Metrix+™
Innovative Excellence

SOUND LEVEL METER

INSL 4005

Integrating data measurement with statistics

Measuring principle

Sound is a phenomenon caused by fluctuations in air pressure. Even at same amount of pressure fluctuations, we, humans do not feel they are the same at different frequencies. Hence, to evaluate the loudness as perceived by human ear, it is important to consider auditory sensations and its characteristics.

This sound level meter uses a microphone sensor, which has a diaphragm (with coil and magnet) sensitive to sound pressure fluctuations. It converts these fluctuations to electrical signals which are further filtered digitally to display the sound pressure in decibels(dB) values, a common unit for sound loudness measurement. These digital filters are where the magic happens, where the sound pressure is weighted with time, frequency, octave bands, etc. to display appropriate values.

Applications

This is a highly accurate sound level meter, calibrated using class 1 sound level calibrator. It is useful for sound level and noise level monitoring in occupational health and safety, environmental monitoring, building acoustics, healthcare, noise pollution studies, machinery noise analysis, etc.

Features

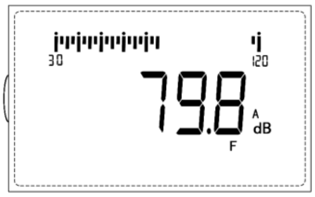
- This has performance in accordance with GB/T 3785-2010 standard level 2, IEC 61672:2013 Class 2 and JJG 188-2017 sound level requirement standards.
- Integrating mode allows for data measurement of either 800 groups (with custom time intervals) or 6 days of data(taken hourly). This data is stored with statistics of each group, like percentiles, max, std deviation, etc.
- Fast and slow time weights.
- Exponential time weighted sound level with A, C and Linear frequency weightings
- Backlit display, dynamic scale graph with range selection for better accuracy
- AC output port
- Power source via battery or external power supply
- Optional data logging and printer accessories

Technical Specifications

Model	*Metrix+* INSL 4005
Standards	GB/T 3785-2010 standard level 2, IEC 61672:2013 Class 2 and JJG 188-2017
Frequency Range	20Hz ~ 8kHz
Microphone	12.7mm (1/2”) diameter test condenser microphone
Frequency weighting	A, C and Linear(Lin)
Sound measuring range	25 ~ 130dB (A)
Integrating mode	Allows for data measurement of either 800 groups (with custom time intervals) or 6 days of data(taken hourly). This data is stored with statistics of each group, like percentiles, max, std deviation, etc.
Range control	Manual 3-selection range, linear range > 60dB 30 ~ 90dB (graph display range 10~100) 50 ~ 110dB (graph display range 30~120) 70 ~ 130dB (graph display range 50~140)
Accuracy	As per IEC 61672, class. Differ as per frequency, approx. ±1.4dB at 1kHz, and ±6dB at higher(8kHz) and lower(16Hz) frequencies
Resolution	0.1/ 1 dB
Time weighting	Fast(F), Slow(S)
Display	Large screen backlit display with dynamic graph
Calibration	Use class 1 sound level calibrator
Power supply	4 x 1.5V AAA batteries or 5V DC external power supply
Operating conditions	-10 ~ 50C, <90% RH
Dimensions	227 x 63 x 26mm, approx. 185g
Standard accessories	Main unit, windscreen for sensor, manual, case
Optional accessories	Data logging: PC interface(USB & software), Bluetooth Printer

Statistics of data

L5	Statistical sound level
L10	Statistical sound level
L50	Statistical sound level
L90	Statistical sound level
L95	Statistical sound level
SD	Standard deviation
LAE	Acoustic exposure level
Lmax	Maximum sound level
Lmin	Minimum sound level
E	Human voice exposure, Taking Pa^2h as a unit
Ld	Daytime equivalent sound level
Ldn	Day night equivalent sound level
Ts	Set measurement time



Sample Printer Output

No. = 0000 No: = 0000
2004/08/11 13:00
Weight: Fast T = 20M
13:00---
Leq = 64.8 L95= 59.2
Lae =95.5 L90= 59.6
SD =04.6 L50= 61.6
Lmax=86.2 L10= 70.4
Lmin=58.0 L5 = 73.6

