

*Audio*<sup>3</sup>  
soundBadge<sup>®</sup>  
*personal noise dose recorder*

Manual  
v2.05



## In the box



soundBadge®



protective case

in the box



usb cable



acoustic calibration coupler

*Audio<sup>3</sup> Ltd. soundBadge® Manual  
version 2.05  
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## Welcome

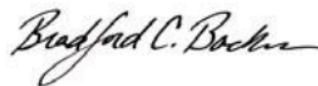
*Thank you for purchasing the Audio3 soundBadge. We believe it is one of the finest acoustic measuring devices available and hope you will enjoy it.*

*Audio3 Ltd. is owned and operated by hearing research scientists who study noise-induced hearing loss (NIHL). We are dedicated to reducing the prevalence of NIHL and our primary concern is hearing health. The soundBadge is unique among noise dosimeters; it is the smallest, easiest to use meter available. It is also one of the most accurate meters ever made due to our true RMS technology.*

*This manual gives you information about hearing health and all the instructions you will need to get the most from your soundBadge.*

*Further information and software updates can be found at the Audio3 web site, [audio-3.com](http://audio-3.com).*

**Warm Regards,**



**Managing Director**

## Safety Information

### Important Safety Information

#### 1. Disposal



Do not dispose of the soundBadge in municipal waste. Special collection must be used as denoted by the WEE symbol.

#### 2. Water and moisture

Keep your soundBadge dry, water and moisture can damage it. The soundBadge tolerates 5% to 95% relative humidity.

#### 3. Heat

Keep your soundBadge away from flames and heat producing appliances such as radiators, stoves, toasters, etc. The soundBadge tolerates -25 to 50 °C (-13 to 122 °F).

#### 4. Climate

The soundBadge has been designed for use in most outdoor climates, however, extreme heat, cold or humidity can damage the unit. To prevent possible damage from a power surge, do not plug the unit into a mains-connected computer or charger during lightning storms.

#### 5. Cleaning

The soundBadge metal case only requires an occasional wipe with a soft, lint-free cloth. Do not use chemical solvents, household cleaning agents or polishes. These chemicals can damage it. The glass lens, however, may be cleaned using a soft, lint-free cloth dampened with a non-abrasive household glass cleaner.

## Safety Information

#### 6. Connecting and Recharging

Connect your soundBadge to a standard (computer) USB socket using a standard USB cable for charging and downloading data.

#### 7. Non-use periods

During long periods of non-use, store the soundBadge in a cool (< 30 °C), dry place (< 50 % humidity). It should be charged at least once a year to retain its calendar and clock information and to help extend the battery's lifespan.

#### 8. Abnormal smell

If any abnormal smell or smoke is detected coming from the unit, immediately unplug the unit, turn it off, and contact your dealer—do not reconnect the equipment.

#### 9. Servicing

You should not attempt to service the unit yourself. It should only be serviced by qualified service personnel.

#### 10. Safety compliance

This equipment has been designed to meet the IEC/EN 60065 international electrical safety standard. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## Noise Induced Hearing Loss

### Noise induced hearing loss

An estimated 10 million EU/US workers suffer from noise-induced hearing loss (NIHL). And 16% of all the disabling hearing loss in adults is attributed to occupational noise (Nelson et al. 2005). The bad news is that once this hearing loss has occurred, it is usually permanent. The good news is that it is preventable. Those who have hearing loss find it socially isolating and wish they would have taken steps to prevent it when they had the chance. Hopefully you have that chance now.

### Regulations to measure and limit the energy going into your ears

EU and US regulations (Directive 2003/10/EC and 29 CFR 1910.95 respectively) require that employers limit the amount of sound energy going into workers ears to safe levels. In the EU, this requirement also applies to self-employed people like musicians. The specified regulatory levels have been determined from hearing research collected over years. Both US and EU regulations require monitoring noise levels, the US regulations state:

“Where circumstances such as high worker mobility, significant variations in sound level, or a significant component of impulse noise make area monitoring generally inappropriate, the employer shall use representative personal sampling to comply with the monitoring requirements of this paragraph unless the employer can show that area sampling produces equivalent results.” - 1910.95(d)(1)(ii)

## Noise Induced Hearing Loss

The soundBadge is designed to measure a personal noise dose. The dose can be used to demonstrate regulatory compliance for your organization or to provide information needed to design a compliant hearing conservation program. More importantly, we believe that when individuals know their own dose, it helps protect them from overexposure and NIHL. The soundBadge is EU and US compliant, however, Audio3 Ltd. recommends that US organizations adopt the stricter EU regulations which are based on more defensible hearing research.

### Wear hearing protection

Audio3 Ltd. recommends you wear hearing protection to limit your ears' sound exposure to safe levels when measured dose levels are high. Data from the soundBadge can help determine the most appropriate type of hearing protection.

### Schedule hearing checkups

Audio3 Ltd. recommends you schedule hearing tests with accredited audiologists as part of your hearing conservation program.

### NIHL and musicians

In 2008, Noise at Work Regulations (Statutory Instrument 2005 No. 1643)—previously only applicable to industry—came into force for EU musicians. The regulation requires that musicians monitor their own noise exposure. The soundBadge gives all the information needed to limit noise/music exposure to a safe level.

## Meet the soundBadge



### Parts

The soundBadge has a microphone, two buttons: (A) on the left, and (B) on the right, an LCD display, and a micro USB jack for connecting to a computer's USB port to recharge and retrieve data.



LCD display



USB recharge

### Switching on and off

To turn the soundBadge on or off, press and hold buttons (A) and (B) simultaneously for 5 seconds. When turning the meter off, the display will show 'OFF' after 2 seconds. Continue to hold the buttons down for a further 2 seconds to turn off the soundBadge.

Note: the soundBadge automatically switches itself off when its battery capacity drops below 10% or if there has been no activity for 8.5 minutes.

## Charge the Battery

### How do I recharge the battery?

Before using the soundBadge for the first time, charge the battery by connecting it to a computer USB port with the USB cable. It takes 3 hours to recharge. While charging, the battery indicator on the display will flash. When fully charged, the indicator will stop flashing and indicate a full charge.

