

Norsonic

Certificate of Calibration

Certificate No.: Cal 



Test object:	Manufacturer :	Type :
Sound level meter :	Norsonic	140
Microphone :	Norsonic	1225
Preamplifier :	Norsonic	1209
Sound calibrator :	none	

Serial No.:



Customer:
Order No:



The measurements are performed according to the IEC 61672-3 Ed. 1 (2006).

Acoustical levels are stated relative to 20 μ Pa. Other dB levels are relative values.

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

Statement of Conformity.

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2, to demonstrate that the model of sound level meter fully conforms to the requirements in the IEC 61672-2, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1.

Indication at the Calibration Check Frequency

The level indication of the sound level meter is controlled using the laboratory reference: WSC5 - Nor1251-32140. The indicated level was: 113,8 dB.

The test object had the following sensitivity setup: Microphone sensitivity :53,7 mV/Pa or
-25,4 dB rel 1V/Pa Preamplifier gain: -0,5 dB

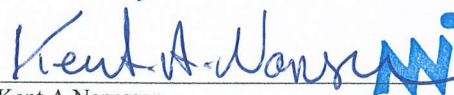
Environmental conditions:
Reference conditions:
Measurement conditions :

Pressure :
101,325 kPa
97,78 $\pm$ 0,20 kPa

Temperature :
23,0 $^{\circ}$ C
22,9 $\pm$ 1,0 $^{\circ}$ C

Humidity :
50 %RH
37,6 $\pm$ 2,0 %RH

Date of calibration: 2016-12-12
Date of issue: 2016-12-19
Supervisor: Ole-Herman Bjor
Engineer:


Kent A Narvesen

 **Norsonic AS**
Postboks 24
3421 Lierskogen
Org.nr. 929 743 040

This certificate of calibration is issued by a laboratory accredited by Norwegian Accreditation (NA). NA is one of the signatories to the EA Multilateral Agreement for mutual recognition of calibration certificates (European Co-operation for Accreditation). The accreditation states that the laboratory meets the NA requirements concerning competence and calibration system for all the calibrations contained in the accreditation. It also states that the laboratory has a satisfactory quality assurance system and traceability to accredited or national calibration laboratories. This certificate may not be reproduced other than in full.

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Preconditioning :

The equipment was preconditioned for more than 12 hours at the specified calibration temperature and humidity.

Measurement method :

A description of the calibration procedure (NTQ-L-007-005) is available separately from the calibration laboratory.

Traceability:

The measured quantities are traceable to the following laboratories:

Sound Pressure Level: PTB, Braunschweig, Germany

Ambient Pressure: Justervesenet, Kjeller, Norway

Temperature: Justervesenet, Kjeller, Norway

Relative Humidity: Justervesenet, Kjeller, Norway

Electrical quantities: IKM Laboratorium AS, Oslo, Norway

Summary of Measurement Results

Indication at the calibration check frequency - IEC61672-3 Ed.1 Clause 9

Self-generated noise - IEC 61672-3 Ed.1 Clause 10

Acoustical signal tests of a frequency weighting - IEC 61672-3 Ed.1 Clause 11

Electrical signal tests of frequency weightings - IEC 61672-3 Ed.1 Clause 12

Frequency weightings: A-Network - IEC 61672-3 Clause 12

Frequency weightings: C Network - IEC 61672-3 Ed.1 Clause 12.3

Frequency weightings: Z Network - IEC 61672-3 Ed.1 Clause 12.3

Frequency and time weightings at 1 kHz IEC 61672-3 Ed.1 Clause 13

Level linearity on the reference level range - IEC 61672-3 Ed.1 Clause 14

Toneburst response - IEC 61672-3 Ed.1 Clause 16

Peak C sound level - IEC 61672-3 Ed.1 Clause 17

Overload indication - IEC 61672-3 Ed.1 Clause 18

Records:

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Passed
Passed
Passed
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Passed

Verification:

The verification measurements have been performed using the calibration system Nor1504A with software type Nor1019.

Most of the verification tests are electrical tests. Test signals are fed to the sound measuring device through an adapter that resembles the microphone signal. A special adapter with a suitable electrical characteristic is used.

Some measurements are acoustical (with microphone). This is the acoustical part of the self-noise test and the acoustical verification of the frequency response.

Detailed measurement results are printed on the following pages.

