

CERTIFICATE OF CALIBRATION

ISSUED BY: LAMBDA CALIBRATION LTD

DATE OF ISSUE: 30th May 2014

CERTIFICATE No: 306519



Lambda
CALIBRATION LTD

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Page 1 of 7

APPROVED SIGNATORY

D Whalley
A Kelly D Pilkington
D Whalley C Reed R Armitage

Customer: Premier Autoclaves Services & Solutions Ltd, Keighley, BD20 5LN
Item No: 11648
Description: Digital Multifunction Calibrator
Model/Range: MC2-TE
Manufacturer: Beamex
Date of Cal: 29/5/2015
Basis: E-2000
Equipment Used: LMMC-10, LVD-21, LTHE-158
Temp/Humidity: 20°C ± 2°C, <80%rh

Visual /Operational Checks:

Case Condition	Satisfactory
Operation of Switches & Display	Satisfactory
Leads Condition	Satisfactory
Battery	Recharged

Summary of Results:

Pre Calibration Status	The reported results fall within the specified tolerances
Post Calibration Status	The reported results fall within the specified tolerances
Adjustments	No
Repairs	No
Other Comments	-

Measured results and measurement uncertainties are detailed on the following pages.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

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UKAS ACCREDITED CALIBRATION LABORATORY No: 0495

CERTIFICATE No:
306519

Page 2 of 7

Measurement Mode:

Low DC Voltage

Range (mV)	Applied Value (mV)	Manufacturers Tolerance	Instrument Reading (mV)
150	0.0000	$\pm(0.02\% + 4\mu\text{V})$	0.000
150	100.000	$\pm(0.02\% + 4\mu\text{V})$	99.996

DC Voltage

Range (V)	Applied Value (V)	Manufacturers Tolerance	Instrument Reading (V)
250 m	0.0000 m	$\pm(0.02\% + 4\mu\text{V})$	-0.003m
250 m	50.000 m	$\pm(0.02\% + 4\mu\text{V})$	49.998m
250 m	-50.000 m	$\pm(0.02\% + 5\mu\text{V})$	-50.001m
250 m	100.000 m	$\pm(0.02\% + 5\mu\text{V})$	99.999m
250 m	-100.000 m	$\pm(0.02\% + 5\mu\text{V})$	-99.999m
1000 m	500.00 m	$\pm(0.02\% + 5\mu\text{V})$	499.99m
1000 m	-500.00 m	$\pm(0.02\% + 5\mu\text{V})$	-500.00m
1000 m	900.00 m	$\pm(0.02\% + 5\mu\text{V})$	899.99m
1000 m	-900.00 m	$\pm(0.02\% + 5\mu\text{V})$	-899.99m
25	2.00000	$\pm(0.02\% + 0.25\text{mV})$	1.9999
25	5.00000	$\pm(0.02\% + 0.25\text{mV})$	4.9998
25	10.00000	$\pm(0.02\% + 0.25\text{mV})$	9.9997
25	20.00000	$\pm(0.02\% + 0.25\text{mV})$	19.9994
60	50.0000	$\pm(0.02\% + 0.25\text{mV})$	49.997

DC Current

Range (mA)	Applied Value (mA)	Manufacturers Tolerance	Instrument Reading (mA)
25	5.00000	$\pm(0.02\% + 1.5\mu\text{A})$	5.0002
25	10.00000	$\pm(0.02\% + 1.5\mu\text{A})$	10.0004
25	24.00000	$\pm(0.02\% + 1.5\mu\text{A})$	23.9985
100	95.0000	$\pm(0.02\% + 1.5\mu\text{A})$	95.003
100	-95.0000	$\pm(0.02\% + 1.5\mu\text{A})$	-95.009

CERTIFICATE OF CALIBRATION

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UKAS ACCREDITED CALIBRATION LABORATORY No: 0495

CERTIFICATE No:
306519

Page 3 of 7

Frequency

Range (Hz)	Applied Value (Hz)	Manufacturers Tolerance	Instrument Reading (Hz)
5	4.50000	±0.01%	4.50004
50	45.0000	±0.01%	45.0004
500	450.000	±0.01%	450.003
5k	4.50000 k	±0.01%	4500.04
50k	45.0000 k	±0.01%	45000.4

Module TE

Resistance (measurement) – 4 Wire

Range (Ω)	Applied Value (Ω)	Manufacturers Tolerance	Instrument Reading (Ω)
250	0.0000	±(0.02% + 3.5mΩ)	0.001
250	240.000	±(0.02% + 3.5mΩ)	240.003
2500	2400.00	±(0.02% + 3.5mΩ)	2399.85
4000	3900.00	±(0.02% + 3.5mΩ)	3899.7

Temperature Check (Cold junction reference compensation switched on)

Temperature Type K (measurement)

Applied Simulated Temperature (°C)	Manufacturers Tolerance	Instrument Reading (°C)
-200.00	±0.55°C	-200.51
0.00	±0.55°C	-0.27
1200.00	±0.65°C	1199.73

Temperature Type J (measurement)

Applied Simulated Temperature (°C)	Manufacturers Tolerance	Instrument Reading (°C)
-200.00	±0.55°C	-200.31
1000.00	±0.55°C	999.89

CERTIFICATE OF CALIBRATION

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UKAS ACCREDITED CALIBRATION LABORATORY No: 0495

CERTIFICATE No:
306519

Page 4 of 7

Temperature Type N (measurement)

Applied Simulated Temperature (°C)	Manufacturers Tolerance	Instrument Reading (°C)
-150.00	±0.65°C	-150.45
100.00	±0.65°C	99.81
1200.0	±0.65°C	1199.81

