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A Guide to Occupational Noise Measurement Terminology

A summary of Occupational Noise parameters and functions shown by the Optimus® Sound Level Meters and doseBadge® Noise Dosimeter

Occupational Noise Terminology
An Introduction

Most noise measurement equipment is capable of measuring, recording and storing a wide range of parameters.

Some of the more advanced instruments can measure and store over 100 different noise parameters at the same time!

There are different versions of all of these instruments and some may not show all of the parameters listed in this booklet.

We'll cover some essential noise terminology, as well as listing all of the parameters that you may see displayed by the Optimus Sound Level Meters and the doseBadge Noise Dosimeter.

A brief explanation of each parameter is provided along with additional information where appropriate.

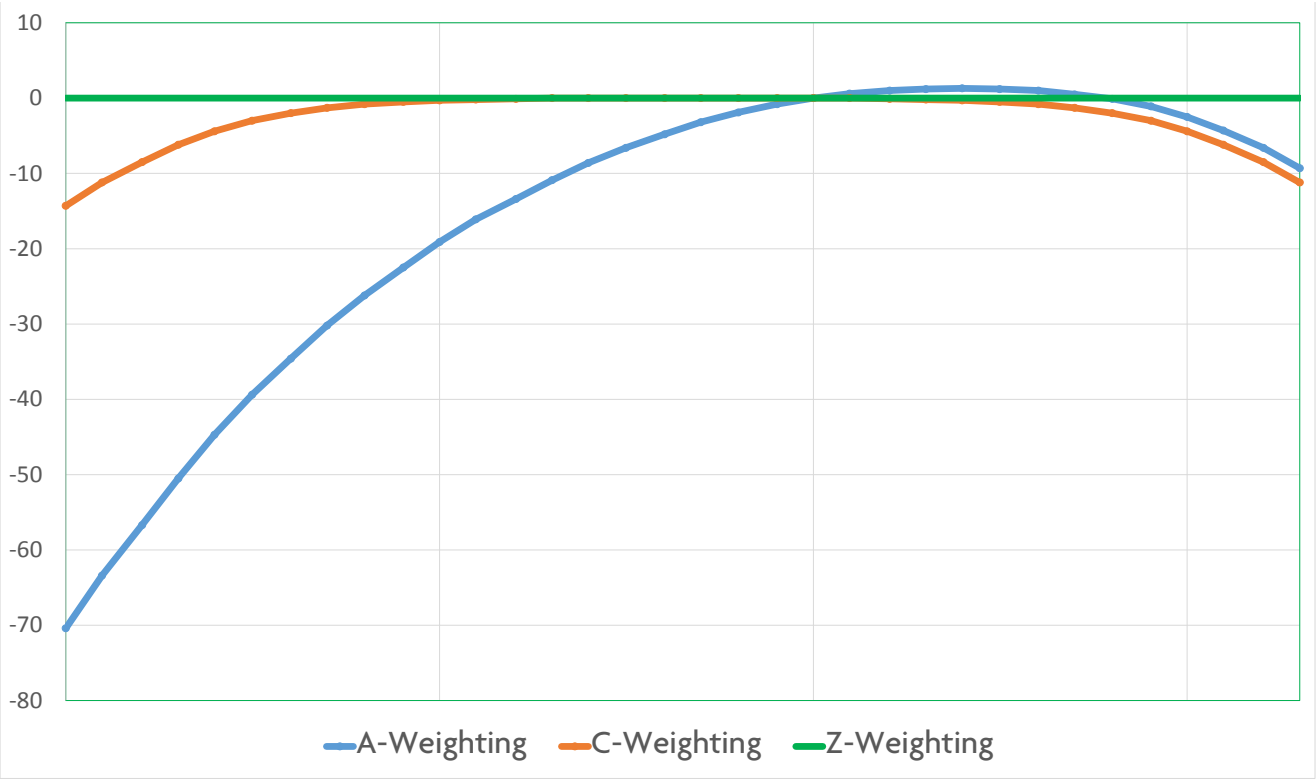
If you need a more detailed description of any parameter or you have any questions, please ask us and we will be happy to help.

You can contact us through our website at www.cirrusresearch.co.uk/support, email us at support@cirrusresearch.com or call us on **01723 891 655**.