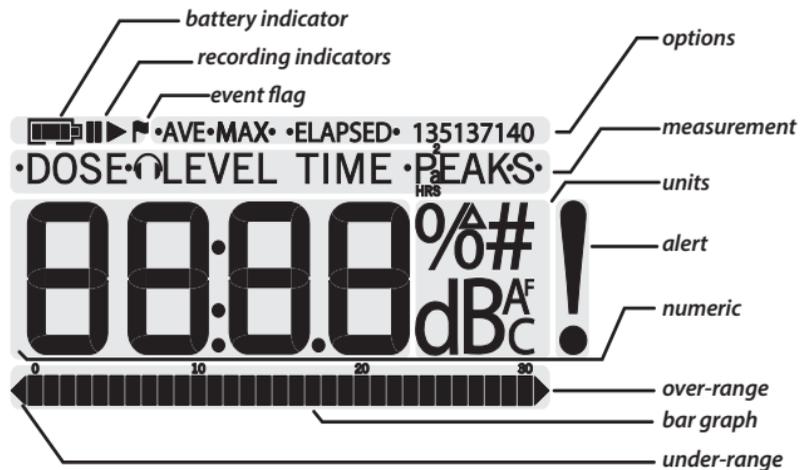
### How long will the battery last?

The battery will last 20 hours. Each bar on the battery indicator represents 20% capacity or 4 hours. When the battery drops to 10%, the meter will turn off automatically. If you want to know exactly how long the battery will last, make a measurement using the count-up timer (see page 16). When the battery drops to 10%, the unit will automatically stop recording and turn off. Recharging will bring back the final values of all measurements including the elapsed time.

### Will I need to replace the battery?

The soundBadge battery will slowly lose capacity over years of use. If you require long duration measurements (>10 hrs) you may need to replace the battery after 5 years or 300 charge cycles. If the battery indicator never stops flashing when you charge it, it no longer supports its original capacity. **WARNING:** The battery can only be replaced by a qualified technician. Please contact *Audio<sup>3</sup>* at [audio-3.com](http://audio-3.com) or your local sales office to arrange to replace the battery.

## Display



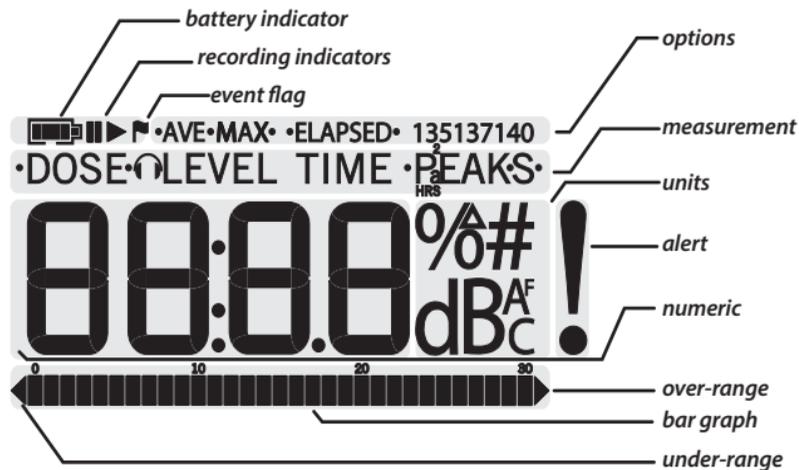
### The Display

The soundBadge displays information about the amount of sound it has measured over periods of elapsed time. There are 7 main display areas: measurement, numeric, units, options, alert, bar graph and special annunciators. In general, the measurement is advanced by the **(A)** button and the options and units for that measurement are selected using the **(B)** button. The display also has indicators for: battery level, recording mode, special events, over-range, under-range, sub-measurement (dots), and a headphone measurement indicator (not implemented in all devices).

## Display

Display	Explanation
DOSE	cumulative noise dose from current (or the last) recording displayed in units: %, dBA ( $L_{EX,8}$ , $L_{EP,d}$ ) or Pa <sup>2</sup> Hrs
LEVEL	current SPL reading in dBA, dBC, or dB(Z); fast or slow
•AVE• LEVEL	true average equivalent sound level 3 dB exchange rate ( $L_{Aeq}$ or $L_{Ceq}$ ). Dots indicate a sub-measurement is in progress.
<sup>MAX</sup> LEVEL	maximum level recorded (taken from 1/4 s intervals)
TIME	the current time
ELAPSED TIME	the elapsed recording time when countup mode is selected ( <b>(▶)</b> ) or the remaining recording time if in a countdown ( <b>(◀)</b> )
PEAK	maximum instantaneous peak level recorded
PEAKS	number of peak events recorded above user set level
<sup>135</sup> PEAKS	number of peak events above 135 dBC
<sup>137</sup> PEAKS	number of peak events above 137 dBC
<sup>140</sup> PEAKS	number of peak events above 140 dBC

## Display



Display	Explanation
	headphone measurement - user specifies headphones worn
	battery indicator (each bar = 4 hrs, flashes when charging, stops flashing when charging complete)
	soundBadge not currently recording a measurement
	soundBadge currently recording a measurement

## Display

Display	Explanation
	event flag (e.g. vibrational shock detected during recording)
	difference between prior calibration and acoustic signal
	noise dose in units proportional to energy (pascals <sup>2</sup> • hrs)
	noise dose in % of daily allowed dose (typ. 85 dBA, for 8 hrs)
	on DOSE page noise dose units are equivalent dBA normalized to 8 hr workday. On LEVEL page, A-weighting.
	units for LEVEL are C-weighted with fast time constant
	indicates a count of events above selected dB Cpk
	flashes to indicate dose has exceeded daily limit
	autorange 30 dB bargraph, for LEVEL each bar = 1 dB. On TIME pages it indicates memory storage each bar = 2 hrs.
	under-range indicator for levels below 55 dB <sub>A</sub> . On TIME or ELAPSED TIME pages it indicates count-down timer.
	latching over-range indicator, latches above 143 dB <sub>C</sub> pk. On TIME or ELAPSED TIME pages it indicates count-up timer

## Clock

### About the clock

The soundBadge includes a clock and a calendar that you should set before using it. Data files stored on the soundBadge use this clock and calendar to timestamp the files. The clock uses very little power and runs even when the meter is off. To set the clock use the **(A)** and **(B)** buttons as described below. In general the **(A)** button is used to advance to the next item and the **(B)** button is used to increment a value.

### How do I set the clock?

- 1 Turn the soundBadge on by pressing and holding the **(A)** and **(B)** buttons simultaneously for 5 seconds.
- 2 Press **(A)** to advance to the TIME main page. If ELAPSED TIME is displayed, press **(B)** to remove it.
- 3 Hold **(A)** down for 2 seconds to begin to set the clock and calendar. The display will show 'hh:--' with '--' flashing.
- 4 Set the current minute by pressing **(B)** until it is correct. Hint: holding down **(B)** will increment the units rapidly.



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## Clock



- 5 Press **(A)** to advance to setting the hour (24-hour format). The hours digits will flash. Press **(B)** until the correct hour is displayed.
- 6 Press **(A)** to advance to setting the month. The display will show '--.dd' with '--' flashing. Press **(B)** until the correct month is displayed.
- 7 Press **(A)** to advance to setting the day. Press **(B)** until the correct day is displayed.
- 8 Press **(A)** to advance to setting the year '20yy' will be displayed with 'yy' flashing. Press **(B)** until the correct decade is displayed.
- 9 Press the **(A)** button one final time to start the clock.

