SONIK Sound Level Meter

Technical Specifications

Models S and SE

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HB/0142/109/EL

Rev A

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Contents

Technical Specification

Instrument Standards

IEC 61672-1:2013 (Class 1 Group X or Class 2 Group X)

IEC 61252:1993, amendment 1:2000, amendment 2:2017

ANSI S1.4:2014

ANSI S1.25:1991 R2007

Measurement Parameters

Model S

Measurement 1: LEQ, LMAX, LEP'd, Exposure Points, %Dose, %Dose per Hour, Exposure (Pa2h)

Measurement 2: LEQ, LMAX, LPEAK

Model SE

Template: All Parameters

Measurement 1: LEQ, LMAX, LE, LEP'd, %Dose, %Dose per Hour, Exposure (Pa2h), LN1 - LN3

Measurement 2: LEQ, LMAX, LPEAK

Template: Environmental

Measurement 1: LEQ, LMAX, LE, LN1 - LN3

Measurement 2: LEQ, LMAX, LPEAK

Template: Noise at Work

Measurement 1: LEQ, LMAX, LEP'd, Exposure Points, %Dose, %Dose per Hour, Exposure (Pa2h)

Measurement 2: LEQ, LMAX, LPEAK

Reference Points

Description	Value
Sound Pressure Level	94.0dB
Range	Med (45 to 120dB)
Frequency	1000Hz

Frequency Weighting

All Sonix meters meet the requirements for the specified instrument standards and for the relevant class of the Sonix sound meter model (class 1 or class 2).

Measurement 1: 'A' weighting

Measurement 2: 'A', 'C' or 'Z' weighting

Time Weighting

All Sonix meters meet the requirements for the specified instrument standards and for the relevant class of the dBAir sound meter model (class 1 or class 2).

Measurement 1 and 2: Slow, Fast or Impulse weighting

Typical Electrical Self Generating Noise Level

Weighting	dB
A	16.0
C	17.2
Z	18.9

The lower limit of measurement and the actual noise floors are a function of the microphone sensitivity.

Frequency Range

Electrical Frequency Range (Hz)
1 to 20000

Class 1 (7146A Microphone)

Acoustic Frequency Range (Hz)
10 to 20000

Class 2 (7052 Microphone)

Acoustic Frequency Range (Hz)
20 to 8000

Microphone

Class 1

ACO ½" Electret Condenser Microphone Cartridge Type 7146A. Microphone reference point is the centre of the diaphragm.

Type (ACO 7146A)	Specification
Diameter (inch)	0.5
Response Type	Free-Field
Polarization (V)	0.0
Frequency Range (Hz)	10 - 20000
Sensitivity (mV/Pa)	25.0
Sensitivity (dB re 1V/Pa)	-26.0 ±1.5dB
Capacitance (pF)	18.0
Max. Sound Pressure Level (dB)	146.0
Temperature Coefficient (dB/°C)	-0.01

The pressure to free-field correction value to be applied when used with a Castle calibrator GA601/GA607 or B&K4231 is as follows: **-0.2dB**

Typical ACO 7146A Microphone Response			
16Hz	0.0	1kHz	0.0
31.5Hz	0.0	2kHz	0.0
63Hz	0.0	4kHz	-0.1
125Hz	0.0	8kHz	-0.7
250Hz	0.0	16kHz	1.0
500Hz	0.0		

Typical Actuator to free field correction factors(dB) of an ACO 7146A microphone (Based on 500Hz = 0)			
250Hz	0.0	2.5kHz	1.0
315Hz	0.0	3.15kHz	1.2
400Hz	0.0	4kHz	1.5
500Hz	0.0	5kHz	2.0
630Hz	0.0	6.3kHz	2.5
800Hz	0.0	8kHz	3.8
1kHz	0.0	10kHz	4.6
1.25kHz	0.2	12.5kHz	6.8
1.6kHz	0.4	16kHz	8.8
2kHz	0.5	20kHz	10.0

Class 2

ACO ½" Electret Condenser Microphone Cartridge Type 7052. Microphone reference point is the centre of the diaphragm.