For Cirrus customers, the Details View on the Optimus will show the capabilities fitted to that instrument so you can see what features are available.

Key Noise Parameters

Term	Description
'A' Weighting	'A' Weighting is a standard weighting of the audible frequencies designed to reflect the response of the human ear to noise. The 'A' Frequency Weighting network is the most widely used, and is used to represent the response of the human ear to loudness. Measurements made with this frequency weighting will typically be displayed as dB(A) or dBA. For example, as LAeq, LAFmax, LAE etc where the A shows the use of 'A' Weighting.
'C' Weighting	'C' weighting gives much more emphasis to low frequency sounds than the 'A' weighting response and is essentially flat or linear between 31,5Hz and 8kHz, the two -3dB or 'half power' points. In addition, Peak Sound Pressure measurements are made using the 'C' Frequency Weighting. Measurements made with this frequency weighting will typically be displayed as dB(C) or dBC. For example, as LCeq, LCPeak, LCE etc where the C shows the use of 'C' Weighting.
'Z' Weighting	This has replaced Linear or Flat, and is defined as being a flat frequency response of 8Hz to 20kHz ±1.5dB. Measurements made with this frequency weighting will typically be displayed as dB(Z) or dBZ. For example, as LZeq, LZFmax, LZE etc where the Z shows the use of 'Z' Weighting.



Term	Description
Fast, Slow and Impulse Time Weightings	The Time Weightings of Fast, Slow and Impulse are defined by the standards to which the instrument are designed, such as IEC 61672, and they determine the "speed" at which the instrument responds to changing noise levels. For example, an instrument set to Fast will respond quickly to changes in the noise level, whereas an instrument set to Slow will respond more slowly. If the noise level is constant, both instruments will display the same level. An instrument set to Impulse will respond very quickly to an increase in the noise level, but will take much longer to fall when the noise level decreases. Time weighting is only applied to Sound Level, Maximum Sound Level and Minimum Sound Level. Also, the Ln Percentile Levels are calculated from Sound Level, and therefore are also affected by the selected Time Weighting. Measurements parameters that use these time weightings will show this, for example, as LAFmax which shows that the values are the maximum A-Weighted Fast Time Weighted sound levels.
Equivalent Continuous Sound Level (Leq)	Leq is the equivalent continuous sound level, and represents the total sound exposure for the period of interest or an energy average noise level for the period of interest. Leq is often described as the "average" noise level during a noise measurement which although not technically correct, is often the easiest way to think of Leq. If the noise is varying quickly, the average energy over a period of time is a useful measurement parameter and it is for this reason Leq is often called the Equivalent continuous level. Leq values should be written with a Frequency Weighting, such as dB(A) and also the measurement duration. For example, LAeq, 5min = 90dB

Term	Description
Peak Sound Pressure	This function is often confused with the maximum Sound Level. Whereas the maximum is the highest sound level, the Peak level is the actual peak level of the pressure wave. The reason for this is that the maximum sound level is the RMS level with a time constant (F,S or I) applied, whereas the Peak is the highest point of the pressure wave before any time constant is applied. The measurement of Peak sound pressure levels is required by the UK Noise at Work regulations where it is C-weighted. In this case, the value would be written as LCPeak = 134dB.
1:1 Octave Band Filters	When detailed information about a complex sound is needed, the frequency range can be split into sections, or frequency bands. A sound level meter may provide 1:1 (or single) octave band filters or 1:3 (or third) octave band filters. An Octave is a frequency band where the highest frequency is twice the lowest frequency. For example, an octave filter with a centre frequency of 1kHz has a lower frequency of 707Hz and an upper frequency of 1.414kHz.

Optimus Sound Level Meter Instrument Views

The Optimus Sound Level Meters provide a range of Views or Screens that show the measurement information. This section describes what each of these screens shows.

Some screens are only available on certain versions of the instruments. The General View on the Optimus instruments shows the capabilities of that specific instrument.

