Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, CM6 1HD
www.campbell-associates.co.uk
Phone 01371 871030 Facsimile 01371879106

Certificate of Calibration

Certificate number: **U5630** **CALIBRATION** **0789**

Test object : **Sound Level Meter**
Manufacturer: **Norsonic**
Type : **140**
Serial no: **1402708**

Customer: **Campbell Associates Ltd**
Demo Fleet
Sonitus House, 5b Chelmsford Road Industrial Estate,
Contact name: **Mr John Campbell**
Contact telephone: **01371 871233**

Method of Calibration
Calibration has been performed as set out in the CA Technical procedures TP01 & 2 as appropriate.

The following items have been tested according to IEC 60651

	Producer:	Type:	Serial No:	Certificate number
Microphone	Norsonic	1225	91748	5629
Calibrator*	Norsonic	1251	30754	U5446
Preamplifier	Norsonic	1209	12184	Included

Additional items that also have been submitted for verification

Wind shield	Norsonic	Nor1451
Attenuator	None	

These items have been taken into account wherever appropriate.

Environmental conditions:	Pressure :	Temperature :	Relative humidity :
Reference conditions:	101.325 kPa	23.0 °C	50 %RH
Measurement conditions :	100.948 kPa	24.1 °C	58.1 %RH

Date received : 14/08/2009
Date of calibration: 14/08/2009
Date of issue: 17/08/2009

Engineer

Darren Batten

Supervisor

David Egan

* The calibrator was complete with any required coupler for the microphone specified

Calibration Certificate

UKAS Laboratory Number 0789

Certificate number U5630

Method

From markings on the sound level meter or by reference to the manufacturer's published literature it has been determined that the instrument submitted for verification was originally manufactured to BS EN 60651 and or BS EN 60804. The reference range, reference sound pressure level, primary indicator range, secondary indicator range, pulse range, linearity range and display range as specified by the manufacturer were used for the verification. The sound level meter was set to A weighting and adjusted to read correctly in response to the associated sound calibrator the reading was derived from the calibrator calibration certificate and manufacturer's instruction manuals. A measurement of the self noise of the sound level meter was then made using a dummy microphone having a capacitance of ±20% of the associated microphones self capacitance. The sound level meter was then tested, and its overall sensitivity adjusted, in accordance with Section 5 of BS 7580:Part 1:1997. The acoustic calibration at 1 kHz specified in sub-clause 5.6.1 of the standard was performed by application of a reference sound calibrator, whilst the tests at 125 Hz and 8k Hz (sub-clause 5.6.2) were performed by the electrostatic actuator method. At the end of the test, the associated sound calibrator was reapplied to the sound level meter and the meter reading was recorded and is noted below in the statements section.

Traceability
The measured values are traceable to the following laboratories:
Sound Pressure Level: National Physical Laboratory United Kingdom
Voltage: National Physical Laboratory United Kingdom
Frequency: National Physical Laboratory United Kingdom
Ambient Pressure: National Physical Laboratory United Kingdom
Temperature & Relative Humidity: National Physical Laboratory United Kingdom

Measurement Results:

Noise test - BS 7580 #5.5.2	Passed
Level Linearity Test - BS 7580, #5.5.3	Passed
Frequency weightings: A Network - BS 7580 #5.5.4	Passed
Frequency weightings: C Network - BS 7580 #5.5.4	Passed
Time weightings F and S - BS7580 #5.5.5	Passed
Peak response - BS7580 #5.5.6	Passed
RMS accuracy - BS7580 #5.5.7	Passed
Time weighting I - BS7580 #5.5.8	Passed
Integrating Test : Time averaging - BS7580 #5.5.9	Passed
Integrating Test : Pulse range - BS7580 #5.5.10	Passed
Integrating Test : Sound exposure level - BS7580 #5.5.11	Passed
Overload SPL Test - BS 7580 #5.5.12	Passed
Overload Leq Test - BS 7580 #5.5.12	Passed
Acoustic tests - BS 7580 #5.4 and 5.6	Passed
Summation of acoustic tests - BS 7580 #5.5.4	Passed

Statements

The self-generated noise recorded in the test specified in sub-clause 5.5.2 was: 7.3 dB(A) 10.4 dB(C) 18.1 dB(Z)

The correct setting for this combination of instruments as per BS 7580 #5.6.3 is: 114.0dB(A)

A stricter test than that specified in paragraphs 5.5.6 of BS7580:1997 has been used by verifying that the 10 ms reference pulse is also correct. The level uncertainty of the Laboratory's 1 kHz sound calibrator used during this verification is ± 0.1 dB.

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.