Each of the verification test points has a Result indication (P, U, or N) that tells the obtained result of the actual test.

P = the result is Passed

U = the result is not passed due to the high Uncertainty of the measurement.

N = the result is Not passed

All verification tests must have a Passed indication in order to fulfill the requirements in the IEC61672-3 standard.

Measurements performed by

Measurement results

Indication at the calibration check frequency - IEC61672-3 Ed.1 #9

Reference level: 114,0 dB
Reference full scale setting: 130 dB FS
Reference frequency: 1000 Hz
Reference Calibrator: WSC5 - Nor1251-32140
Reference calibrator level: 114,02 dB
Environmental corrections: dB
Other corrections: -0,2 dB
Notional level: 113,82 dB
Indicated level: 113,8 dB
Preamplifier gain: -0,5 dB
Microphone sensitivity: -25,4 dB rel 1V/Pa
Test Passed

Self-generated noise - IEC 61672-3 Ed.1 #10

Network	Level (dB)	Comment
A	8,3	Equivalent capacity
C	9,8	Equivalent capacity
Z	18,1	Equivalent capacity

Test Passed

Acoustical signal tests of a frequency weighting - IEC 61672-3 Ed.1 #11

C-Weighted results

Frequency	SLM		Microphone		Case Refl.		Wind Screen		Uncert	Lim	Result
	Meas (dB)	U (dB)	Corr (dB)	U (dB)	Corr (dB)	U (dB)	Corr (dB)	U (dB)			
125 Hz	98,5	0,1	0,0	0,1	0,0	0,1			0,2	+/-1.5	0,0 P
1 kHz	98,5	0,1	0,1	0,2	-0,1	0,1			0,2	+/-1.1	0,0 P
8 kHz	98,5	0,1	2,8	0,2	0,0	0,3			0,4	2.1/3.1	0,7 P

The overall frequency response of the sound level meter, nominal case reflections and microphone response has shown to conform with the requirements in IEC 61672-3 for a class 1 sound level meter.

Frequency response test using multi frequency calibrator.

Sources for correction data:

Calibrator levels and uncertainty: Norsonic - NCL
Microphone field corrections and uncertainty: Norsonic AS
Case reflections and uncertainty: Norsonic AS
Wind screen corrections and uncertainty:

Test Passed

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Electrical signal tests of frequency weightings - IEC 61672-3 Ed.1 #12

A-Weighted results:

Frequency	SLM		Microphone		Case	Refl.	Wind	Screen	Uncert	Lim	Result
	Meas	U	Corr	U	Corr	U	Corr	U	(dB)	(dB)	(dB)
	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)			
63 Hz	0,0	0,1	0,0	0,1	0,0	0,1			0,17	+1.5	0,0 P
125 Hz	-0,1	0,1	0,0	0,1	0,0	0,1			0,17	+1.5	-0,1 P
250 Hz	-0,1	0,1	0,0	0,1	0,1	0,1			0,17	+1.4	0,0 P
500 Hz	-0,1	0,1	0,0	0,1	0,2	0,1			0,17	+1.4	0,1 P
1 kHz	0,0	0,1	-0,1	0,1	-0,1	0,1			0,17	+1.1	-0,2 P
2 kHz	-0,1	0,1	-0,1	0,2	0,3	0,2			0,30	+1.6	0,1 P
4 kHz	-0,1	0,1	-0,2	0,2	-0,3	0,2			0,30	+1.6	-0,6 P
8 kHz	-0,1	0,1	-0,4	0,3	0,0	0,3			0,44	2.1/3.1	-0,5 P
16 kHz	0,0	0,1	-1,8	0,4	0,3	0,3			0,51	3.5/17	-1,5 P

C-Weighted results:

