 °C to 750 °C 750 °C to 850 °C	0.040 °C 0.35 °C 0.40 °C		
DC VOLTAGE				
Generation	0 mV to 10 mV 10 mV to 0.1 V 0.1 V to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1000 V	0.027 % + 3.9 μV 0.018 % + 8.5 μV 0.010 % + 14 μV 0.012 % + 120 μV 0.023 % + 6.0 mV 0.035 % + 58 mV	Application of known DC voltages to voltage measuring instruments.	
Measurement	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	0.030 % + 6.0 μV 0.0050 % + 9.0 μV 0.0040 % + 60 μV 0.0060 % + 0.70 mV 0.0060 % + 2.0 mV	Using digital multimeter.	
	1 kV to 2 kV 2 kV to 20 kV	0.060 % + 0.60 V 0.080 % + 6.0 V	Using multimeter and voltage divider.	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
DC RESISTANCE				
Generation	10 mΩ to 10 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ	0.013 % + 0.30 mΩ 0.070 % + 45 mΩ 0.070 % + 2.5 Ω 0.070 % + 120 Ω 0.090 % + 1.5 kΩ	Application of known DC resistances to resistance measuring instruments.	
Measurement	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	0.012 % + 5.4 mΩ 0.012 % + 2.9 mΩ 0.012 % + 0.13 Ω 0.012 % + 1.30 Ω 0.013 % + 17 Ω 0.050 % + 0.26 kΩ 1.3 % + 12 kΩ	Using digital multimeter.	
DC CURRENT				
Generation	0 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 10 A	0.029 % + 6.4 nA 0.019 % + 8.1 nA 0.012 % + 0.27 μA 0.013 % + 2.4 μA 0.035 % + 63 μA 0.071 % + 2.3 mA	Application of known DC currents to current measuring instruments.	**Site Calibration**
Measurement	0 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A 1 A to 3 A	0.060 % + 2.5 μA 0.060 % + 6.0 μA 0.12 % + 0.20 mA 0.15 % + 1.0 mA	Using digital multimeter.	
AC VOLTAGE			Application of known AC voltages to voltage measuring instruments.	
Generation	1 mV to 10 mV			
	40 Hz to 400 Hz *400 Hz to 800 Hz* *800 Hz to 3.2 kHz* *3.2 kHz to 6.4 kHz* *6.4 kHz to 12.8 kHz*	0.17 % + 6.0 μV 0.33 % + 12 μV 0.47 % + 12 μV 1.2 % + 23 μV 2.9 % + 60 μV		
	10 mV to 100 mV			
	40 Hz to 400 Hz *400 Hz to 800 Hz* *800 Hz to 1.6 kHz* *1.6 kHz to3.2 kHz* *3.2 kHz to 6.4 kHz* *6.4 kHz to 12.8 kHz*	0.12 % + 60 μV 0.33 % + 120 μV 0.49 % + 120 μV 0.47 % + 120 μV 1.2 % + 230 μV 2.9 % + 580 μV		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC VOLTAGE (continued)				**Site Calibration**
Generation	100 mV to 1 V			
	40 Hz to 400 Hz	0.090 % + 87 μV		
	400 Hz to 800 Hz	0.17 % + 140 μV		
	800 Hz to 1.6 kHz	0.33 % + 240 μV		
	1.6 kHz to 3.2 kHz	0.47 % + 470 μV		
	3.2 kHz to 6.4 kHz	1.2 % + 1.2 mV		
	6.4 kHz to 12.8 kHz	2.9 % + 2.3 mV		
	1 V to 10 V			
	40 Hz to 400 Hz	0.090 % + 0.90 mV		
	400 Hz to 800 Hz	0.17 % + 1.2 mV		
	800 Hz to 1.6 kHz	0.33 % + 2.4 mV		
	1.6 kHz to 3.2 kHz	0.47 % + 5.0 mV		
	3.2 kHz to 6.4 kHz	1.2 % + 12 mV		
	6.4 kHz to 12.8 kHz	2.9 % + 35 mV		
	10 V to 100 V			
	40 Hz to 400 Hz	0.14 % + 14 mV		
	100 V to 1000 V			
	40 Hz to 400 Hz	0.19 % + 0.59 V		
Measurement	10 mV to 100 mV		Using digital multimeter.	