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## Sound Level

### How do I measure current sound levels with the soundBadge?

① Press **A** to advance to the LEVEL page. If MAX or AVE is displayed press **B** until you remove them.

② Press and hold **B** to cycle through to the combination of frequency weighting (A, C, or no weighting) and time constant (fast = 1/8s or slow = 1s) you require.

③ A small 'F' or a large 'S' is displayed to indicate a fast or slow time constant; while an 'A' or 'C' are displayed for A and C weightings. If neither A nor C is displayed, no frequency weighting is applied (often called Z-weighting).

### How well does the soundBadge measure sound levels?

The soundBadge measures A, C, and Z-weighted sound levels from 55 dB

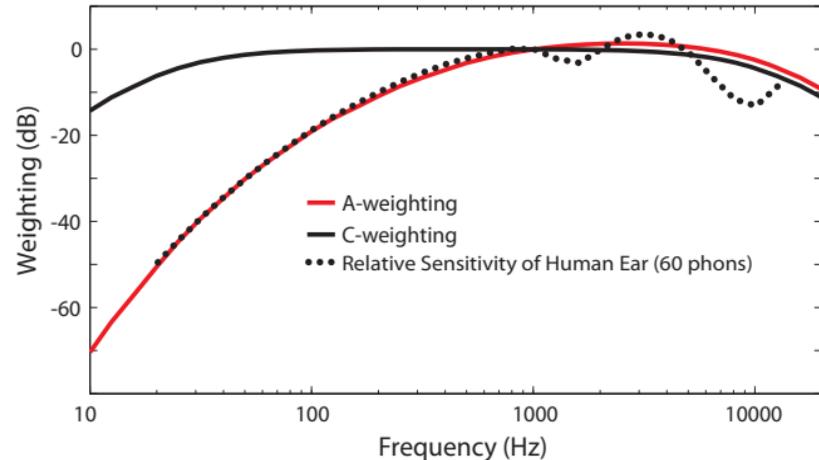
to 140 dB with a 0.1 dB display resolution. When calibrated, the levels are within +/- 2.0 dB of acoustic values from 63 Hz to 12 kHz or better. In accordance with sound metering standards, the soundBadge can measure sound levels using a 'fast' response mode (1/8 s time constant—an 'F' is displayed) or a slow mode (1s time constant—an 'S' is displayed). For most measurements, the slow mode is preferable.



## Sound Level

### What is sound level?

Sound level is a quantity proportional to acoustic power. Several different sound level measurements can be made. The difference between these measurements is the different way they weight various frequency components. The most commonly measured sound levels are the 'A-weighted' sound level, which mimics the sensitivity of the ear at low to moderate sound levels, and the C-weighted sound level, which spans the range of human hearing and mimics the ear's sensitivity at high sound levels. The soundBadge measures both of these and also measures Z-weighted or 'flat' frequency response. Use A-weighting when measuring low-level sounds (55-100 dBA) and use C-weighting for high-level sounds (100-140 dBC).



## Sound Level

### How do I measure an average sound level with the soundBadge?

The soundBadge calculates energy-balanced average sound levels known as Leq. There are two ways to make an average measurement: (1) during a sub-measurement (which does not require the elapsed timer to be set-up and does not record a data file); (2) while recording a main-measurement to a data file using the elapsed timer.

### Take an average reading using a sub-measurement

- 1 Press **A** to advance to the LEVEL page. Press **B** until AVE is displayed.
- 2 Press and hold **B** to cycle through to the combination of frequency weighting (A, C, or no weighting) and time constant (fast = 1/8s or slow = 1s) you require.
- 3 Press **A** and **B** together to start a sub-measurement. Dots will appear

on either side of AVE to indicate a sub-measurement is in progress.

- 4 Press **A** and **B** together again to end the sub-measurement.

Note: For main-measurements A-weightings are always available but only the last selected fast/slow time constant and C/Z weighting can be viewed. When a sub-measurement is ended, the display reverts to its previous value.



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## Sound Level

### Take an average reading using a main measurement

- 1 Press **A** to advance to the LEVEL page.
- 2 Press and hold **B** to cycle through to the combination of frequency weighting (C, or no weighting) and time constant (fast = 1/8s or slow = 1s) you require. (A is always measured).
- 3 Press the **A** button to advance to the TIME main page. If ELAPSED TIME is not displayed, press the **B** button to display it.
- 4 Reset the elapsed timer by pressing and holding the **A** button for 5 seconds. Hold the button while several flashing indicators are displayed and until the timer displays 00:00 and begins to count-up. This will also reset and record the noise dose, maximum levels, peak level, and peak counts.
- 5 Return to the LEVEL main page by pressing the **A** button.
- 6 Press the **B** button to display AVE.
- 7 Press **A** and **B** together from the ELAPSED TIME page to pause.

### When should I measure the average sound level over a period of time?

When regulations specify time limits tied to an A-weighted level, it is the average A-weighted level that is specified. Although average levels are specified, it isn't always practical to measure an average for an entire 8 hours. Averaging for less time (e.g. 15 minutes) can be used as an estimate.



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## Sound Level

### Average A-weighting and regulations

Regulations in the European Union and the United States use average A-weighted sound levels when specifying the maximum time a working individual is allowed to stay in a noisy workplace. The EU and many US organizations (NIOSH, EPA, ACGIH, TLV ) use a permissible exposure limit (PEL) of 85 dBA for 8-hours. They also specify a 3 dB exchange (or doubling) rate meaning that for each 3 dB increase in level the amount of time permitted is halved. The US Occupational Safety and Health Administration (OSHA) uses a 90 dBA PEL and a 5 dB exchange rate (see table for comparison).

NOTE: the soundBadge only measures true energy balanced averages (3 dB exchange rate). It does not compute averages based on other exchange rates—except on the DOSE page.

*Table of permitted time limits in the EU and US for various A-weighted average sound levels.*

Sound Level (dBA)	EU time limit (hrs:min)	US (OSHA) time limit (hrs:min)
82	16:00	24:15
85	8:00	16:00
88	4:00	10:30
90	2:32	8:00
91	2:00	6:58
94	1:00	4:36
97	0:30	3:02
100	0:15	2:00
103	0:08	1:19
106	0:04	0:52
109	0:02	0:34

## Sound Level

### How do I measure a maximum sound level with the soundBadge?

The soundBadge retains the maximum sound levels that occurred during a measurement. Levels are compared every 1/4 s. Like average levels, there are two ways to make a maximum measurement: (1) during a sub-measurement; (2) while recording a main-measurement using the elapsed timer.

