SONOR Kalibratie

Kalibratie-certificaat

Certificaatnummer: AC-11653

Aanvrager	Naam :	**Sensornet**	
	Adres :	**Casuariestraat 7**	
		2511 VB Den Haag	
Geluidsmeter	Fabrikaat :	**SINUS Messtechnik**	
	Type :	**Tango**	
	Serienummer :	**#0002507**	Configuratie :
	Klant ID nr :	**T041**	Gebruikers manual 29-06-2009
Microfoon	Fabrikaat :	**Microtech Gefell**	
	Type :	**MK255**	
	Serienummer :	**20805**	
Voorversterker	Fabrikaat :	**SINUS Messtechnik**	
	Type :	**907144.5**	
	Serienummer :	**#21618**	

Wijze van onderzoek: De geluidsniveaumeter is gekalibreerd conform IEC 61672-3:- Electroacoustics - Sound level meters - Part 3: Periodic test, voor een Klasse 1 geluidsniveaumeter.

Onzekerheid: De gerapporteerde onzekerheid is gebaseerd op een standaardonzekerheid, vermenigvuldigd met een dekkingsfactor *k*=2, welke overeenkomt met een betrouwbaarheid interval van ongeveer 95 %. De standaardonzekerheid is bepaald volgens de EA-4/02.

Herleidbaarheid: De metingen zijn uitgevoerd met standaarden waarvan de herleidbaarheid naar (inter)nationale standaarden, ten overstaan van de Raad voor Accreditatie is aangetoond.

Toelichting: De geluidsniveaumeter heeft met succes de periodieke test voltooid als beschreven in IEC 61672-3:- voor klasse 1 onder de omgevingscondities genoemd in dit certificaat. Een "Type Goedkeuring" conform IEC 61672-2:- is geleverd door de PTB onder nummer 21.21 / 12.04 voor dit model. Dit betekent dat de geluidsniveaumeter voldoet aan de specificaties conform IEC 61672-1:- klasse 1 instrument.

Environmental conditions:

Air pressure	991 hPa
Temperature	23 °C
Relative humidity	50 %rh

Ontvangstdatum: 23 maart 2023
Kalibratie datum: 31 maart 2023
Certificaat datum: 31 maart 2023

Ing. P. Smit
Tekenbevoegd: Kalibratiemanager

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De Raad voor Accreditatie is een van de ondertekenaars van de multilaterale verklaring van de European Cooperation for Accreditation (EA) en van de ILAC Mutual Recognition Arrangements (MRA) voor de wederzijdse acceptatie van kalibratiecertificaten.

Results

Preliminary inspection

Prior to any measurements, the sound level meter and all accessories are visually inspected: damage to, or accumulation of foreign material on, the protection grid or diaphragm of the microphone. All relevant controls are operated to ensure that they are in working order.

Results:	SLM	OK
	Microphone	OK
	Accessories	-

Power supply

Measured before Acoustical test	N.A.
Measured after Acoustical test	N.A.
Measured before Electrical test	N.A.
Measured after Electrical test	N.A.

Environmental conditions

The static air pressure, air temperature and relative humidity are measured and recorded at the start and end of the testing.

Start of testing	Pressure	991 hPa
	Temperature	23 °C
	Relative humidity	50 %
End of testing	Pressure	991 hPa
	Temperature	23 °C
	Relative humidity	50 %

Indication at the calibration check frequency

The indication of the sound level meter at the calibration check frequency is checked by application of a calibrated sound calibrator and adjusted, if necessary, to indicate the required sound pressure level for the environmental conditions under which the tests are performed.

SLM reading	Before	93,7 dB
	After adjustment	94,0 dB
Calibrator used	In house calibrator	

Self-generated noise

Microphone installed
Self-generated noise is measured with the microphone installed on the sound level meter. The sound level meter in the configuration submitted for periodic testing, with the most-sensitive level range and frequency weighting A selected. The indication of sound pressure level A-weighted sound level averaged over 10 measurements is recorded

Measured LAS	24,3 dB
Expected	< 27,6 dB
Measurement uncertainty	1,0 dB

Microphone replaced by the electrical input signal device
With the microphone replaced by the electrical input signal device the indicated level of the time-averaged self-generated noise is recorded for the most-sensitive level range and for all frequency weightings available in the sound level meter.

Measured LAeq	4,4 dB
Expected	< 25 dB
Measurement uncertainty	1,0 dB

NOTE: The level of self-generated noise is reported for information only and is not used to assess conformance to a requirement.