	32 Hz to 330 Hz	0.12 % + 25 μV		
	330 Hz to 10 kHz	0.19 % + 25 μV		
	100 mV to 1.0 V			
	32 Hz to 330 Hz	0.080 % + 0.18 mV		
	330 Hz to 10 kHz	0.080 % + 0.18 mV		
	1 V to 10 V			
	32 Hz to 330 Hz	0.080 % + 5.0 mV		
	330 Hz to 10 kHz	0.080 % + 5.0 mV		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC VOLTAGE (continued)				**Site Calibration**
Measurement	10 V to 100 V			
	32 Hz to 330 Hz	0.080 % + 50 mV		
	330 Hz to 10 kHz	0.080 % + 50 mV		
	100 V to 750 V			
	32 Hz to 330 Hz	0.080 % + 0.50 V		
	330 Hz to 10 kHz	0.080 % + 0.50V		
	50 Hz			
	750 V to 2 kV	0.51 % + 3.00 V		
	2 kV to 8 kV	0.68 % + 50 V		
AC CURRENT			Application of known AC currents to current measuring instruments.	
Generation	10 μA to 100 μA			
	45 Hz to 100 Hz	0.22 % + 85 nA		
	100 Hz to 400 Hz	0.12 % + 90 nA		
	400 Hz to 800 Hz	0.34 % + 150 nA		
	100 μA to 1 mA			
	45 Hz to 100 Hz	0.11 % + 0.51 μA		
	100 Hz to 400 Hz	0.090 % + 0.70 μA		
	400 Hz to 800 Hz	0.12 % + 0.40 μA		
	800 Hz to 1.6 kHz	0.24 % + 0.42 μA		
	1.6 kHz to 3.2 kHz	0.47 % + 0.60 μA		
	1 mA to 10 mA			
	45 Hz to 100 Hz	0.10 % + 2.6 μA		
	100 Hz to 400 Hz	0.070 % + 3.1 μA		
	400 Hz to 800 Hz	0.12 % + 3.2 μA		
	800 Hz to 1.6 kHz	0.23 % + 3.8 μA		
	1.6 kHz to 3.2 kHz	0.58 % + 5.5 μA		
	3.4 kHz to 6.4 kHz	2.3 % + 12 μA		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC CURRENT (continued)				**Site Calibration**
Generation	10 mA to 100 mA			
	45 Hz to 100 Hz	0.10 % + 26 μA		
	100 Hz to 400 Hz	0.070 % + 29 μA		
	400 Hz to 800 Hz	0.12 % + 30 μA		
	800 Hz to 1.6 kHz	0.23 % + 36 μA		
	1.6 kHz to 3.2 kHz	0.58 % + 54 μA		
	3.4 kHz to 6.4 kHz	2.3 % + 120 μA		
	100 mA to 1 A			
	45 Hz to 100 Hz	0.13 % + 0.30 mA		
	100 Hz to 400 Hz	0.15 % + 0.30 mA		
	400 Hz to 800 Hz	0.17 % + 0.40 mA		
	800 Hz to 1.6 kHz	0.26 % + 0.50 mA		
	1.6 kHz to 3.2 kHz	0.60 % + 0.70 mA		
	3.4 kHz to 6.4 kHz	2.3 % + 1.2 mA		
	1 A to 10 A			
	10 Hz to 400 Hz	0.14 % + 10 mA		
	400 Hz to 800 Hz	0.24 % + 12 mA		
	800 Hz to 1.6 kHz	0.36 % + 12 mA		
Measurement	0.1 A to 1 A		Using digital multimeter.	
	10 Hz to 1 kHz	0.15 % + 0.60 mA		
	1 A to 3 A			
	10 Hz to 1 kHz	0.20 % + 2.8 mA		
PRESSURE				
Gas pressure (absolute)				
Calibration of pressure indicating instruments and gauges	10 kPa to 400 kPa 400 kPa to 2.0 MPa	0.022 % + 420 Pa 0.062 % + 350 Pa	Including calibration of pressure measuring devices with an electrical output	
Gas pressure (gauge)				
Calibration of pressure indicating instruments and gauges	-95 kPa to 0 kPa 0 kPa to 10 kPa 10 kPa to 2 MPa	0.014 % + 75 Pa 0.020 % + 1.8 Pa 0.015 % + 370 Pa		
Hydraulic pressure (gauge)				
Calibration of pressure indicating instruments and gauges	0 MPa to 7 MPa 7 MPa to 16 MPa	0.035 % + 0.24 kPa 0.12 % + 2.3 kPa		

END

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: $Q[a, b] = [a^2 + b^2]^{1/2}$