Type (ACO 7052)	Specification
Diameter (inch)	0.5
Response Type	Free-Field
Polarization (V)	0.0
Frequency Range (Hz)	20 - 8000
Sensitivity (mV/Pa)	25.0
Sensitivity (dB re 1V/Pa)	-32.0 ±1.5dB
Capacitance (pF)	18.0
Max. Sound Pressure Level (dB)	146.0
Temperature Coefficient (dB/°C)	-0.01

The pressure to free-field correction value to be applied when used with a Castle calibrator GA601/GA607 or B&K4231 is as follows: **-0.2dB**

Typical ACO 7052 Microphone Response			
31.5Hz	0.2	1kHz	0.0
63Hz	0.1	2kHz	0.0
125Hz	0.0	4kHz	0.0
250Hz	0.0	8kHz	0.5
500Hz	0.0		

Typical Actuator to free field correction factors(dB) of an ACO 7052 microphone (Based on 500Hz = 0)			
20Hz	0.0	500Hz	0.0
25Hz	0.0	630Hz	0.0
31.5Hz	0.0	800Hz	0.0
40Hz	0.0	1kHz	0.1
50Hz	0.0	1.25kHz	0.2
63Hz	0.0	1.6kHz	0.3
80Hz	0.0	2kHz	0.4
100Hz	0.0	2.5kHz	0.5
125Hz	0.0	3.15kHz	0.8
160Hz	0.0	4kHz	1.2
200Hz	0.0	5kHz	1.6
250Hz	0.0	6.3kHz	2.3
315Hz	0.0	8kHz	3.6
400Hz	0.0		

Typical Microphone Inherent Noise

Microphone	Level (dBA)
7146A	17.0
7052	17.0

Max SPL at the Microphone for No Damage

Microphone	Level (dB)
7146A	146.0
7052	146.0

Calibration Reference Conditions

The reference direction of incidence for Free Field microphones is perpendicular to the front face (diaphragm surface) of the microphone.

Sound Field	Free Field
Air Temperature	23°C (73°F)
Relative Humidity	50%
Atmospheric Pressure	101.325 kPa
Sound Pressure Level	94.0dB
Reference Level Range (Med)	45 – 120dB
Reference Frequency	1kHz

Electrical Signal Input

Electrical signals can be applied to the Sonix sound level meter by removing the microphone capsule and replacing with an 18pF dummy microphone.

The BNC terminal can then be interfaced with a suitable signal generator with an output impedance of 600 Ohms.

Maximum Peak to Peak Signal for No Damage

21.0V

Overload

Latching overload warning when the input circuitry saturates. Overload conditions are triggered from measurement 1 **or** measurement 2.

Detector Characteristics

RMS and Peak

Peak Operating Range @ 1kHz

Range	Range (dB)
Low	40.0 – 103.0
Med	60.0 – 123.0
High	80.0 – 143.0

Display Range

Range	Range (dB)
L (Low)	20.0 – 100.0
M (Med)	40.0 – 120.0
H (High)	60.0 – 140.0

Total Measuring Range

The difference between the lowest possible measurement on the Low range and the highest possible measurement on the High range at an input frequency of 1kHz.

Frequency Weighting	Range (dB)
A	25.0 – 140.0
C	25.0 – 140.0
Z	29.0 – 140.0

Measurement Resolution

0.1dB (1dB for percentile measurements).

Linear Operating Range

Class 1

Test start point for frequencies 31.5Hz, 1kHz, 4kHz, 8kHz and 12.5kHz:

'A' Weighting

Range	31.5Hz	1kHz	4kHz	8kHz	12.5kHz
	dB	dB	dB	dB	dB
Low	25.0–60.6	25.0–100.0	25.0–100.0	25.0–100.0	25.0–100.0
Med	45.0–80.6	45.0–120.0	45.0–120.0	45.0–120.0	45.0–120.0
High	65.0–100.6	65.0–140.0	65.0–140.0	65.0–140.0	65.0–140.0

'C' Weighting

Range	31.5Hz	1kHz	4kHz	8kHz	12.5kHz
	dB	dB	dB	dB	dB
Low	25.0–100.0	25.0–100.0	25.0–100.0	25.0–100.0	25.0–98.5
Med	45.0–120.0	45.0–120.0	45.0–120.0	45.0–120.0	45.0–118.5
High	65.0–140.0	65.0–140.0	65.0–140.0	65.0–140.0	65.0–138.5