Term	Description
General View	The information view pages on the Optimus Sound Level Meters. These screens show information about the instrument such as the serial number, calibration information and measurement storage space.
Sound Level View	The Sound Level View provided by the Optimus Sound Level Meters. These screens provide a display of the Sound Level and include values such as LAF, LAS, LAFmax and LAFmin.
Leq View	The view of the integrated sound level shown as Leq. When the instrument is not measuring, this view will show the 1 second Leq samples and can show this with A, C or Z frequency weighting. When the instrument is measuring, the primary number is the cumulative Leq (A, C or Z weighted) with the LCPeak and C-A values shown. LAPeak, LAE, LCeq and LCE values are also available. A graph of the 1 second LAeq and LCPeak values is also shown.
1:1 Octave Band View	The view in the Optimus Sound Level Meters that displays the 1:1 Octave Band Filters
Dose View	The view in the Optimus Sound Level Meters that shows a range of occupational noise exposure values. The values shown in this view are determined by the Quick Settings options chosen.

Measurement Parameters

This section shows the measurement parameters that are available in the Optimus Sound Level Meters, the Trojan and Trojan^2 Noise Nuisance Recorders and the doseBadge Noise Dosimeter.

The parameters are listed in alphabetical order.

Term	Description
% Dose or Dose %	The noise exposure expressed as a percentage (%) of a fixed level for 8 hours. For example, if the noise limit is 85 dB and a person is exposed to a constant or equivalent sound pressure level of 85 dB for eight hours, then the result is a 100% noise dose. In the UK a 3dB Exchange Rate, or Q, is used. This means that a noise level of 88dB has twice as much energy as a level of 85dB and so a constant level of 88dB is a 200% Dose. The 8 hour average level is known as LEP,d (Daily Personal Noise Exposure) or LEX,8h.
115dBA	A Yes/No value in the doseBadge that shows if the 115dB(A) level has been exceeded during a measurement.
115dB LAS ex.	The time for which the LAS exceeded 115dB during a measurement.
ACGIH	The settings in the Dose View that allow the Optimus to calculate the Lavg, TWA, Dose and Est. Dose values in accordance with the ACGIH standard. This affects the threshold level, exchange rate and time weighting used in the calculation of these values.
A-weighted Octave Band Leq,1s	The 1:1 Octave Band Filters shown numerically with A-weighting applied.
A-weighted Octave Band Leq,t	The 1:1 Octave Band Filters shown graphically when the instrument is measuring. The cumulative LAeq in each band is shown.
A-Weighted Octave Band Leq,t	The 1:1 Octave Band Filters shown numerically with the cumulative LAeq in each band shown.

Term	Description
A-weighted Octave Band LF	The 1:1 Octave Band Filters shown graphically with A-weighting applied.
C-A	The LCeq-LAeq value over a measurement period. Commonly used in determining the most appropriate hearing protection using the HML method.
Criterion Level or CL	The maximum Leq sound level allowed for an 8-hour period and corresponds to the 100% noise dose value. Used for calculating % Dose and Estimated % Dose. In the UK is this set to 85dB.
Criterion Time or CT	The time over which the doseBadge and Optimus instruments calculate exposure and dose values.
dB(A)	Decibels 'A' Weighted The most commonly used standard frequency weighting designed to reflect the response of the human ear to noise. Also written as 'A' weighting or dB(A)
dB(C)	Decibels 'C' Weighted A standard frequency weighting commonly used for the measurement of Peak Sound Pressure level. Also written as dB(C) or dBC.
dB(Z)	Decibels 'Z' weighted Z weighting is a flat frequency response between 10 Hz and 20 kHz ±1.5 dB excluding microphone response. Replaces Flat and Linear. Also written as dB(Z) and dBZ
Estimated Dose or Est Dose %	The % dose projected forwards over an 8 hour period.
Estimated Exposure	The noise exposure projected forwards over an 8 hour period. Also displayed as Est. Exposure.