Frequency	SLM		Microphone		Case	Refl.	Wind	Screen	Uncert	Lim	Result
	Meas	U	Corr	U	Corr	U	Corr	U	(dB)	(dB)	(dB)
	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)			
63 Hz	0,0	0,1	0,0	0,1	0,0	0,1			0,17	+1.5	0,0 P
125 Hz	0,0	0,1	0,0	0,1	0,0	0,1			0,17	+1.5	0,0 P
250 Hz	-0,1	0,1	0,0	0,1	0,1	0,1			0,17	+1.4	0,0 P
500 Hz	0,0	0,1	0,0	0,1	0,2	0,1			0,17	+1.4	0,2 P
1 kHz	0,0	0,1	-0,1	0,1	-0,1	0,1			0,17	+1.1	-0,2 P
2 kHz	-0,1	0,1	-0,1	0,2	0,3	0,2			0,30	+1.6	0,1 P
4 kHz	-0,1	0,1	-0,2	0,2	-0,3	0,2			0,30	+1.6	-0,6 P
8 kHz	-0,1	0,1	-0,4	0,3	0,0	0,3			0,44	2.1/3.1	-0,5 P
16 kHz	-0,1	0,1	-1,8	0,4	0,3	0,3			0,51	3.5/17	-1,6 P

Z-Weighted results:

Frequency	SLM		Microphone		Case	Refl.	Wind	Screen	Uncert	Lim	Result
	Meas	U	Corr	U	Corr	U	Corr	U	(dB)	(dB)	(dB)
	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)			
63 Hz	0,0	0,1	0,0	0,1	0,0	0,1			0,17	+1.5	0,0 P
125 Hz	-0,1	0,1	0,0	0,1	0,0	0,1			0,17	+1.5	-0,1 P
250 Hz	-0,1	0,1	0,0	0,1	0,1	0,1			0,17	+1.4	0,0 P
500 Hz	0,0	0,1	0,0	0,1	0,2	0,1			0,17	+1.4	0,2 P
1 kHz	0,0	0,1	-0,1	0,1	-0,1	0,1			0,17	+1.1	-0,2 P
2 kHz	-0,1	0,1	-0,1	0,2	0,3	0,2			0,30	+1.6	0,1 P
4 kHz	-0,1	0,1	-0,2	0,2	-0,3	0,2			0,30	+1.6	-0,6 P
8 kHz	-0,1	0,1	-0,4	0,3	0,0	0,3			0,44	2.1/3.1	-0,5 P
16 kHz	-0,1	0,1	-1,8	0,4	0,3	0,3			0,51	3.5/17	-1,6 P

The nominal frequency response of Norsonic / 1225 has been used for the calculations.

The overall frequency response of the sound level meter, nominal case reflections and microphone response has shown to conform with the requirements in IEC 61672-3 for a class 1 sound level meter.

The calculated uncertainties are checked against the requirements in the standard.

Sources for correction data:

Microphone response and uncertainty:

Norsonic AS

Case reflections and uncertainty:

Norsonic AS

Test Passed

Measurements performed by

Frequency weightings: A-Network - IEC 61672-3 #12

Frequency (Hz)	Ref. (dB)	Meas. (dB)	Uncert. (dB)	Dev. (dB)
63,1	92,0	92,0	0,1	0,0
125,9	92,0	91,9	0,1	-0,1
251,2	92,0	91,9	0,1	-0,1
501,2	92,0	91,9	0,1	-0,1
1000,0	92,0	92,0	0,1	0,0
1995,3	92,0	91,9	0,1	-0,1
3981,1	92,0	91,9	0,1	-0,1
7943,3	92,0	91,9	0,1	-0,1
15848,9	92,0	92,0	0,1	0,0

Test Passed

Frequency weightings: C Network - IEC 61672-3 Ed.1 #12.3

Frequency (Hz)	Ref. (dB)	Meas. (dB)	Uncert. (dB)	Dev. (dB)
63,1	92,0	92,0	0,1	0,0
125,9	92,0	92,0	0,1	0,0
251,2	92,0	91,9	0,1	-0,1
501,2	92,0	92,0	0,1	0,0
1000,0	92,0	92,0	0,1	0,0
1995,3	92,0	91,9	0,1	-0,1
3981,1	92,0	91,9	0,1	-0,1
7943,3	92,0	91,9	0,1	-0,1
15848,9	92,0	91,9	0,1	-0,1

Test Passed

Frequency weightings: Z Network - IEC 61672-3 Ed.1 #12.3

Frequency (Hz)	Ref. (dB)	Meas. (dB)	Uncert. (dB)	Dev. (dB)
63,1	92,0	92,0	0,1	0,0
125,9	92,0	91,9	0,1	-0,1
251,2	92,0	91,9	0,1	-0,1
501,2	92,0	92,0	0,1	0,0
1000,0	92,0	92,0	0,1	0,0
1995,3	92,0	91,9	0,1	-0,1
3981,1	92,0	91,9	0,1	-0,1
7943,3	92,0	91,9	0,1	-0,1
15848,9	92,0	91,9	0,1	-0,1