'Z' Weighting

Range	31.5Hz	1kHz	4kHz	8kHz	12.5kHz
	dB	dB	dB	dB	dB
Low	29.0–100.0	29.0–100.0	29.0–100.0	29.0–100.0	29.0–100.0
Med	45.0–120.0	45.0–120.0	45.0–120.0	45.0–120.0	45.0–120.0
High	65.0–140.0	65.0–140.0	65.0–140.0	65.0–140.0	65.0–140.0

Class 2

Test start point for frequencies 31.5Hz, 1kHz, 4kHz, and 8kHz:

'A' Weighting

Range	31.5Hz	1kHz	4kHz	8kHz
	dB	dB	dB	dB
Low	25.0–60.6	25.0–100.0	25.0–100.0	25.0–100.0
Med	45.0–80.6	45.0–120.0	45.0–120.0	45.0–120.0
High	65.0–100.6	65.0–140.0	65.0–140.0	65.0–140.0

'C' Weighting

Range	31.5Hz	1kHz	4kHz	8kHz
	dB	dB	dB	dB
Low	25.0–100.0	25.0–100.0	25.0–100.0	25.0–100.0
Med	45.0–120.0	45.0–120.0	45.0–120.0	45.0–120.0
High	65.0–140.0	65.0–140.0	65.0–140.0	65.0–140.0

'Z' Weighting

Range	31.5Hz	1kHz	4kHz	8kHz
	dB	dB	dB	dB
Low	29.0–100.0	29.0–100.0	29.0–100.0	29.0–100.0
Med	45.0–120.0	45.0–120.0	45.0–120.0	45.0–120.0
High	65.0–140.0	65.0–140.0	65.0–140.0	65.0–140.0

Environmental, Electrostatic & Radio-frequency

Do not expose instrument beyond the specified limits for prolonged periods of time.

Air Temperature Range & Effect

Class	Operating Range (°C)	Accuracy (dB)
1	-10 to 50	±0.5
2	0 to 40	±0.5

Humidity Range

Relative Humidity (%)	Accuracy (dB)
25 to 90	< 0.5 (Provided there is no condensation)

Relative to the value at 50% RH and 40°C

Vibration

Frequency (Hz)	Effect
20 to 1000	None noticeable

Input Voltage

Batteries: 3.6V to 6.4V

Alkaline Type AA 1.5V recommended

Typical life >24 Hours continuous recording use with Auto Dim feature enabled

USB: 4.9V to 5.1V @ 500mA

Display

2.4" Full Colour TFT LCD with 240 x 320 pixels

Refresh rate = 500mS

Recording Intervals

User selectable with a minimum integrating period of one second.

Maximum potential recording size containing approximately 4000 intervals.

Timer Functions

An adjustable countdown timer to automatically stop recordings with a user defined overall measurement period.

Real Time Clock

Battery backed clock and calendar.

Dimensions

Including Pre-Amplifier and microphone: **210mm (H) x 70mm (W) x 30mm (D)**

Excluding Pre-Amplifier and microphone: **145mm (H) x 70mm (W) x 30mm (D)**

Weight

Weight: 480g approximately (including batteries)

Reflection Data

Pre-amplifier length 60.6mm excluding microphone			
Frequency (Hz)	Case Effect (dB)	Frequency (Hz)	Case Effect (dB)
31.5	0.0	1250	0.0
63	0.0	1600	0.2
80	0.0	2000	0.3
100	0.0	2500	-0.1
125	0.1	3150	0.1
160	0.2	4000	0.0
200	0.1	5000	-0.2
250	0.2	6300	-0.1
315	0.1	8000	0.0
400	0.3	10000	0.0
500	0.0	12500	-0.5
630	0.3	16000	0.1
800	0.1	20000	-0.3
1000	REF 0.0		

Windshield

The meter conforms to the quoted standards when fitted with the specified windshield.