Term	Description
Exchange Rate (Q)	The increase in noise level that corresponds to a doubling of the noise level. LAeq is always based on an Exchange Rate, or Q, of 3. In the US, the exchange rate defined in the OSHA standard is 5 dB. Using the 5 dB exchange rate, the 8 hour average level is known as TWA or the Time Weighted Average. For other exchange rates the average level for the measurement duration is known as Lavg
Exposure	The measured noise exposure expressed in Pa2h (Pascal Squared Hours)
Exposure Time	The actual time that a person is exposed to noise during a workday - used for calculation of LEP,d
ISO (EU)	The settings in the Dose View that allow the Optimus to calculate the Leq, LEP,d, Dose and Est. Dose values in accordance with the EU Physical Agents (Noise Directive). This affects the threshold level, exchange rate and time weighting used in the calculation of these values.
LAE	Sound Exposure Level (SEL) with 'A' frequency weighting. See LE
LAeq	See Leq
LAeq,1s	An 'A' Weighted 1 second Leq value
LAeq,t	See Leq
LAF	The Sound Level with 'A' Frequency weighting and Fast Time weighting
LAFmax	The maximum Sound Level with 'A' Frequency weighting and Fast Time weighting during the measurement period.
LAFmin	The minimum Sound Level measured with 'A' frequency weighting and Fast Time weighting during the measurement period.
LAFTeq	Takt maximal sound level as defined by DIN 45641
LAI	The Sound Level with 'A' Frequency weighting and Impulse Time.
LAImax	The maximum Sound Level with 'A' Frequency weighting and Impulse Time weighting
LAImin	The minimum Sound Level measured with 'A' frequency weighting and Impulse Time weighting during the measurement period.

Term	Description
LAS	The Sound Level with 'A' Frequency weighting and Slow Time weighting
LASmax	The maximum Sound Level with 'A' Frequency weighting and Slow Time weighting during the measurement period.
LASmin	The minimum Sound Level measured with 'A' frequency weighting and Slow Time weighting during the measurement period.
LAT	See Leq
LAVG	The Time Averaged Sound Level with an exchange rate other than 3dB.
LCE	Sound Exposure Level (SEL) with 'C' frequency weighting
LCeq,1s	'C' Weighted 1 second Leq value
LCeq,t	An Leq value measured with 'C' frequency weighting
LCF	The Sound level with 'C' Frequency weighting and Fast Time weighting
LCFmax	The maximum Sound level with 'C' Frequency weighting and Fast Time weighting during the measurement period.
LCFmin	The minimum Sound Level measured with 'C' Frequency weighting and Fast Time weighting during the measurement period
LCI	The Sound Level with 'C' Frequency weighting and Impulse Time weighting
LCImax	The maximum Sound level with 'C' Frequency weighting and Impulse Time weighting during the measurement period
LCImin	The minimum Sound Level measured with 'C' Frequency weighting and Impulse Time weighting during the measurement period
LCPeak	The Peak Sound pressure level with 'C' frequency weighting
LCS	The Sound level with 'C' Frequency weighting and Slow Time weighting
LCSmax	The maximum Sound level with 'C' Frequency weighting and Slow Time weighting during the measurement period
LCSmin	The minimum Sound Level measured with 'C' Frequency weighting and Slow Time weighting during the measurement period

Term	Description
LE (SEL)	This is an Leq normalised to 1 second. It can be used to compare the energy of noise events which have different time durations. For example if a noise level of 90 dB last for 1 second then the LE = 90 dB. If the same noise event lasted 10 seconds the LE would be 100 dBA. If it lasted 20 seconds the LE would be 103 dBA and so on. The LE is the Sound Exposure expressed as a logarithm and basically Leq is the LE divided by time. This will usually be displayed as LAE, LCE or LZE
LEP,d	Daily personal noise exposure. Also see LEX,8h. The LEP,d is the average A-weighted noise exposure level for a nominal 8 hour working day. This is also known as the LEX,8h. LEP,d is calculated from the measured sound exposure, the measurement time and the reference 8 hour day.
LEP,w	A measure of the total noise exposure received by an employee during a working week. It is similar to the daily noise exposure but is calculated for a 40-hour week (five 8-hour days) instead of an 8-hour day.
Leq	Equivalent Continuous Sound Level This is the most commonly used value used to describe sound levels that vary over time. An Leq is the level that would produce the same sound energy over a stated period of time when using a 3 dB exchange rate. It is defined as the sound pressure level of a noise fluctuating over a period of time T, expressed as the amount of average energy. Commonly written as Leq, LAeq, LAeq,t or LAT
Leq,t	See Leq
LEX,8h	See LEP,d
LIeqT	Impulse weighted Leq,t as defined by DIN 45641
Lmax	Maximum Sound Level
Lmin	Minimum Sound Level