Acoustical signal tests of a frequency weighting

The sound level meter is set for frequency weighting A. The frequency weighting is tested using an electrostatic actuator. The indications on the sound level meter is adjust to equivalent free-field level. The effects of reflections from the case of the sound level meter are included in the adjustment data.

Frequencies	Expected Deviation	Average of two measurements	Deviation	Uncertainty	Acceptance Limit
Hz	dB	dB	dB	dB	dB
1000,00	0,0	94,0	0,0	0,2	+/- 0,7
125,90	0,0	78,1	0,3	0,2	+/- 1,0
7943	0,0	89,3	-0,8	0,5	+1,5 / -2,5

Electrical signal tests of frequency weightings

Frequency weightings is determined relative to the response at 1 kHz using steady sinusoidal electrical input signals and for the three frequency weightings A, C, Z.. The sound level meter is set to display F-time-weighted soundlevel. On the reference level range and for each frequency weighting to be tested, the level of a 1 kHz input signal is adjusted to yield an indication that is 45 dB less than the upper limit stated in the instruction manual for the linear operating range at 1 kHz on the reference level range. The input signal level is recorded for the nine frequencies at nominal octave intervals from 63 Hz to 16 kHz.

A-Weighting

Frequencies	Expected	Measured	Deviation	Uncertainty	Acceptance Limit
Hz	dB	dB	dB	dB	dB
63,10	94,7	94,6	-0,1	0,1	+/- 1
125,89	94,9	94,8	-0,1	0,1	+/- 1
251,19	95,0	94,9	-0,1	0,1	+/- 1
501,19	95,0	94,9	-0,1	0,1	+/- 1
1000,00	95,0	95,0	0,0	0,1	+/- 0,7
1995,30	95,1	94,7	-0,3	0,1	+/- 1
3981,10	95,1	95,0	-0,1	0,1	+/- 1
7943,30	95,0	95,8	0,8	0,1	+1,5 / -2,5
15849,00	95,0	96,3	1,3	0,1	+2,5 / -16

C-Weighting

Frequencies	Expected	Measured	Deviation	Uncertainty	Acceptance Limit
Hz	dB	dB	dB	dB	dB
63,10	94,7	94,6	-0,1	0,1	+/- 1
125,89	94,9	94,8	-0,1	0,1	+/- 1
251,19	95,0	94,9	-0,1	0,1	+/- 1
501,19	95,0	95,0	0,0	0,1	+/- 1
1000,00	95,0	95,0	0,0	0,1	+/- 0,7
1995,30	95,0	94,7	-0,3	0,1	+/- 1
3981,10	94,9	94,9	0,0	0,1	+/- 1
7943,30	94,7	95,5	0,8	0,1	+1,5 / -2,5
15849,00	95,3	96,5	1,2	0,1	+2,5 / -16

Frequency and time weightings at 1 kHz

For a steady sinusoidal electrical input signal at 1 kHz on the reference level range and with an input signal that yields an indication of the reference sound pressure level with frequency weighting A, the indications is recorded for frequency weightings C and Z response, with the sound level meter set to display F-time-weighted sound level, S-time-weighted sound level and time-average sound level.

Time weighting	A-Weighted measured	Differential deviation	Uncertainty	Acceptance Limit
Fast	94,0	0,0	0,1	+/- 0,2
Slow	94,0	0,0	0,1	+/- 0,2
Leq	94,0	0,0	0,1	+/- 0,2

Peak C sound level

Indications of peak C sound level is tested on the least-sensitive level range. The test signals are a single complete cycle of an 8 kHz sinusoid starting and stopping at zero crossings and positive and negative half cycles of a 500 Hz sinusoid that also start and stop at zero crossings.

Signals	Measured parameter	Expected	Measured	Deviation	Uncertainty	Acceptance Limit
		dB	dB	dB	dB	dB
Continous signal 8 kHz	SPL	132,0	129,8	-2,2	0,1	ref
1 cycle	Peak	135,4	133,6	-1,8	0,1	+/- 2
Continuous signal 500 Hz	SPL	132,0	132,0	0,0	0,1	ref
Pos 1/2 cycle	Peak	134,4	134,3	-0,1	0,2	+/- 1,0
Neg. 1/2 cycle	Peak	134,4	134,3	-0,1	0,2	+/- 1,0

Level linearity on the reference level range

Level linearity is tested with steady sinusoidal electrical signals at a frequency of 8 kHz with the sound level meter set for frequency-weighting A on on the reference level range.