Typical effects of using the KG205 60mm windshield			
Frequency (Hz)	Effect (dB)	Frequency (Hz)	Effect (dB)
31.5	0.0	1000	0.2
63	0.1	2000	0.2
125	0.1	4000	0.7
250	0.1	8000	0.0
500	0.2		

Environmental Stabilisation Time

30 minutes

Instrument Warm Up Time

<2 minutes

Function Equations

The following tables describe mathematically how the functions available on the range of SONIK Sound Level Meters are calculated.

All calculations displayed are subject to rounding and/or truncation and are based on the equations from the IEC standard 61672-1 where applicable.

Function	Equation
Equivalent Continuous A-weighted Sound Pressure Level	$L_{AeqT} := 20 \cdot \log \cdot \left[\frac{\left[\left(\frac{1}{T} \right) \int_{t-T}^{t} (P_A)^2(\xi)\, d\xi \right]^{\frac{1}{2}}}{Po} \right] dB$ $L_{AeqT} := 10 \cdot \log \cdot \frac{\left[\left(\frac{1}{T} \right) \int_{0}^{T} (P_A)^2(t)\, dt \right]}{(P_o)^2} dB$ ξ is a dummy variable of time integration over the averaging time interval ending at the time observation t T is the averaging time interval $P_A(\xi)$ is the instantaneous A-weighted sound pressure P_o is the reference sound pressure of 20μPa In the equation above, the numerator of the argument of the logarithm is the root-mean-square, frequency-weighted sound pressure over averaging time interval T

Function	Equation
Equivalent Continuous C-weighted Sound Pressure Level	$L_{CeqT} := 20 \cdot \log \cdot \left[\frac{\left[\left(\frac{1}{T} \right) \int_{t-T}^{t} (P_C)^2(\xi)\, d\xi \right]^{\frac{1}{2}}}{P_o} \right] dB$ $L_{CeqT} := 10 \cdot \log \cdot \frac{\left[\left(\frac{1}{T} \right) \int_{0}^{T} (P_C)^2(t)\, dt \right]}{(P_o)^2} dB$ ξ is a dummy variable of time integration over the averaging time interval ending at the time observation t T is the averaging time interval $P_c(\xi)$ is the instantaneous C-weighted sound pressure P_o is the reference sound pressure of 20μPa In the equation above, the numerator of the argument of the logarithm is the root-mean-square, frequency-weighted sound pressure over averaging time interval T

Equivalent Continuous Z-weighted Sound Pressure Level	$L_{ZeqT} := 20 \cdot \log \cdot \left[\frac{\left[\left(\frac{1}{T} \right) \int_{t-T}^{t} (P_Z)^2(\xi)\, d\xi \right]^{\frac{1}{2}}}{P_o} \right] dB$ $L_{ZeqT} := 10 \cdot \log \cdot \frac{\left[\left(\frac{1}{T} \right) \int_{0}^{T} (P_Z)^2(t)\, dt \right]}{(P_o)^2} dB$ ξ is a dummy variable of time integration over the averaging time interval ending at the time observation t T is the averaging time interval $P_z(\xi)$ is the instantaneous Z-weighted sound pressure P_o is the reference sound pressure of 20μPa In the equation above, the numerator of the argument of the logarithm is the root-mean-square, frequency-weighted sound pressure over averaging time interval T

Function	Equation
Daily Personal Noise Exposure Level	$L_{epd} := 10 \cdot \log \cdot \left[\frac{1}{T_n} \cdot \int_{T_1}^{T_2} \frac{P^2(t)}{(P_o)^2} \, dt \right] dB$ $L_{epd} := L_{AeqT} + 10 \cdot \log \cdot \left[\frac{(T_2 - T_1)}{T_1} \right] dB$ $L_{epd} := L_{AeqT} + 10 \cdot \log \cdot \left(\frac{ExposureTime}{8} \right) dB$ P(t) is the instantaneous A-weighted sound pressure in Pascal's P_o is the reference sound pressure of 20μPa T_n is the normalization period governed by the Criterion duration (8 hours typical) L_{AeqT} is the equivalent continuous A-weighted time-average sound level (re 20 μPa) in dB Exposure Time or ET is set on the instrument in hours and is the period in which the recipient is exposed or subject to the noise source
Noise Dose Using Measurement Time	$Dose := \left(\frac{100}{T_C} \right) \cdot \int_0^T 10^{\left[\frac{(L - L_C)}{\frac{Q}{\log 2}} \right]} dt$ $Dose_{(MT)} := \frac{100 \cdot T}{T_C} \cdot 10^{\left[\frac{(L - L_C)}{\frac{Q}{\log 2}} \right]}$ T_c is the Criterion duration in hours (8 hours typical) L is the Slow (or Fast) frequency (A) weighted sound level L_c is the Criterion level in dB T is the Log Length (Measurement period) in hours Q is the Exchange Rate constant