#### Measure a maximum level using a sub-measurement

- 1 Press **A** to advance to the LEVEL page. Press **B** until MAX is displayed.
- 2 Press and hold **B** to cycle through to the combination of frequency weighting (A, C, or no weighting) and time constant (fast = 1/8s or slow = 1s) you require.
- 3 Press **A** and **B** together to start a sub-measurement. Dots will appear on either side of MAX to indicate a sub-measurement is in progress.
- 4 Press **A** and **B** together to quit.

### Measure a maximum level by using a main-measurement

- 1 Press **A** to advance to LEVEL page.
- 2 Press and hold **B** to cycle through to the combination of frequency weighting and time constant you require.
- 3 Press the **A** button to advance to the TIME main page. If ELAPSED TIME is not displayed, press the **B** button to display it.
- 4 Reset the elapsed timer by pressing and holding the **A** button for 5 seconds. Hold the button while several flashing indicators are displayed and until the timer displays 00:00 and begins to count-up. This will also reset and record the noise dose, peak level, average levels, and peak counts.
- 5 Press the **A** button to return to the LEVEL page to view maximum level.
- 6 Press **A** and **B** together from the ELAPSED TIME page to pause.

## Peak Level

### How do I measure peak level?

The soundBadge measures instantaneous Cpk levels. There are two ways to measure the peak level: (1) during a sub-measurement; (2) while recording a main-measurement.

#### Measure the peak level using a sub-measurement

- ① Press **A** to advance to the PEAK page. If you see PEAKS, Press **B** repeatedly until PEAK is displayed.
- ② Press **A** and **B** together to start a sub-measurement. Dots will appear on either side of PEAK to indicate a sub-measurement is in progress.
- ③ Press **A** and **B** together to quit.

#### Measure the peak level using a main-measurement

- ① Press the **A** button to advance to the TIME main page. If ELAPSED TIME is not displayed, press the **B**

button to display it.

- ④ Reset the elapsed timer by pressing and holding the **A** button for 5 seconds until the timer displays 00:00 and begins to count up. This will also reset and record the noise dose, max levels, average levels, and peak counts.
- ⑤ Press **A** to return to the PEAK page to view peak level.
- ⑥ Press **A** and **B** together from the ELAPSED TIME page to pause.



## Peak Level

### When should I measure peak sound levels?

In addition to specifying permitted noise doses and time limits for average A-weighted sound levels, EU and US regulations also specify permissible peak dBC sound levels. Peak and maximum sound levels differ. Maximum levels are measured every 1/4 s using 1 s or 1/8 s time-averaging (in 'slow' or 'fast' mode). soundBadge peak measures are truly instantaneous. The soundBadge updates the peak level every 1/32 of a second and also counts any peak levels that exceed: 135, 137, 140 dBC (EU regulatory values). And a user-defined level below 135 dBC. Sound counted to exceed 140 dBC will also be counted to exceed 137, 135 and the user defined dBC peak levels.

*Table of actions required according to EU regulations for given peak levels.*

Peak Level (dBC)	Action required according to EU regulation
135	A risk assessment must be undertaken including measurements and employees shall be informed of risks
137	Maximum allowable peak before hearing protection must be supplied
140	Hearing protection must be supplied and a noise control regime must be adopted to limit exposure.

## Peak Counts

### How do I count peaks?

The soundBadge counts Cpk events that exceed a pre-set dB threshold (135, 137, 140 or a user-set level). There are two ways to start a count: (1) during a sub-measurement; (2) while recording a main-measurement.

#### Count the peaks using a sub-measurement

1 Press **A** to advance to the PEAK page. If you see PEAK, press **B** until PEAKS is displayed.

2 Press **A** and **B** together to start a sub-measurement. Dots will appear on either side of PEAKS to indicate a sub-measurement is in progress.

3 Press **B** to select the threshold (PEAKS alone = user threshold).

4 Press **A** and **B** together to quit.

#### Count the peaks using a main-measurement

1 Press the **A** button to advance to the

TIME main page. If ELAPSED TIME is not displayed, press the **B** button to display it.

4 Reset the elapsed timer by pressing and holding the **A** button for 5 seconds until the timer displays 00:00 and begins to count up. This will also reset and record the noise dose, max levels, average levels, and peak level.

5 Press **A** to return to the PEAKS page.

6 Press **A** and **B** together from the ELAPSED TIME page to pause.



## Peak Counts

### About the instantaneous Cpk peak counter

The soundBadge has an advanced analog Cpk counter that captures true instantaneous peaks. Peak values are checked every 1/4 of a second. If they exceed a pre-set threshold that count is incremented. Many other devices capture Cpk by digitally sampling very rapidly. Such sampling can underestimate the true peak.



Note: knocking or bumping the device can cause spurious events and make the count artificially high. To insure accurate counts, do not knock the meter.

### How do I set the user defined peak count threshold?

1 Press **A** to advance to the PEAK page. If you see PEAK, press **B** once to display PEAKS

2 Hold down **A** until the display flashes.

3 Press or hold down **B** to select the threshold from 65 dBC to 134 dBC.

4 Press **A** to set that threshold.



## Noise Dose

### How do I measure noise dose?

The soundBadge automatically calculates and displays noise dose based on a pre-chosen area, criterion level and exchange rate (default = EU, 85.0 dBA and 3 dB respectively). There are two ways to measure a dose: (1) during a sub-measurement; (2) while recording a main-measurement.

### Measure a noise dose using a sub-measurement

- 1 Press **A** to advance to the DOSE page.
- 2 Press **A** and **B** together to start a sub-measurement. Dots will appear on either side of DOSE to indicate a sub-measurement is in progress.
- 3 Press **B** to cycle to the units you wish to view the dose in (LEX,8h/LEP,d = dBA; % Dose = %; or Pa<sup>2</sup>•hrs; If AVE is also displayed, this is the LAeq or average level not a dose).

- 4 Press **A** and **B** together to end the sub-measurement.



Note: Regulations governing dose calculations are different in EU vs the US. For EU calculations soundBadge uses an ultra-fast A-weighted channel to comply. This is why you can view both dB<sup>A</sup> on the LEVEL page and dB<sup>A</sup> with AVE on the DOSE page.



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## Noise Dose

### Record the noise dose using a main-measurement

- 1 Press the **A** button to advance to the TIME main page. If ELAPSED TIME is not displayed, press the **B** button to display it.
- 2 Reset the elapsed timer by pressing and holding the **A** button for 5 seconds until the timer displays 00:00 and begins to count up. This will also reset the peak level, max levels, average levels, and all peak counts.
- 3 Press **A** to return to the DOSE page.
- 4 Press **B** to cycle to the units you wish to view the dose in (L<sub>Acc,8</sub> = dBA, L<sub>EP,d</sub> = %, Pa<sup>2</sup>•hrs).