The sound level meter in the configuration tested was found to comply with BS 7580:1997 part 1 for a type 1 device. The associated calibrator has been corrected for barometric pressure at the time of calibration in accordance with the relevant manufacturer's instructions

Calibration Report

Certificate number 5631

Norsonic Type : 140 Serial no : 1402708

Customer:	Campbell Associates Ltd
Department:	Demo Fleet
Place:	Sonitus House, 5b Chelmsford Road Industrial Estate,
City:	Great Dunmow, Essex CM6 1HD
Order No:	Schedule
Contact Person:	Mr John Campbell
Phone/Mail:	01371 871 033

Microphone :	Norsonic	Type : 1225	Serial no : 1748	Sens:-26.23dB
Pre amplifier	Norsonic	Type : 1209	Serial no : 12 34	
Calibrator :	Norsonic	Type : 1251	Serial no : 30754	Level:114.11dB
Wind screen	Norsonic	Type : Nor1451		

Measured with Pre Amplifier
RS232 cable was included
Mains adapter was included

Measurement Results:

DIN 45 657 : Statistical Distribution Test - According to DIN45 657 #3.3	Passed
Filter Test 1/1octave: Anti Alias Filter - IEC 61260, #4.8 & #5.7	Passed
Filter Test 1/1octave: Linear operating range - IEC 61260, #4.6 & #5.5	Passed
Filter Test 1/1octave: Relative attenuation - IEC 61260, #4.4 & #5.3	Passed
Filter Test 1/1octave: Summation of output signals - IEC 61260, #4.9 & #5.8	Passed
Filter Test 1/1octave: Flat frequency response - IEC 61260, #4.10 & #5.9	Passed
Filter Test 1/3octave: Anti Alias Filter - IEC 61260, #4.8 & #5.7	Passed
Filter Test 1/3octave: Linear operating range - IEC 61260, #4.6 & #5.5	Passed
Filter Test 1/3octave: Relative attenuation - IEC 61260, #4.4 & #5.3	Passed
Filter Test 1/3octave: Summation of output signals - IEC 61260, #4.9 & #5.8	Passed
Filter Test 1/3octave: Flat frequency response - IEC 61260, #4.10 & #5.9	Passed

Comment :
Correct level with associated calibrator is 114.0 dB(A).

Environmental conditions:

Pressure :	Temperature :	Relative humidity :
100.948 kPa	24.1 °C	58.1 %RH

Date of calibration: 14/08/2009
Date of issue: 17/08/2009

Supervisor: David Egan
Engineer

Darren Batten TechIOA

Campbell Associates
www.campbell-associates.co.uk

Calibration Report

Certificate number 5629

Manufacturer:	Norsonic
Type :	1225
Serial no:	91748

Customer:	Campbell Associates Ltd
Department:	Hire
Place:	Sonitus House, 5b Chelmsford Road Industrial Estate, Dunmow,
City:	Essex. CM6 1HD
Contact Person:	Mr.David Egan - Laboratory Manager.

Measurement Results:

	Sensitivity : (dB re 1V/Pa)	Capacitance : (pF)
1:	-26.23	21.6
2:	-26.23	21.6
3:	-26.24	21.6
Result (Average) :	**-26.23**	**21.6**
Expanded Uncertainty:	0.10	2.00
Degree of Freedom:	>100	>100
Coverage Factor:	2.00	2.00

The following correction factors have been applied during the measurement:
Pressure :-0.010 dB/kPa Temperature :-0.007 dB/°C Relative humidity :0.000 dB/%RH

Reference Calibrator: WSC1 - Nor1253-24269. Volume correction: 0.000 dB

Records :K:\C A\Calibration\Nor-1504\Nor-1017 MicCal\2009\NOR1225_91748_M1.nmf

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA publication EA-4/02.

Comment:

Environmental conditions:

Pressure :	Temperature :	Relative humidity :
100.949 ± 0.002 kPa	24.0 ± 1.1 °C	53.9 ± 6.9 %RH

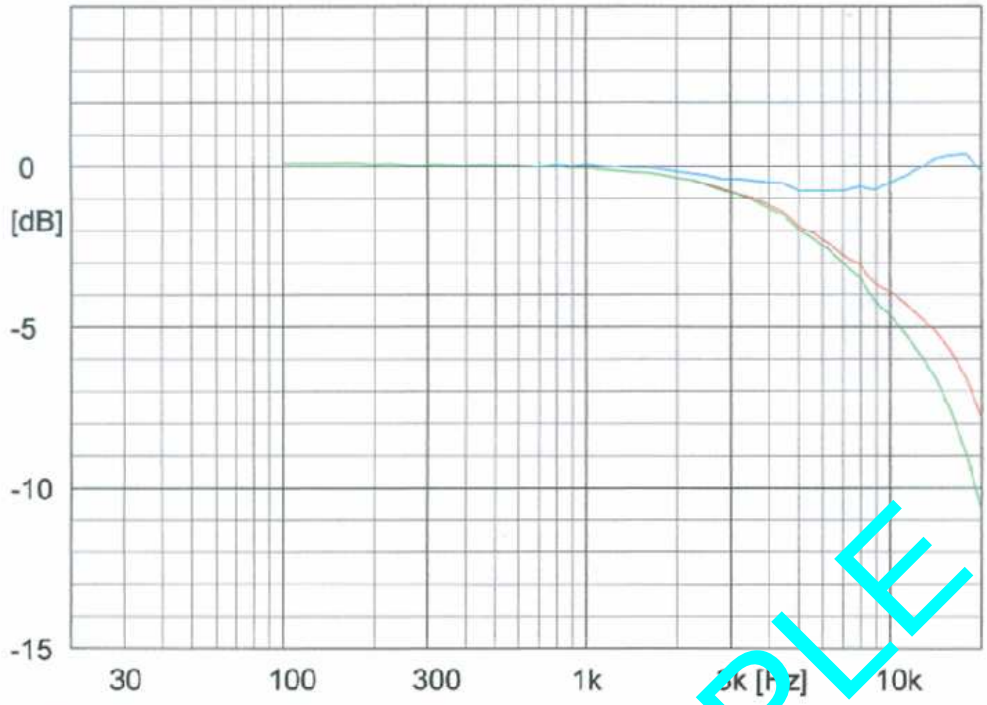
Date of calibration:14/08/2009
Date of issue:14/08/2009