Term	Description
Lp	Sound Pressure Level
Lw	Sound Power Level
LZE	Sound Exposure Level (SEL) with 'Z' frequency weighting
LZeq,1s	A 1 second Leq value with 'Z' Frequency Weighting
LZeq,t	A Leq measured with 'Z' Frequency weighting.
LZF	The Sound level with 'Z' Frequency weighting and Fast Time weighting
LZFmax	The maximum Sound level with 'Z' Frequency weighting and Fast Time weighting during the measurement period
LZFmin	The minimum Sound Level measured with 'Z' Frequency weighting and Fast Time weighting during the measurement period
LZI	The Sound level with 'Z' Frequency weighting and Impulse Time weighting
LZImax	The maximum Sound level with 'Z' Frequency weighting and Impulse Time weighting during the measurement period
LZImin	The minimum Sound Level measured with 'Z' Frequency weighting and Impulse Time weighting during the measurement period
LZPeak	Peak Sound pressure level with 'Z' Frequency weighting
LZS	The Sound level with 'Z' Frequency weighting and Slow Time weighting
LZSmax	The maximum Sound level with 'Z' Frequency weighting and Slow Time weighting during the measurement period
LZSmin	The minimum Sound Level measured with 'Z' Frequency weighting and Slow Time weighting during the measurement period
Maximum Sound Level (Lmax)	Maximum Sound Level. The maximum noise level during a measurement period or a noise event.
Minimum sound level (Lmin)	Minimum Sound Level. The minimum noise level during a measurement period or a noise event.
MSHA EC	The settings in the Dose View that allow the Optimus to calculate the Lavg, TWA, Dose and Est. Dose values in accordance with the MSHA Permissible Exposure Limits. This affects the threshold level, exchange rate and time weighting used in the calculation of these values.

Term	Description
MSHA HC	The settings in the Dose View that allow the Optimus to calculate the Lavg, TWA, Dose and Est. Dose values in accordance with the MSHA Hearing Conservation values. This affects the threshold level, exchange rate and time weighting used in the calculation of these values.
NC	Noise Criteria A single number for rating the sound quality of a room, used extensively by the air conditioning industry, for example, to test the background levels on offices etc. The measured octave bands are compared with the NC Curves which are based on equal loudness curves. The NC rating is the value of the highest NC curve touched by the measured octave bands. The NC Decisive Band is the frequency band touching the NC Curve.
NR	Noise Rating A method for rating the acceptability of indoor environments for the purposes of hearing preservation, speech communication and annoyance Sound Pressure Levels measured in octave bands are compared with curves from which a noise rating (NR) is obtained. The NR rating is the highest NR Curve touched by the measured octave band spectrum. The NR Decisive Band is the frequency band touching the NR Curve.
Octave Band Leq,1s	The 1:1 Octave Band Filters shown numerically. No frequency weighting is applied.
Octave Band Leq,t (Graph)	The 1:1 Octave Band Filters shown graphically when the instrument is measuring. The cumulative Leq in each band is shown. No frequency weighting is applied.
Octave Band Leq,t (Numbers)	The 1:1 Octave Band Filters shown numerically with the cumulative Leq in each band shown. No frequency weighting is applied.
Octave Band LF	The 1:1 Octave Band Filters shown graphically. No frequency weighting is applied.
OSHA HC	The settings in the Dose View that allow the Optimus to calculate the Lavg, TWA, Dose and Est. Dose values in accordance with the OSHA Hearing Conservation values. This affects the threshold level, exchange rate and time weighting used in the calculation of these values.

Term	Description
OSHA PEL	The settings in the Dose View that allow the Optimus to calculate the Lavg, TWA, Dose and Est. Dose values in accordance with the OSHA Permissible Exposure Limits. This affects the threshold level, exchange rate and time weighting used in the calculation of these values.
Pa2h (Pa^2h)	Noise Exposure in Pascal Squared Hours
Peak	The maximum value reached by the sound pressure at any instant during a measurement period (in dB usually with C frequency weighting)
Projected Exposure	The measured LAeq projected over a range of durations to give the equivalent daily exposure values.
Q	Exchange Rate This is the increase in noise level that corresponds to a doubling of the noise energy. LAeq is always based on an Exchange Rate of 3dB. Using the 3 dB exchange rate, the 8 hour average level is known LEP,d or LEX,8h. In the US, the exchange rate defined in the OSHA standard is 5 dB. Using the 5 dB exchange rate, the 8 hour average level is known as TWA or time weighted average
Sound exposure level (SEL)	See LE
Threshold Level	A number of occupational noise regulations specify that for the measurement of noise at work, sound levels below a certain limit (the threshold) should be disregarded. These include the OSHA and MSHA Regulations commonly used in the USA.
TW	The time weighting used by the doseBadge Noise Dosimeter.
TWA (Time Weighted Average)	Using a 5 dB exchange rate, the total amount of workplace noise exposure expressed as an equivalent standard 8 hour working day. Used by the OSHA specification.