Test Passed

Frequency and time weightings at 1 kHz IEC 61672-3 Ed.1 #13

Weightings	Ref. (dB)	Measured (dB)	Lim. (dB)	Uncert. (dB)	Dev. (dB)	Result
Time Netw						
Fast A	114,0	114,0	0,4 -0,4	0,1	0,0	P
Fast C	114,0	114,0	0,4 -0,4	0,1	0,0	P
Fast Z	114,0	114,0	0,4 -0,4	0,1	0,0	P
Slow A	114,0	114,0	0,3 -0,3	0,1	0,0	P
Leq A	114,0	114,0	0,3 -0,3	0,1	0,0	P
SEL A	124,0	124,0	0,3 -0,3	0,1	0,0	P

Test Passed

Measurements performed by

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Level linearity on the reference level range - IEC 61672-3 Ed.1 #14

Ref. (dB)	Measured (dB)	Lim. (dB)	Uncert. (dB)	Dev. (dB)	Result
Measured at 31.5 Hz					
94,0	94,0	1,1	-1,1	0,1	P
95,0	95,0	1,1	-1,1	0,1	P
96,0	96,0	1,1	-1,1	0,1	P
97,0	97,0	1,1	-1,1	0,1	P
98,0	98,2	1,1	-1,1	0,1	P
94,0	94,0	1,1	-1,1	0,1	P
89,0	89,1	1,1	-1,1	0,1	P
84,0	84,1	1,1	-1,1	0,1	P
79,0	79,0	1,1	-1,1	0,1	P
74,0	74,0	1,1	-1,1	0,1	P
69,0	69,1	1,1	-1,1	0,1	P
64,0	64,1	1,1	-1,1	0,1	P
59,0	59,1	1,1	-1,1	0,1	P
54,0	54,0	1,1	-1,1	0,1	P
49,0	49,0	1,1	-1,1	0,1	P
44,0	44,1	1,1	-1,1	0,1	P
39,0	39,0	1,1	-1,1	0,1	P
35,0	35,0	1,1	-1,1	0,1	P
34,0	34,0	1,1	-1,1	0,1	P
33,0	33,0	1,1	-1,1	0,1	P
32,0	32,0	1,1	-1,1	0,1	P
31,0	31,1	1,1	-1,1	0,1	P
30,0	30,1	1,1	-1,1	0,1	P
Measured at 1 kHz					
114,0	114,0	1,1	-1,1	0,1	P
119,0	119,0	1,1	-1,1	0,1	P
124,0	124,0	1,1	-1,1	0,1	P
129,0	129,0	1,1	-1,1	0,1	P
133,0	133,0	1,1	-1,1	0,1	P
134,0	134,0	1,1	-1,1	0,1	P
135,0	135,0	1,1	-1,1	0,1	P
136,0	136,0	1,1	-1,1	0,1	P
137,0	137,0	1,1	-1,1	0,1	P
114,0	114,0	1,1	-1,1	0,1	P
109,0	109,0	1,1	-1,1	0,1	P
104,0	104,0	1,1	-1,1	0,1	P
99,0	99,0	1,1	-1,1	0,1	P
94,0	94,0	1,1	-1,1	0,1	P
89,0	89,0	1,1	-1,1	0,1	P
84,0	84,0	1,1	-1,1	0,1	P
79,0	78,9	1,1	-1,1	0,1	-0,1
74,0	74,0	1,1	-1,1	0,1	0,0
69,0	69,0	1,1	-1,1	0,1	0,0
64,0	63,9	1,1	-1,1	0,1	-0,1
59,0	58,9	1,1	-1,1	0,1	-0,1
54,0	53,9	1,1	-1,1	0,1	-0,1
49,0	49,0	1,1	-1,1	0,1	0,0
44,0	44,0	1,1	-1,1	0,1	0,0
39,0	39,0	1,1	-1,1	0,1	0,0
35,0	35,0	1,1	-1,1	0,1	0,0
34,0	34,0	1,1	-1,1	0,1	0,0
33,0	33,1	1,1	-1,1	0,1	0,1
32,0	32,0	1,1	-1,1	0,1	0,0
31,0	31,0	1,1	-1,1	0,1	0,0
30,0	30,1	1,1	-1,1	0,1	0,1