Function	Equation
Noise Dose Using Exposure Time	$Dose_{(ET)} := Dose_{(MT)} \cdot \left(\frac{ET}{MT}\right)$ ET is the Exposure Time in hours MT is the Log Length (Measurement period) in hours

Noise Dose per Hour	$DoseHour := \frac{Dose}{LogLength}$ Log Length is the Measurement period in hours Dose is the calculated Noise Dose determined over the Log Length (Measurement period)

Sound Exposure Level	$L_{AE} := 10 \cdot \log\left[\frac{\left[\int_{t1}^{t2} (P_A)^2(t)\, dt\right]}{(P_o)^2 T_o}\right] dB$ $L_{AE} := 10 \cdot \log\left(\frac{E_A}{E_o}\right) dB$ $L_{AE} := L_{AeqT} + 10 \cdot \log\left(\frac{T}{T_o}\right) \cdot dB$ E_A is the A-weighted sound exposure in Pascal-squared hours E_o is the reference sound exposure of: - $(20\mu Pa)^2 \cdot (1s) := 400 \cdot 10^{-12} Pa^2 s$ T_o = 1s and T = t_2-t_1 which is the time interval for measurement, in seconds, for sound exposure level and time-average sound level L_{AeqT} is the equivalent continuous A-weighted sound pressure level (re 20 µPa) in dB

Function	Equation
Peak sound Pressure Level A-weighted	$$LApeak = 20\log\left(\frac{PApeak}{Po}\right) dB$$ P_{Apeak} is the maximum A-weighted sound pressure value in Pascal's P_o is the reference sound pressure of 20µPa
Peak sound Pressure Level C-weighted	$$L_{Cpeak} := 20\log\left(\frac{P_{Cpeak}}{P_o}\right) dB$$ P_{Cpeak} is the maximum C-weighted sound pressure value in Pascal's P_o is the reference sound pressure of 20µPa

Peak sound Pressure Level Z-weighted	$$L_{Zpeak} := 20\log\left(\frac{P_{Zpeak}}{P_o}\right) dB$$ P_{Zpeak} is the maximum Z-weighted sound pressure value in Pascal's P_o is the reference sound pressure of 20µPa

Pascal Squared Hours	$$Pa^2h := \left(20\cdot 10^{-6}\right)^2 \cdot LogLength \cdot 10^{\left(\frac{L_{AeqT}}{10}\right)}$$ Log Length is the Measurement period in hours L_{AeqT} is the equivalent continuous A-weighted time-average sound level (re 20 µPa) in dB

EC Declaration of Conformity

CE The CE marking of this Castle Product indicates compliance with the EMC Directive.

Castle Group Ltd declares that the: -

- *GA142S, GA142SE, GA142E SONIK Sound Level Meters*

have in accordance with the following Electromagnetic Compatibility Directives: -

- *89/336/EEC*

been designed and manufactured to the following specification:

- *EN61326-1:1997 + A1:1998*

with the following Tests:

- *Radiated Emissions: EN55022:1995 Class: B*
- *ESD: EN61000-4-2:1995 Levels: ±4kV (C) , ± 8kV (A)*
- *Radio-frequency EM field amplitude mod: EN61000-4-3:1996 Level: 3V/m*

No differences in radio frequency emissions are apparent between the available operating ranges where applicable on the SONIK range of instruments.

Approved cables for use with the Castle SONIK Range of instruments to comply with these standards: -

Cable	Order Code
Micro USB	ZL1108-01
Microphone Extension	ZL1141-xx

I hereby declare that the instruments named above have been designed to comply with the relevant sections of the above referenced specifications, and that the above-named instruments comply with all essential requirements of the specified Directives.

Simon Bull

Managing Director

EMC tests conducted at the standard test level of 74dB