Sound Level Meter Standards & Terms

The table shows the current standards for Sound Level Meters, Integrating Averaging Sound Level Meters (i.e. those that measure Leq), Noise Dosemeters and Acoustic Calibrators which apply in the UK.

Instrument Type	Current Standards	Superseded Standards
Sound Level Meters	BS EN 61672-1:2003 Also published as IEC 61672-1:2002	BS EN 60651 BS 5569:1981 IEC 60651:1979 (previously known as IEC 651)
Integrating Sound Level Meters	BS EN 61672-1:2003 Also published as IEC 61672-1:2002	BS EN 60804:2001 BS 6698:1986 IEC 804:1985
Noise Dosemeters	BS EN 61252:1997 Also published as IEC 61252:1993	BS 6402:1994 (Previously numbered as IEC 1252:1993 and BS 6402:1994)
Acoustic Calibrators	BS EN 60942:2003 Also published as IEC 60942:2003	BS EN 60942:1998 IEC 60942:1997

Term	Description
Class 1	Precision grade meters for laboratory and field use as defined in IEC 61672. This may also be referred to as Type 1 although the IEC 61672 standard uses the term Class rather than Type.
Class 2	General grade meters for field use as defined in IEC 61672. This may also be referred to as Type 2 although the IEC 61672 standard uses the term Class rather than Type.
Type 1	Laboratory & Field Grade for Sound Level Meters defined in standards such as IEC 60651 and IEC 60804. These standards have been superseded by IEC 61672 which uses Class 1 rather than Type 1.

Term	Description
Type 2	General Field Grade for Sound Level Meters defined in standards such as IEC 60651 and IEC 60804. These standards have been superseded by IEC 61672 which uses Class 2 rather than Type 2.
IEC	International Electrotechnical Commission The international standards body responsible for issuing technical standards for instrumentation such as the IEC 61672 standard for sound level meters.
IEC 60651	A standard for Sound Level Meters, now superseded by IEC 61672 In the UK this was known as BS EN 60651
IEC 60804	A Standard for Integrating & Integrating-Averaging Sound Level Meters, now superseded by IEC 61672 In the UK this was known as BS EN 60804 and previously BS 6698
IEC 61252	The international standard for personal sound exposure meters or noise dosemeters. In the UK this is known as BS EN 61252 The standard for noise dosemeters has no Class or Type levels.
IEC 61260	The International Standard for 1:1 Octave & 1:3 Octave Band Filters
IEC 61672	The International standard for Sound Level Meter and Integrating Averaging Sound Level Meters has superseded both IEC 60651 and IEC 60804
IEC 651	An international standard for sound level meters, replaced by IEC 60651 and now superseded by IEC 61672
IEC 804	An international standard for integrating averaging sound level meters, replaced by IEC 60651 and now superseded by IEC 61672
IEC 60942	The international standard for sound calibrators (acoustic calibrators)
IEC 942	An international standard for acoustic calibrators. Replaced by IEC 60942
DIN 45641	German Standard which defines the additional measurements LAFTeq & LIeqT
ISO	International Standards Organization. An international standards body that issues measurement standards such as ISO 1996 for environmental noise and ISO 20906 for aircraft noise.

General Noise Terminology

There are a number of other terms that are used when we are discussing sound level meter and noise dosimeters and this section covers some of the more common of these.