Thermocouple Type R (measurement)

Applied Simulated Temperature (°C)	Manufacturers Tolerance	Instrument Reading (°C)
0.00	±1.05°C	-0.02
1750.0	±0.85°C	1749.95

Thermocouple Type T (measurement)

Applied Simulated Temperature (°C)	Manufacturers Tolerance	Instrument Reading (°C)
-200.00	±0.55°C	-200.42
390.00	±0.45°C	389.88

RTD (4 Wire) – Type PT100/385

Applied Simulated Temperature (°C)	Manufacturers Tolerance	Instrument Reading (°C)
-190.00	±0.1°C	-190.00
100.00	±0.1°C	100.03
400.00	±0.2°C	400.04
800.00	±0.3°C	800.04

CERTIFICATE OF CALIBRATION

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UKAS ACCREDITED CALIBRATION LABORATORY No: 0495

CERTIFICATE No:
306519

Page 5 of 7

Generation Mode:

Module TE

DC Voltage

Range (V)	Instrument Indication (V)	Manufacturers Tolerance	Measured Output (V)
0.25	0.20000	$\pm(0.02\% + 0.1\text{mV})$	0.200005
0.25	-0.20000	$\pm(0.02\% + 0.1\text{mV})$	-0.200014
12	1.00000	$\pm(0.02\% + 0.1\text{mV})$	1.000037
12	2.50000	$\pm(0.02\% + 0.1\text{mV})$	2.50012
12	5.00000	$\pm(0.02\% + 0.1\text{mV})$	5.00020
12	11.00000	$\pm(0.02\% + 0.1\text{mV})$	11.00066

Low DC Voltage

Range (mV)	Instrument Indication (mV)	Manufacturers Tolerance	Measured Output (mV)
150	0.000	$\pm(0.02\% + 4\mu\text{V})$	0.0017
150	25.000	$\pm(0.02\% + 4\mu\text{V})$	25.0016
150	100.000	$\pm(0.02\% + 4\mu\text{V})$	100.0037

DC Current

Range (mA)	Instrument Indication (mA)	Manufacturers Tolerance	Measured Output (mA)
25	5.0000	$\pm(0.02\% + 1.5\mu\text{A})$	4.99989
25	10.0000	$\pm(0.02\% + 1.5\mu\text{A})$	9.99971
25	15.0000	$\pm(0.02\% + 1.5\mu\text{A})$	14.99963
25	20.0000	$\pm(0.02\% + 1.5\mu\text{A})$	20.0025
25	24.0000	$\pm(0.02\% + 1.5\mu\text{A})$	24.0027

Resistance

Range (Ω)	Instrument Indication (Ω)	Manufacturers Tolerance	Measured Output (Ω)
400	200.00	$\pm 0.04\%$	200.036
400	390.0	$\pm 0.04\%$	390.045
4000	3900.0	$\pm 0.04\%$	3900.52

CERTIFICATE OF CALIBRATION

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CERTIFICATE No:
306519

Page 6 of 7

RTD – Type PT 100/385 – (4 Wire)

Range (°C)	Instrument Indication (Ω)	Manufacturers Tolerance	Measured Output (Ω)	Equivalent Temperature (°C)
0.0	100.00	±0.1°C	100.0065	0.017
100.00	138.50	±0.1°C	138.5168	100.030
600.00	313.72	±0.2°C	313.7330	600.078

Thermocouple Simulation

With the MC2 CJ set to INT the appropriate compensating cable was used for the selected input. A standard thermometer was used as a comparator to measure the output of the MC2 against our standard calibrator with its calibrated cold junction module.

Temperature Type K (Simulation)

Instrument Indication (°C)	Manufacturers Tolerance	Measured Equivalent Temperature (°C)
-190.00	±0.55°C	-189.6
0.00	±0.55°C	0.2
500.00	±0.55°C	500.3
950.00	±0.55°C	950.4
1300.00	±0.65°C	1300.3

ET: Temperature Type J (Simulation)

Instrument Indication (°C)	Manufacturers Tolerance	Measured Equivalent Temperature (°C)
-200.00	±0.55°C	-199.7
1000.00	±0.55°C	1000.4

CERTIFICATE OF CALIBRATION

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CERTIFICATE No:
306519

Page 7 of 7

ET: Temperature Type N (Simulation)

Instrument Indication (°C)	Manufacturers Tolerance	Measured Equivalent Temperature (°C)
0.00	±0.65°C	0.3
1000.00	±0.65°C	1000.3

Estimated Uncertainty of Measurement:

Resistance (generation): $\pm(0.03\% + 11\text{m}\Omega + 1\text{LSD})$

Resistance (measurement): $\pm(15\text{ppm} + 68\mu\Omega + 1\text{LSD})$

DC Voltage (generation): $\pm(0.022\% + 5\mu\text{V} + 1\text{LSD})$

DC Voltage (measurement): $\pm(7.4\text{ppm} + 2\mu\text{V} + 1\text{LSD})$

DC Current (generation): $\pm(0.11\% + 1\text{LSD})$

DC Current (measurement): $\pm 118\text{ppm} + 1.2\mu\text{A}$

Frequency (generation): $\pm 0.29\text{ppm} + 1\text{LSD}$.

Temperature (electrical simulation) Type K, J, N & T (generation): $\pm 0.34^\circ\text{C}$, Type R (generation): $\pm 0.53^\circ\text{C}$

Temperature (electrical simulation) Type K, J, N (measurement): $\pm 0.44^\circ\text{C}$