### Change the area, criterion level and exchange rate

The soundBadge calculates noise dose in 3 different units (dBA, %, Pa<sup>2</sup>•hrs). When the units are dBA or %, the calculation takes into account a pre-set criterion level and exchange rate (for an explanation see page 20).

- 1 Press the **A** button to advance to the

DOSE page.

- 2 Hold the **A** to display 'A'; the area selection will flash. Press or hold down **B** to toggle between 'EU' and 'US'.
- 3 Press **A** to advance to setting the criterion. 'C' will now be displayed with the criterion level flashing. Press or hold down **B** to select the desired 8hr-criterion: 75.0, 80.0, 85.0 or 90.0 dBA.



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## Noise Dose

④ Press **A** to advance to setting the exchange rate. 'E' will now be displayed with the exchange rate flashing. Press or hold down **B** to select the desired exchange rate: 3.0, 4.0 or 5.0 dB.

### Adjust the Threshold Limit Level

Using a threshold limit is not necessary on today's modern dosebadges but you can set a threshold level of 80 or 90 for compatibility with previous measurement. When the area is set to 'US', any level below the set threshold will not be accumulated into the dose calculation.

⑤ Press **A** to advance to setting the threshold limit. 'L' will be displayed with limit value flashing. Press or hold down **B** to select the desired limit: OFF, 80, or 90.

### Adjust the Phones NR Level

The soundBadge has a 'phones'

setting. This setting will not change the dose calculation on soundBadge. It is used to store the noise reduction rating (NRR) of headphones worn during a measurement. Your soundView software can take this into account when calculating dose on your PC.

⑥ Press **A** to advance to setting the phones NRR. 'P' will now be displayed with the phones NRR value flashing. Press or hold down **B** to select the desired NRR.



## Noise Dose

### Select the Input Channel

soundBadge is mainly used on channel 4 (internal microphone), however, an Audio3 Ltd. external microphone may be connected to the micro-USB port too to extend the measurement range to lower levels (channel 5). In this configuration the dose will still be measured from the internal microphone but level page will be measured from the external one providing two independent measurements from two microphones.

⑦ Press **A** to advance to setting the channel. 'Ch' will now be displayed with the channel number flashing. Press or hold down **B** to select the desired channel.

Channel	Description	LEVEL page displays
0,1,2,3,6	Testing	Inputs from PCB test points, A, C and Z-filters with adaptive gain. Used for factory testing.
4	Internal Microphone	Default setting for measuring from internal microphone.
5	External Microphone	Sets the Level Page to display measurements from the external microphone (Dose is still calculated from the internal microphone).
7	Ground	Displays electrical noise floor on the A-channel

## Noise Dose

### What is a Noise Dose?

A noise dose reflects the accumulated amount of acoustic energy that has entered your ears over a period of time. It is an important quantity because as more energy enters your ears, more noise-induced hearing damage may occur. The US and EU have set limits on the amount of this energy your ears are allowed to absorb each day while working. For the default settings (EU/NIOSH), the equation governing the soundBadge noise dose calculation is:

$$Dose = 100 \cdot \int_{t=0}^{t=T} p_A(t)^2 \cdot dt$$

where: (1)  $p_A$  is the sound pressure (in N/m or equivalently Pascals) measured at time 't' with a microphone processed by an 'A-weighting' filter, (2) T is the period of time over which the measurement is accumulated (in hours).



NOTE: When the meter reaches the 9999% display limit, it will display --.--% and will automatically switch to Pa<sup>2</sup>\*hrs units.

### What are the EU/US Noise Dose Regulations?

The soundBadge can report the 'noise dose' as a percentage. Depending on the settings, 100% is the allowable daily dose according to EU or US regulations (EU Directive 2003/10/CE specifies: criterion = 85 dBA / 8-hr, exchange rate = 3 dB; US regulation 29 CFR 1910.95 specifies: criterion = 90 dBA / 8-hr, exchange rate=5 dB).

## Noise Dose

*Table of actions required according to EU regulations when various noise doses are exceeded. Equivalent average A-weighted sound levels are given for an 8-hr work day.*

Daily Dose	Average A-weighted Level (8-hr)	Action required according to regulation
32.0%	80.0 dBA	A risk assessment must be undertaken including measurements and employees shall be informed of risks
100.0%	84.9 dBA	Maximum allowable dose before hearing protection must be supplied
101.2%	85.0 dBA	Hearing protection must be supplied and a noise control regime to limit exposure adopted
160.4%	87.0 dBA	These limits must not be exceeded; strategies must implemented to reduce levels below these limits

### How well does the soundBadge measure Noise Dose?

The soundBadge calculates noise dose as a percentage of your daily allowed dose according to EU/US regulations with a resolution of 1% and with an accuracy that exceeds allowable standards, typically within +/- 10%.

## Recording Data

### How do I record sound level data?

When the soundBadge is recording a main-measurement, ► is displayed near the battery indicator and it records and stores sound levels every 1/4 s. There are two ways to start a main-measurement: (1) using a count-up timer after which you must stop the measurement yourself, or (2) using a count-down timer where you pre-set a measurement duration and the soundBadge automatically stops the measurement for you.

### Start a main-measurement using the count-up timer

- 1 Press the Ⓐ button to advance to the TIME main page. If ELAPSED TIME is not displayed, press the Ⓑ button to display it.
- 2 Make sure the Elapsed Timer is set to 00:00 (follow the steps in 'Start a main-measurement using the count-

-down' timer to view it and set it to 00:00).

- 3 Press the Ⓐ and Ⓑ together. The timer will display 00:00 and begin to count-up. Indicators will change from pause (||) to play (▶) and count-up will be indicated by (▶).

Note: The display will read minutes and seconds (e.g. 30:45) until 1 hour has passed, then it will read hours and minutes.

### Start a main-measurement using the count-down timer

- 1 Press the Ⓐ button to advance to the TIME main page. If ELAPSED TIME is not displayed, press the Ⓑ button to display it.
- 2 Hold Ⓐ down for 2 seconds to begin to set the count-down duration. The display will show 'hh:--' with '--' flashing.
- 3 Set the minutes by pressing Ⓑ until it is correct. Hint: holding down Ⓑ will increment the units rapidly.
- 4 Press Ⓐ to advance to setting the hours.

## Recording Data

The hours digits will flash.

- 6 Press Ⓑ until the correct number of hours is displayed.
- 7 Press Ⓐ, the display will flash all digits.
- 8 Press Ⓐ to again start the main-measurement and begin the count-down. The recording indicator will change from pause (||) to play (▶) and count-down will be indicated by (◀).