Supervisor : David Egan
Engineer :

Michael Tickner

Campbell Associates
www.campbell-associates.co.uk

Microphone Calibration Certificate



Norsonic
Type : 1225

Serial no : 91748

Sensitivity : 48.81 mV/Pa
-26.23 ±0.10 dB re. 1 V/Pa
Capacitance : 21.6 ±2.0 pF
Date : 14/08/2009

Signature :

Measurement conditions :

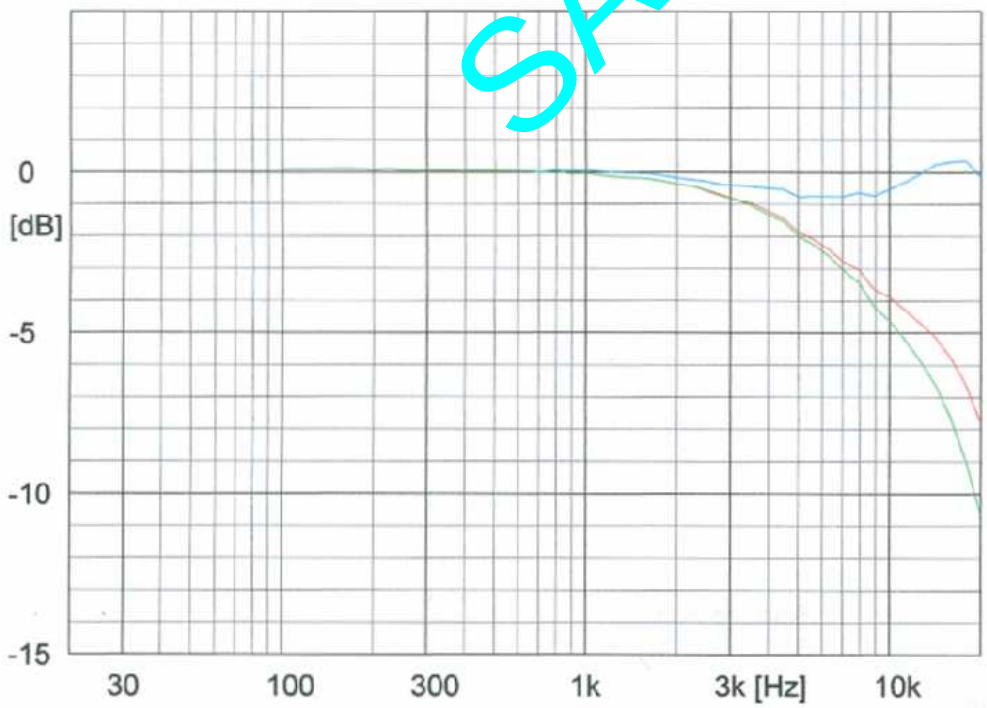
Polarisation voltage :	200.0 V
Pressure :	100.95 ±0.00 kPa
Temperature :	24.0 ±1.1 °C
Relative humidity :	53.9 ±6.9 %RH

Results are normalised to the reference conditions.

Free field response
Diffuse field response
Pressure (Actuator) response

Campbell Associates
www.campbell-associates.co.uk

Microphone Calibration Certificate



Norsonic
Type : 1225

Serial no : 91748

Sensitivity : 48.81 mV/Pa
-26.23 ±0.10 dB re. 1 V/Pa
Capacitance : 21.6 ±2.0 pF
Date : 14/08/2009

Signature :

Measurement conditions :

Polarisation voltage :	200.0 V
Pressure :	100.95 ±0.00 kPa
Temperature :	24.0 ±1.1 °C
Relative humidity :	53.9 ±6.9 %RH

Results are normalised to the reference conditions.

Free field response
Diffuse field response
Pressure (Actuator) response

Campbell Associates
www.campbell-associates.co.uk

Comment :