14:00---
Leq = 59.9 L95= 59.0
Lae =90.6 L90= 59.2
SD =01.5 L50= 60.0
Lmax=74.0 L10= 61.2
Lmin=58.6 L5 = 63.0

XX:XX---
Leq = 64.8 L95= 59.2
Lae = 95.5 L90= 59.6
SD = 04.6 L50= 61.6
Lmax= 86.2 L10= 70.4
Lmin= 58.0 L5 = 73.6

12:00---
Leq = 64.8 L95= 59.2
Lae =95.5 L90= 59.6
SD =04.6 L50= 61.6
Lmax=86.2 L10= 70.4
Lmin =58.0 L5 = 73.6

Understanding basic sound level measurement concepts

Sound is a phenomenon caused by fluctuations in air pressure. Even at same amount of pressure fluctuations, we, humans do not feel they are the same at different frequencies. Hence, to evaluate the loudness as perceived by human ear, it is important to consider auditory sensations and its characteristics.

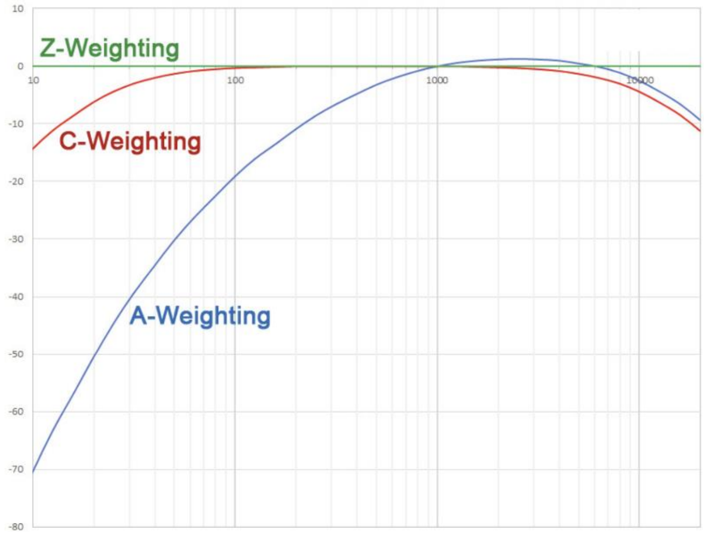
Frequency weightings:

Our ears are most sensitive to frequencies between 500Hz and 6kHz and are less sensitive to frequencies above and below these. For a sound level meter to measure and report noise levels that represent what we hear, frequency weightings are used.

'A' frequency weighting – A Weighting is the most commonly used and covers the full frequency range of 20Hz all the way up to 20 kHz. It adjusts the readings to reflect the sensitivity of the human ear. At lower and higher frequencies, the human ear is not very sensitive whilst being more sensitive between 500 Hz and 6 kHz. This is the most commonly used weighting to understand effect of sound level on human ears.

'C' frequency weighting – At higher sound levels (volumes), our ears have a flatter response, and this C weighting is used to represent that, giving much more emphasis to low frequency sounds. This is commonly used for peak sound pressure level.

'Z' frequency weighting – 'Linear' weighting is similar to Z frequency weighting, which represents a flat frequency response(no filters) to the entire frequency measuring range. It is used where analysis of the sound source is required rather than the effect the sound has on humans, such as in testing the frequency response of produced loudspeakers in a manufacturing process.



Time averaging:

Time averaging is used to analyze signals with a need to reduce the impact of short term fluctuations. The idea is to compute an average of signal over a specified time period to get smoother representation of the signal.