### Pausing and resuming or stopping a main-measurement

A main measurement can be paused and resumed. When paused no data is stored. To pause/resume a main measurement:

- 1 Press the Ⓐ button to advance to the TIME main page. If ELAPSED TIME is not displayed, press the Ⓑ button to display it.
- 2 Press Ⓐ and Ⓑ together to toggle between pause and resume. When paused, ► will be displayed and || will flash. To stop a measurement, hold Ⓐ and Ⓑ together for 2 seconds, || will be displayed.

Pausing and resuming will create blank time in the data file (this will not consume memory). To create a new data file, first stop the main-measurement then start a new one.

## Recording Data

### What data does the soundBadge store?

The soundBadge can record and store 3 different sound levels: dBA, dB Cpk, and either dBC or dBZ every 1/4 s. In addition the soundBadge records: the device serial number, timestamps, calibration information, any error events (such as over-range, memory errors and shock detection) and all device settings (including criterion and exchange rates) at the time of the recording. All this 'meta-data' about a measurement is stored in the same file with the data.

### How are the data stored?

Recorded data are stored in onboard memory with pre-defined and auto-incremented filenames. Up to 255 different filenames can be stored (e.g. SB\_001.DAT to SB\_255.DAT). The data format is a special compressed binary format.

### For how long can I record?

Total recording capacity of the soundBadge is 30 hours. On the ELAPSED TIME page, the bar graph displays the amount of memory used, and each bar represents 2 hours. When the memory becomes full, the device stops recording and displays 'FULL'.



## Recording Data

### About the timer

The soundBadge timer is the heart of its measurements. It is used to calculate average and maximum sound levels, noise doses and peak counts. The timer must be running to make these measurements. While the timer is running it can take two simultaneous measurements: (1) a main-measurement (which is recorded to disk), and (2) a sub-measurement (which is only displayed while it is active). A special feature of the soundBadge is that sub-measurements can be made while a main-measurement is in progress without interfering with it. In this case data for the sub-measurement including its ELAPSED TIME are displayed until the sub-measurement is cancelled.

Main-measurement	Sub-measurement	ELAPSED TIME displays	All other pages display
Count-up	not active	main-measurement elapsed duration	main-measurement data
Count-up	active	sub-measurement elapsed duration	sub-measurement data
Count-down	not active	main-measurement remaining time	main-measurement data
Count-down	active	sub-measurement elapsed duration	sub-measurement data

## Protecting Data

### How can I prevent someone from tampering with a measurement?

The soundBadge has a password protection function that locks the device during a measurement. When the soundBadge is locked, 'LOC' is displayed and only the '!' over-dose indicator will be shown.

### How do I lock the soundBadge during a measurement?

- 1 Press **A** to advance to the PEAK main page. If PEAKS is displayed, press **B** repeatedly until the S is removed.
- 2 Hold **A** down for 2 seconds to display 'PASS'. Continue to hold **A** while you press **B**, the current passcode (default = 1234) will be displayed and will flash.
- 3 Hold **B** for 2 seconds to lock the device. The display will read 'LOC'

NOTE: You cannot turn off the soundBadge if it is measuring a dose and is locked.

### How do I unlock the soundBadge?

- 1 Hold **A** down for 2 seconds to display the default passcode (1234). The first digit, 1, will flash.
- 2 Set the correct passcode by pressing **B** until the first digit is correct then press **A** to advance to the next digit.
- 3 Once all the digits are correct press **A** again to unlock.

## Protecting Data

### How do I change the passcode?

- 1 Press **A** to advance to the PEAK main page. If PEAKS is displayed, press the **B** repeatedly until the S is removed.
- 2 Hold **A** down for 2 seconds to display 'PASS'. Continue to hold **A** while you press **B**, the current passcode (default = 1234) will be displayed and will flash.
- 1 Press **A** again the first digit of the current passcode will flash.
- 3 Press **B** until the new first digit is correct then press **A** to advance to the next digit.
- 4 Once all digits are set, press **A** again, all the digits will flash.
- 5 Press **B** to set the passcode and return to the PEAK page (or Hold **B** for 2 seconds to lock the device with the new passcode).



If you forget your passcode, it can be recovered using the soundView™ software from the device info button.

## Managing Data

### What do I do when I see 'FULL' displayed?

When the memory is full the soundBadge will stop recording automatically and display 'FULL'. You will not be able to record a new main measurement until you have deleted some files.

### How do I completely erase the internal memory?

- 1 Press the **(A)** button to advance to the TIME main page. If ELAPSED TIME is not displayed, press the **(B)** button to display it.
- 2 Hold **(B)** down for 2 seconds to display 'del.'. Continue to hold **(B)** while you press **(A)** '\_ALL' will be displayed and will flash.
- 3 Hold **(A)** down for 2 seconds 'none' will be displayed. The memory is now erased.



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## Managing Data

### How do I erase a specific data file?

- 1 Press the **(A)** button to advance to the TIME main page. If ELAPSED TIME is not displayed, press the **(B)** button to display it.
- 2 Hold **(B)** down for 2 seconds to display 'del.'. Continue to hold **(B)** while you press **(A)** '\_All' will be displayed and will flash.
- 3 Press the **(B)** button again. '\_001' or something similar will be displayed and will be flashing.
- 4 Press the **(B)** button or hold down the **(B)** button to cycle to the file number you want to delete. Only exiting files are displayed. If a main-measurement is in progress that file will not be available.
- 5 Hold **(A)** down for 2 s to delete the file and advance to the next existing file in order.



Changing a filename using your computer will make it impossible to select and delete that file using the soundBadge.

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## Viewing Data

### How do I download the data to a PC?

The soundBadge stores its data to an internal USB flash disk. Connecting the soundBadge to a computer will open this disk without the need for any special drivers. The individual data files (e.g. SB\_001.DAT) can be copied to your computer and renamed as usual but Audio3 Ltd. soundView™ software is needed to view the data.

### How do I view the data in a previously recorded file?

Audio3 Ltd. soundView™ software is the easiest way to view and analyze data stored on your soundBadge. Stored soundBadge data cannot be viewed directly on the soundBadge itself. soundView software is available to download from audio-3.com.

A core mission of Audio3 Ltd. is to encourage independent, unbiased and high-quality hearing research so soundView can export the raw data to standard spreadsheet format and Audio3 can provide, upon request, Matlab® scripts that can read the data files directly.



Although you can format the soundBadge disk and add or delete the files on the soundBadge using your computer, we recommend that you delete the files and erase the soundBadge disk via the soundBadge 'dEL' function described in the section on Managing Data.

## Viewing Data

### What can I do with the soundView software that I cannot do with the soundBadge

The soundView software allows you to re-analyze data, print reports, calculate noise doses, average and maximum levels and peak counts for any duration window you choose in the measurement.