Term	Description
Acoustic Calibrator	An instrument that provides a reference noise source that is used to calibrate and check the performance of a Sound Level Meter.
Acoustic Fingerprint	An advanced system that allows triggers to be set up to start and stop audio recordings and markers in the Optimus Green and Trojan instruments. The triggers can be made up of a number of rules which can be level, rate of change or tonal noise based and can use any parameter that is available in the instrument.
Broadband	Noise Measurements using parameters which include all the audible noise, such as dB(A) and dB(C)
Calibrated to	The level to which the instrument sound level meter has been calibrated. This will usually be 93.7dB in the case of the Optimus sound level meters and 114dB in the case of the doseBadge.
Calibration	The process of measuring to determine the accuracy of your measurement chain.
Calibration offset	The difference between the expected calibration level set in the instrument and the level measured by the instrument during calibration.
CE Marking	A label used to show that the Sound Level Meter conforms to the specification of a European Directive
Decibel (dB)	The Decibel is a unit used to measure the intensity of a sound or the power level of an electrical signal by comparing it with a given level on a logarithmic scale. In the case of noise measurement, the measured sound pressure, p (in Pascals) is compared to a reference value p_0 of $2x10^{-5}$ Pa using the equation: $dB = 20\ x\ log_{10}\left(\frac{p}{p_0}\right)$

Term	Description
Data Logging	The storage of measurement information into a sound level meter or noise dosimeter that can be downloaded into software on a PC such as NoiseTools.
Display	The screen on the sound level meter or noise measurement instrument that shows the noise levels and measurement information.
Dynamic Range	All noise instruments are limited in the range of levels that they can accurately measure by inherent noise at low levels and by overload at high levels. The usable region between these two is the dynamic range of the instrument. Expressed in dB.
Free Field Microphone	At frequencies above 1 kHz the wavelength of sound is small enough for a standard half-inch microphone to 'disturb' or affect the sound field being to measured. Free field microphones are designed to compensate for this effect.
Integrating Averaging Sound Level Meter	A Sound Level Meter which accumulates the total sound energy over a measurement period and calculates an equivalent average value, usually displayed as an Leq.
Microphone Capsule	The microphone capsule is the part of the noise measurement instrument that converts the acoustic pressure, or noise, into an electrical signal that can be measured and displayed by the instrument. This is often the most sensitive and fragile part of a noise measurement instrument as it has to deal with both very small and very large changes in pressure with great accuracy and precision.
Noise Floor	The lower limit of measurement of an instrument calculated from the addition of all noise sources and unwanted signals within a measurement system. Signals beneath the noise floor cannot be measured.
Overload	The input to the Sound Level Meter is too high for the current measurement range.
Pa	Pascal. This is the SI derived unit of pressure.
Preamplifier	The preamplifier is an electronic circuit which takes the electrical signal from the microphone capsule and converts it into a signal that can be used in the sound level meter.

Term	Description
Quick Settings	A set of quick configuration options for the Dose View in the Optimus sound level meters.
Single Timer	The duration of a measurement in the Optimus sound level meters. If this is set, the measurement will stop after the specified time. If this is switched off, the measurement will continue until the Stop key is pressed.
Sound Level Meter	An instrument for measuring various noise parameters
Sound Power Level	This is a logarithmic measurement of the sound power as a relation to the threshold of hearing, and makes the values more manageable i.e. 0 to 160 dB and the symbol is Lw.
Sound Pressure Level	SPL, or sound level Lp, is a logarithmic measurement of the RMS sound pressure of a sound relative to a reference value. It is measured in decibels (dB).
Time constant	A standardised time constant used in exponential time weighting for acoustical analysis. The standard time constants for sound level meters are Slow (100ms), Fast (125ms) and Impulse (35 ms while the signal level is increasing or 1,500 ms while the signal level is decreasing).
Time History Rate	The speed, or rate, at which the noise levels are sampled and stored in the instrument. These samples, or time history, can be downloaded to the NoiseTools software and displayed on a graph.
Under Range	The input to the Sound Level Meter is too low for the current measurement range.
USB Socket	The standard USB socket on the Optimus, Trojan and doseBadge Reader units that allows the measurements to be transferred to the NoiseTools software.
VoiceTag	The data logging versions of the Optimus sound level meters allow a short voice recording to be made before the measurement starts. This can be downloaded and listened to in the NoiseTools software.
3.5mm Socket	An additional socket on the Optimus sound level meters that is used for some specialised applications.
18 Way Socket	The large, wide connector on the bottom of the Optimus and Trojan sound level meters that is used to connect accessories and ancillary equipment.

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