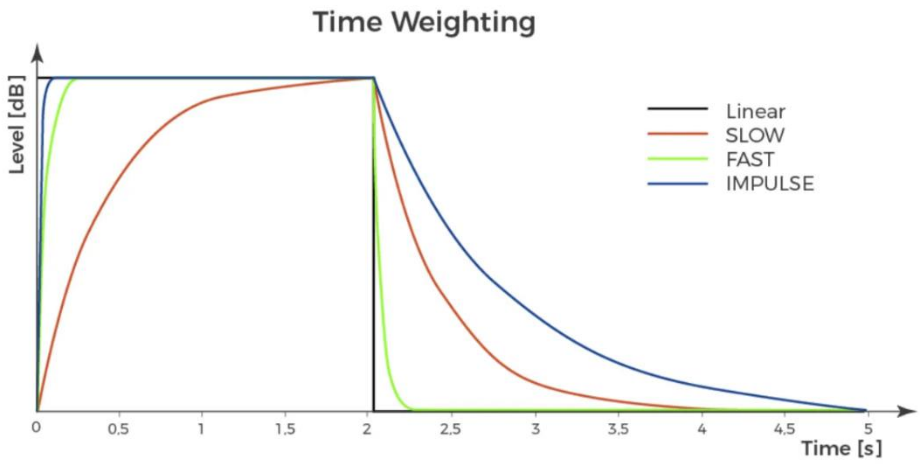
Linear time average – This method averages the signal value over a fixed time window, treating all data in the window equally.

Exponential time average – This method averages the signal value over a fixed time window, giving more weight to recent data, to react faster to signal changes. This is much more common as sound level meters are generally required to measure near to real time changes in noise levels.

Time weighting:

Time weighting refers to exponential time averaging method, where the instrument's sensitivity to fluctuating sound level is adjusted as per the required response.

Slow(S) time weight – With a time constant of 1s, this is slow reacting, used for rapidly changing sound levels.
Fast(F) time weight – With a time constant of 125ms, this is fast reacting, used for sound levels, which do not change rapidly.
Impulse(I) time weight – Specifically designed for measuring sounds with sharp peaks (like gunshots, fireworks), intended for measuring short impulse sound signals. It reacts very quickly to sharp rising sound level signal, while decays slowly to level drops.



Common metrics:

Leq – Equivalent Continuous sound pressure level. This represents the average rms value of sound level over a specified period of time, amounting to the same total sound energy as the source. This is a key metric to understand the total sound energy produced by a fluctuating source within a specified time period.
Lp – Instantaneous sound pressure level generated by the source.
Lmax – Maximum sound level over a specified period of time.
Ln – Percent of sound level over a specified alarm value.

Octave Bands:

Octave bands offer a filtering method of splitting the audible spectrum into smaller segments called octaves, allowing you to identify different noise levels across individual frequencies. This is useful in noise reduction and control, hearing protection, machinery testing, environmental noise issues, etc.

1/1 Octave Band: 1/1 Octave Band measurements are used when the frequency composition of a sound field is needed to be determined. The common octave frequency bands are: 31.5hz → 63Hz → 125Hz → 250Hz → 500Hz → 1.0khz → 2.0khz → 4.0khz → 8.0khz → 16KHz, and their composition is made up of the Lower Band Limit, Centre Frequency and Upper Band Limit.

1/3 Octave Band: Each 1/1 (single) Octave is further split into three, providing a more detailed view of noise content. 1/3 Octave Bands provide a further in-depth outlook on noise levels across the frequency composition. The bands are: 20Hz → 25Hz → 31.5hz → 40Hz → 50Hz → 63Hz → 80Hz → 100Hz → 125Hz → 160hz → 200Hz → 250Hz → 315hz → 400Hz → 500Hz → 630hz → 800Hz → 1.0khz → 1.25khz → 1.6kHz → 2.0khz → 2.5KHz → 3.15khz → 4.0khz → 5.0khz → 6.3khz → 8.0khz → 10kHz → 12.5khz → 16KHz → 20kHz.

Our range of Sound Level Meters for easier selection process

Model → Features ↓	SL 4005	SL 4005A	IMSL 4005	INSL 4005	IISL 4005	NSA 01
Regular	√					
Highly accurate (as per int'l standards)		√	√	√	√	√
Impulse			√		√	√
Integrating				√	√	√
Octave bands (1/1 & 1/3)						√
Data Output	√			√	√	√
Printer				√	√	√

**Integrating feature allows the meter to record 800 groups of measurement or 6 days of data(hourly) with statistics of each group like 5, 10, 90 percentiles, std deviation, day or day/ night equivalent sound level, etc.*
**Data output (PC interface, Bluetooth) and Printer are optional accessories to be purchased separately*