## Positioning

### How should I position the soundBadge to make sound level measurements?

The soundBadge microphone is a pressure-field microphone with a special filter designed to flatten the frequency response at high frequencies. If you are measuring high frequencies (> 8 kHz), the best accuracy is achieved when the sound is coming from 90 degrees. We recommend you hold the device in one of its two reference directions for these measurements:

- Hold the meter vertically while facing the sound source
- Hold the meter horizontally with the sound source coming directly from the right or left.

## Positioning



### How should I position the soundBadge to measure a personal noise dose?

To measure a personal noise dose, the soundBadge must be worn. The closer it is worn to the wearer's ear, the more accurate the dose will be. The included rubber protective case has loops that accept a 1" wide strap that can be used to mount it on a helmet (strap not included). The included rubber shoulder mount is designed to position the soundBadge optimally (4-6cm from the ear) and clips easily to clothing.

## Calibrating

### About calibrating the soundBadge

You can calibrate the soundBadge in the field using the soundBadge's acoustic coupler and an IEC 60942 compliant 1/2" microphone calibrator set to outputs 94.0 dB SPL at 1 kHz.

The soundBadge supports:

- fast—microphone only calibration
- slow—full system calibration

### Perform a fast microphone only calibration

- 1 Place the acoustic calibration coupler on the soundBadge, align the semicircular cutout with the dB symbol on the front of the soundBadge.
- 2 Turn on the calibrator (94.0 dB SPL, 1 kHz) and insert it into the coupler.
- 3 Press **A** to advance to the LEVEL page (any frequency weighting/time constant).
- 4 Hold **A** down until 'CAL' is displayed; while continuing to hold **A**, press **B**.
- 5 The display will show the difference between the sound level as measured with the current calibration and your constant 94.0 dB SPL signal (the new calibration).
- 6 If a signal of 94.0 dB SPL +/-5dB is detected, soundBadge will auto-calibrate
- 7 Or you can Press **B** to adopt the new calibration. This step may be repeated.

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## Calibrating

acoustic calibration coupler  
(accepts 1/2" microphone  
calibrators—94.0 dB SPL, 1 kHz)



Factory-calibrate  
every 2 years (contact  
your authorized  
distributor).

### Perform a full system calibration

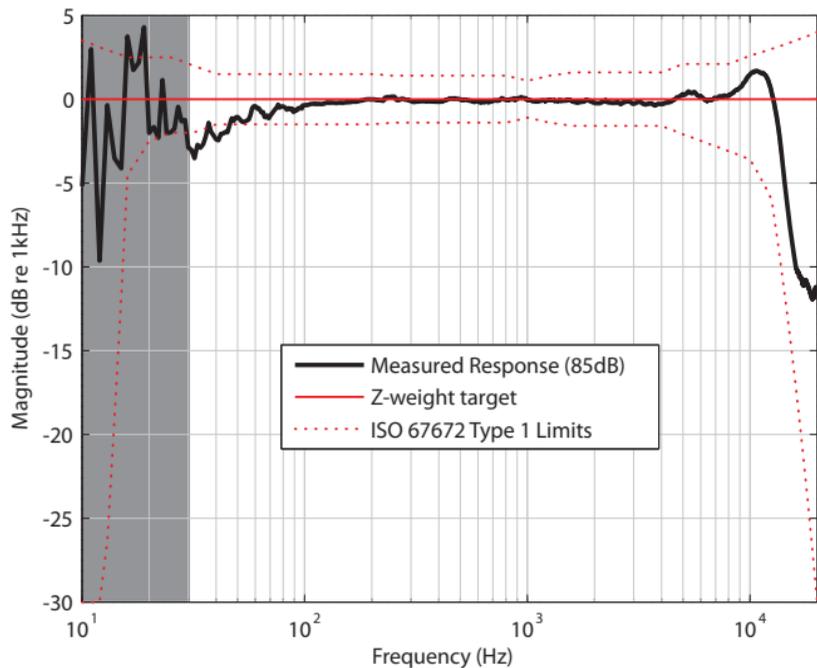
- After long periods of storage (6 months) or if the temperature, humidity or altitude has changed significantly perform a full calibration (dBA, dBC, dB(Z), Dose, Cpk and fast and slow time constants). To perform this calibration follow steps 1 to 5 of the fast microphone calibration opposite but substitute:
- 6 Hold **B** for 2 seconds to initiate a full calibration. The display will update and the bargraph will indicate calibration progress (takes 2 minutes).
  - 7 soundBadge will automatically exit and return to normal operation when done.

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## Specifications

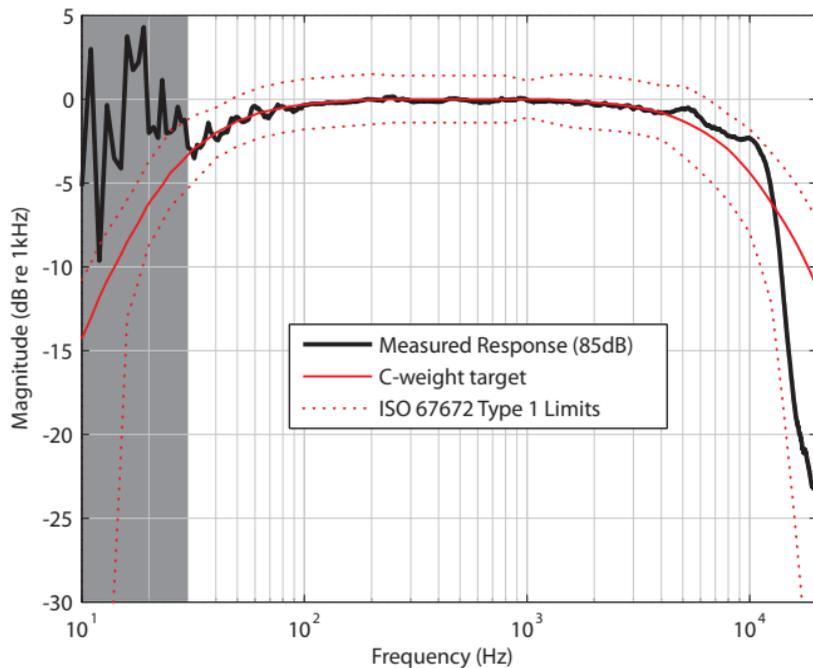
Acoustic test of typical soundBadge Z-weight frequency response (85dB SPL, 90°)