Expected	Measured	Deviation relative	Deviation differential	Uncertainty	Acceptance Limit Relative	Acceptance Limit differential
dB	dB	dB	dB	dB	dB	dB
94,8	94,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
99,8	99,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
104,8	104,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
109,8	109,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
114,8	114,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
119,8	119,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
124,8	124,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
129,8	129,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
134,8	134,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
135,8	135,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
136,8	136,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
137,8	137,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
138,8	138,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
139,8	139,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
140,8	140,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
94,8	94,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
89,8	89,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
84,8	84,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
79,8	79,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
74,8	74,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
69,8	69,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
64,8	64,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
59,8	59,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
54,8	54,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
49,8	49,8	0,0	0,0	0,1	+/- 0,8	+/- 0,3
44,8	44,7	-0,1	-0,1	0,1	+/- 0,8	+/- 0,3
39,8	39,7	-0,1	0,0	0,1	+/- 0,8	+/- 0,3
34,8	34,9	0,1	0,2	0,1	+/- 0,8	+/- 0,3
33,8	34,0	0,2	0,1	0,1	+/- 0,8	+/- 0,3
32,8	33,1	0,3	0,1	0,1	+/- 0,8	+/- 0,3
31,8	32,3	0,5	0,2	0,1	+/- 0,8	+/- 0,3

Toneburst response

The response of the sound level meter to short-duration signals is tested on the reference level range with 4 kHz tonebursts that start and stop at zero crossings and are extracted from steady 4 kHz sinusoidal electrical input signals. The sound level meter is set for frequency weighting A. Maximum F-time-weighted sound level, maximum S-time-weighted sound level level are recorded. The sound exposure level is calculated from the measured Leq

Tone Burst duration in ms.	Time weighting	Expected	Measured	Deviation	Uncertainty	Acceptance Limit
		dB	dB	dB	dB	dB
Continuous	Fast	137,0	137,0	0,0	0,1	+/- 0,3
	Slow	137,0	137,0	0,0	0,1	+/- 0,3
	Leq	137,0	137,0	0,0	0,1	+/- 0,3
200	Max. Fast	136,0	135,9	-0,1	0,1	+/- 0,5
	Max. Slow	129,6	129,5	-0,1	0,1	+/- 0,5
	Sel	130,0	130,0	0,0	0,1	+/- 0,5
2	Max. Fast	119,0	118,5	-0,5	0,1	+ 1,0; -1,5
	Max. Slow	110,0	109,9	-0,1	0,1	+ 1,0; -3,0
	Sel	110,0	110,0	0,0	0,1	+ 1,0; -1,5
0,25	Max. Fast	110,0	109,7	-0,3	0,1	+ 1,0; -3,0
	Sel	101,0	100,9	-0,1	0,1	+ 1,0; -3,0

Overload indication

Overload indication is tested on the least-sensitive level range with the sound level meter set to display A-weighted, time-average sound level. Positive and negative one-half-cycle sinusoidal electrical signals at a frequency of 4 kHz is used. The one-half-cycle signals is extracted from steady signals of the same signal level and begins and ends at zero crossings. The difference between the levels of the positive and negative one-half-cycle input signals that first caused the displays of overload indication is calculated.

Positive signal	Negative signal	Deviation	Uncertainty	Acceptance Limit
dB	dB	dB	dB	dB
101,9	101,8	0,1	0,2	+/- 1,5

Long-term stability

The long-term stability of a sound level meter is evaluated from the difference between the A-weighted sound levels indicated in response to steady 1 kHz signals applied at the beginning and end of a period of operation. The period of continuous operation is 30 min. The measured difference between the initial and final indications of A-weighted sound level is recorded.

Start signal	End signal	Deviation	Uncertainty	Acceptance Limit
dB	dB	dB	dB	dB
94,0	94,0	0,0	0,1	+/- 0,2

High-level Stability

The stability of a sound level meter to operate continuously in response to high signal levels without significant change in sensitivity is evaluated from the difference between the A-weighted sound levels indicated in response to a steady 1 kHz electrical signal at the beginning and end of a 5 min period of continuous exposure to the signal. The level of the steady electrical input signal is that which is required to display the sound level that is 1 dB less than the upper boundary of the 1 kHz linear operating range on the least-sensitive level range.

Meassured Start value	Measured End Value	Deviation	Uncertainty	Acceptance Limit
dB	dB	dB	dB	dB
137,0	137,0	0,0	0,1	+/- 0,2