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Measured at 8 kHz

114,0	113,9	1,1	-1,1	0,1	-0,1	P
119,0	119,0	1,1	-1,1	0,1	0,0	P
124,0	124,0	1,1	-1,1	0,1	0,0	P
129,0	129,0	1,1	-1,1	0,1	0,0	P
132,0	132,0	1,1	-1,1	0,1	0,0	P
133,0	133,0	1,1	-1,1	0,1	0,0	P
134,0	134,0	1,1	-1,1	0,1	0,0	P
135,0	135,0	1,1	-1,1	0,1	0,0	P
136,0	135,9	1,1	-1,1	0,1	-0,1	P
114,0	113,9	1,1	-1,1	0,1	-0,1	P
109,0	109,0	1,1	-1,1	0,1	0,0	P
104,0	103,9	1,1	-1,1	0,1	-0,1	P
99,0	98,9	1,1	-1,1	0,1	-0,1	P
94,0	93,9	1,1	-1,1	0,1	-0,1	P
89,0	88,9	1,1	-1,1	0,1	-0,1	P
84,0	83,9	1,1	-1,1	0,1	-0,1	P
79,0	78,9	1,1	-1,1	0,1	-0,1	P
74,0	73,9	1,1	-1,1	0,1	-0,1	P
69,0	68,9	1,1	-1,1	0,1	-0,1	P
64,0	63,9	1,1	-1,1	0,1	-0,1	P
59,0	58,9	1,1	-1,1	0,1	-0,1	P
54,0	53,9	1,1	-1,1	0,1	-0,1	P
49,0	48,9	1,1	-1,1	0,1	-0,1	P
44,0	43,9	1,1	-1,1	0,1	-0,1	P
39,0	38,9	1,1	-1,1	0,1	-0,1	P
35,0	35,0	1,1	-1,1	0,1	0,0	P
34,0	33,9	1,1	-1,1	0,1	-0,1	P
33,0	33,0	1,1	-1,1	0,1	0,0	P
32,0	32,0	1,1	-1,1	0,1	0,0	P
31,0	31,0	1,1	-1,1	0,1	0,0	P
30,0	30,0	1,1	-1,1	0,1	0,0	P

Test Passed

Toneburst response - IEC 61672-3 Ed.1 #16

Burst type	Ref. (dB)	Measured (dB)	Lim. (dB)	Uncert. (dB)	Dev. (dB)	Result
Fast 200 mSec	134,0	133,9	0,8 -0,8	0,2	-0,1	P
Fast 2.0 mSec	117,0	116,8	1,3 -1,8	0,2	-0,2	P
Fast 0.25 mSec	108,0	107,5	1,3 -3,3	0,2	-0,5	P
Slow 200 mSec	127,6	127,5	0,8 -0,8	0,2	-0,1	P
Slow 2.0 mSec	108,0	107,9	1,3 -3,3	0,2	-0,1	P
SEL 200 mSec	128,0	128,0	0,8 -0,8	0,2	0,0	P
SEL 2.0 mSec	108,0	107,9	1,3 -1,8	0,2	-0,1	P
SEL 0.25 mSec	99,0	98,7	1,3 -3,3	0,2	-0,3	P

Test Passed

Peak C sound level - IEC 61672-3 Ed.1 #17

Pulse Type	Pulse Freq. (Hz)	Ref. RMS (dB)	Ref. Peak (dB)	Measured Value (dB)	Lim. (+/-dB)	Uncert. (dB)	Dev. (dB)	Result
1 cycle	8k	126,0	129,4	129,1	2,4	0,2	-0,3	P
Pos 1/2 cycle	500	129,0	131,4	131,2	1,4	0,2	-0,2	P
Neg 1/2 cycle	500	129,0	131,4	131,1	1,4	0,2	-0,3	P

Test Passed

Measurements performed by

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Overload indication - IEC 61672-3 Ed.1 #18

	Measured (dB)	Lim. (+/-dB)	Uncert. (dB)	Result
Level difference of positive and negative pulses:	0,0	1,8	0,2	P
Positive 1/2 cycle 4 kHz. Overload occurred at:	138,6			
Negative 1/2 cycle 4 kHz. Overload occurred at:	138,6			
Test Passed				

Measurements performed by