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## Specifications

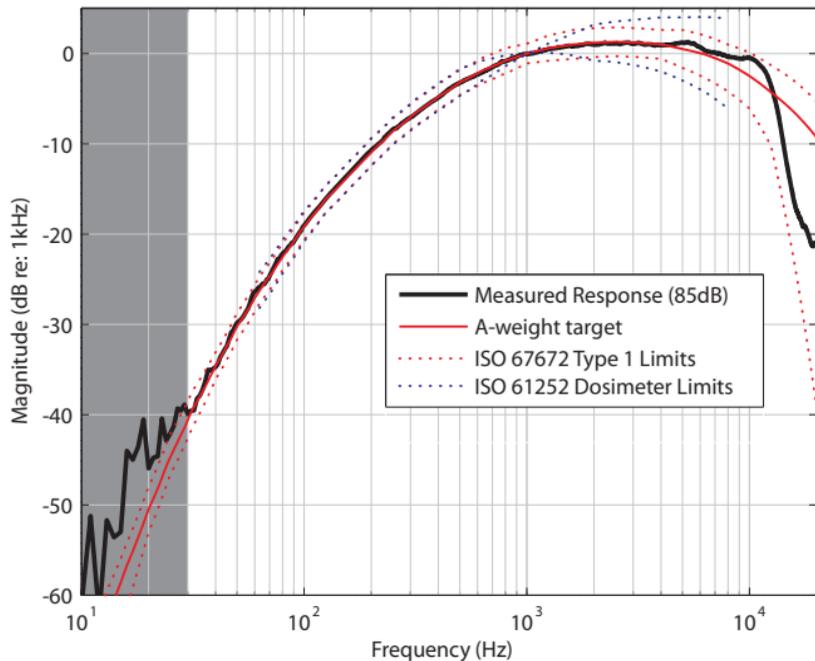
Acoustic test of typical soundBadge C-weight frequency response (85dB SPL, 90°)



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## Specifications

Acoustic test of typical soundBadge A-weight frequency response (85dB SPL, 90°)



## Specifications

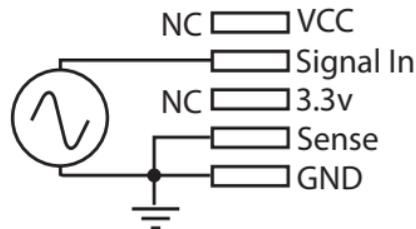
### Acoustic testing

The soundBadge's internal microphone is not removable. The best way to test all aspects of the dosimeter without removing the lens is to use acoustic signals. Alternately contact your authorized dealer who can access the sealed electrical test points.

### Electrical test signals

Electrical test signals from a low impedance (<100 ohms) source can be used to test the frequency response of the soundBadge via the micro-USB connector. These signals should be in the range 5.0 mVrms - 1.0 Vrms.

*Adaptation of the micro-USB connector to accept electrical test signals*



## Specifications

<b>Performance Specifications</b>	
Sound Level Operating Range	55 - 140 dB SPL / 120-143 dB Cpk
Max Level Before Damage	155 dB Cpk
Sound Exposure Range (Pa <sup>2</sup> *h)	0.01 to 9999
Frequency Range	20 Hz - 20 kHz
Over-range Indicator Level	143.5 dB Cpk
Over-range Delay	250 ms
Under-Range Indicator Level	54 dBA
Pulse Range	53 dB
Stabilization Time on Power-Up	1s (8s for slow time-constant measure)
Internal Input Referred Noise	50 dBA, 50dBC, 50 dBZ
<b>Available Measurement Settings</b>	
8-Hr Criterion Level for 100% Dose	75 - 90 dBA (in 5 dB Increments)
Exchange Rate	3.0, 4.0, 5.0 dB
Threshold Level	Off, 80, 90 dBA
Frequency Weightings	A,C,Z (Type 2)
Time Weightings	Fast (1/8s), Slow (1s), Impulse (dB C pk)
<b>Environmental</b>	
Temperature	-10 to 50 °C (+/- 0.5 dB)
Humidity	10 - 90 % RH (+/- 0.5 dB)
Static Atmospheric Pressure	65 to 108 kPa (+/- 0.5 dB)
Magnetic Fields:	Negligible
Vibration	1g acceleration, 1 kHz (62 dB SPL)
Electromagnetic Interference	Negligible (4kV direct shocks +/- 1 dB)

## Specifications

<b>Calibration Conditions</b>	
Sound	94 dB @ 1kHz
Integration Time	6 minutes (or 8 seconds via SLM)
Sound Incident Direction	90° (on axis)
Reference Exposure Level	0.1005 Pa <sup>2</sup> *hrs
Temperature	20 °C (23 °C for SLM)
Pressure	101.325 kPa
Humidity	65% (50 % RH for SLM)
<b>Standards</b>	
IEC 61252: 1993 Class 2	Personal Sound Exposure Meter
<b>General</b>	
Battery voltage	3.7v / 250mA
Power consumption (maximum)	20mA
Dimensions D x H (excluding clip)	50mm x 13mm
Weight (net)	36 g
Weight (packed)	200 g
<b>NOTE:</b> All values are typical unless otherwise stated	

## Warranty

### *Worldwide Guarantee*

This warranty entitles you to have the unit repaired or replaced free of charge, during the first two years after purchase, at any authorised Audio3 Ltd. distributor provided that it was originally purchased from an authorised dealer or distributor and you completed product registration online ([www.audio-3.com](http://www.audio-3.com)). The warranty covers parts, labor and materials but does not cover defects arising from accident, misuse, abuse, wear and tear, neglect or unauthorised adjustment and/or repair. We cannot accept responsibility for damage or loss occurring during transit.

### *The Warranty Covers:*

Parts and labour costs for two years from the purchase date. After two years you must pay for both parts and labour costs. The warranty does not cover transportation costs at any time. The equipment should be packed in the original packing and returned to your authorized dealer. It should be sent carriage prepaid by a reputable carrier – not by post. No responsibility can be accepted for the unit whilst in transit and customers are therefore advised to insure the unit against loss or damage whilst in transit.

*Audio<sup>3</sup> Customer Support*

221 New North Rd, London, N1 7BG, United Kingdom

[www.audio-3.com](http://www.audio-3.com)

## References

soundBadge is RoHS compliant and complies with 2006/95/EC Low Voltage Directive and 2004/108/EC EMC Directives of the European Union, via:

IEC 61000-4-2:1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test. Basic EMC publication.

IEC 61000-4-3:1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio-frequency, electromagnetic field immunity test.

IEC 61000-6-1:1997, Electromagnetic compatibility (EMC) – Part 6: Generic standards –Section 1: Immunity for residential, commercial and light-industrial environments.

IEC 61000-6-2:1999, Electromagnetic compatibility (EMC) – Part 6-2: Generic standards –Immunity for industrial environments.

CISPR 61000-6-3:1996, Electromagnetic compatibility (EMC) – Part 6: Generic standards–Section 3: Emission standard for residential, commercial and light-industrial environments.

