

**einstein™**

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Sound Sensor

Product Number: ENSND320



Overview

The human ear is capable of detecting an enormous range of sound intensities. However our sound perception is not linear – experiments show that a noise we perceive to be twice as loud as another is actually 10 times louder. For this reason, sound is measured on a logarithmic scale (one that shows exponential increases). This means that if one sound is 10 decibels higher than another it sounds twice as loud, but in order to sound twice as loud as that – 20 decibels – it will have to be 100 (10 x 10) times more intense. The Sound Level sensor measures sounds in decibels (dB) within two ranges, the first from 45–80 dB and the second from 65–110 dB. It is ideal for measuring environmental noises and room acoustics.

Typical experiments



Chemistry

- Measuring Sound Level
- Investigating Environmental Noises
- Investigating Room Acoustics
- Measuring respiratory pace

How it works

The Sound Level sensor consists of a microphone and electronic circuits. The microphone detects the small air pressure variations associated with sound and changes them into electrical signals. These signals are then processed by amplifying and filtering the signal to the required levels. For Sound Pressure Level (SPL) measurements the signal is averaged over certain period of time and converted into decibels (dB SPL). The results are calibrated by measuring the instantaneous signal vs. its average (offset removal).

Sensor specification

Range:	45 to 80 dB 65 to 110 dB
Accuracy (at 23° C, ±5°C):	±3 dB
Resolution (12-bit):	0.05 dB
Recommended Sampling Rate:	10 or 25 samples per second
Response Time:	20 ms
Frequency:	31.5 Hz to 8000 Hz
Operating Temperature:	0°C to 50°C (32°F to 122°F)
Operating Humidity:	Maximum 90% RH (0°C to 35°)

Note: sensor cables sold separately

Calibration

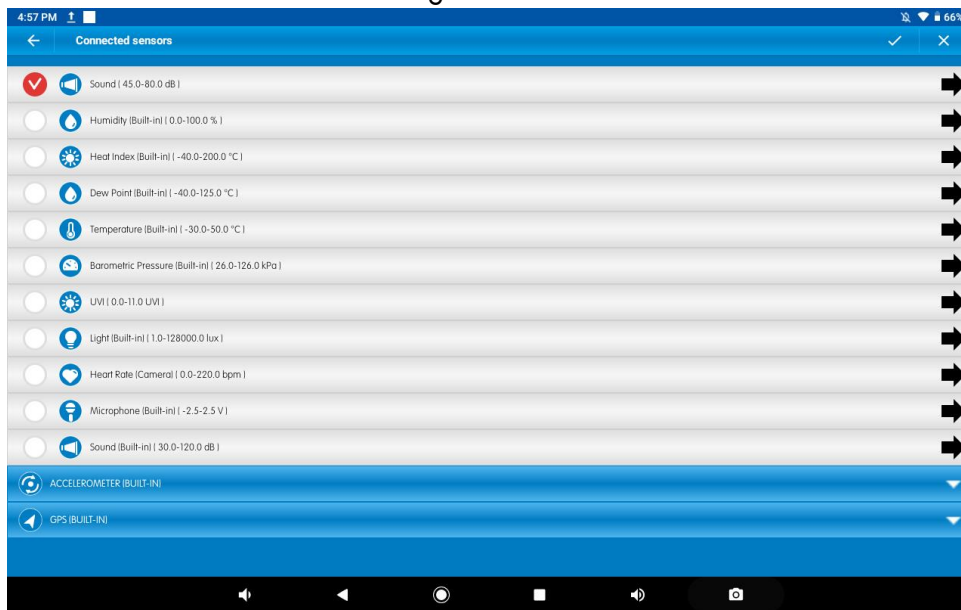
The Sound Level sensor requires no calibration.

Data logging and analysis

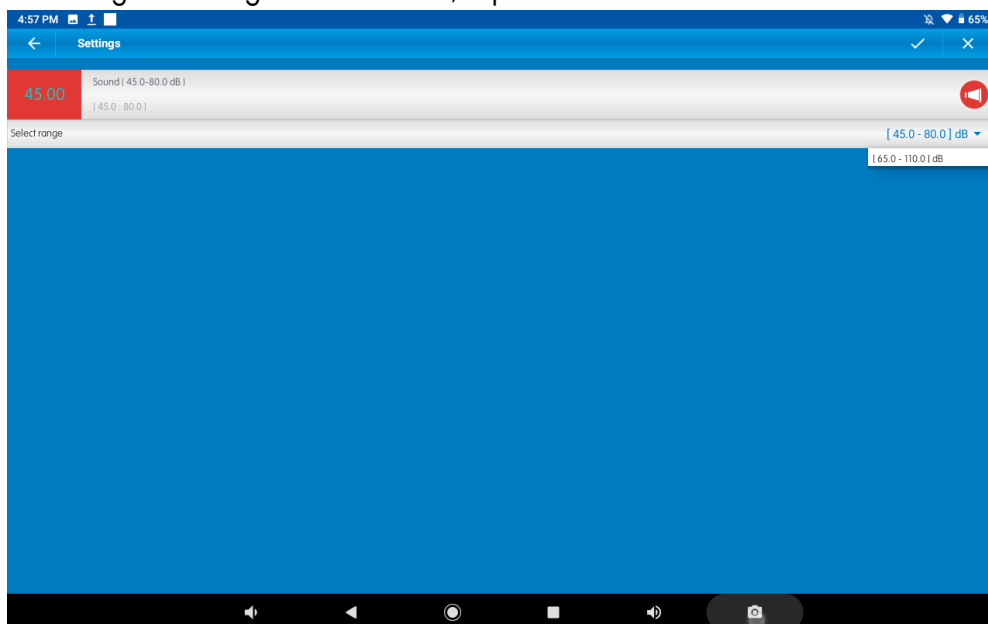
Android

1. Take your einstein™ Tablet OR pair your einstein™ LabMate with your Android or iOS tablet via Bluetooth
2. Insert the sensor cable into one of the sensor ports
3. Launch MiLABEx and then Tap on LAB start an experiment

4. MiLABEX™ will automatically detect the sensor
5. To ensure the sensor is selected go to Sensors



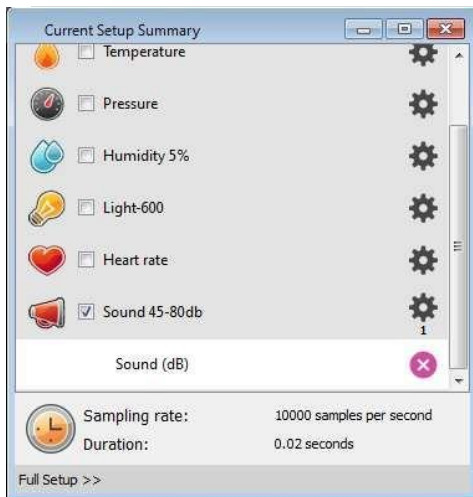
6. Select Sound sensor
7. To change the range of the sensor, tap on the arrow icon



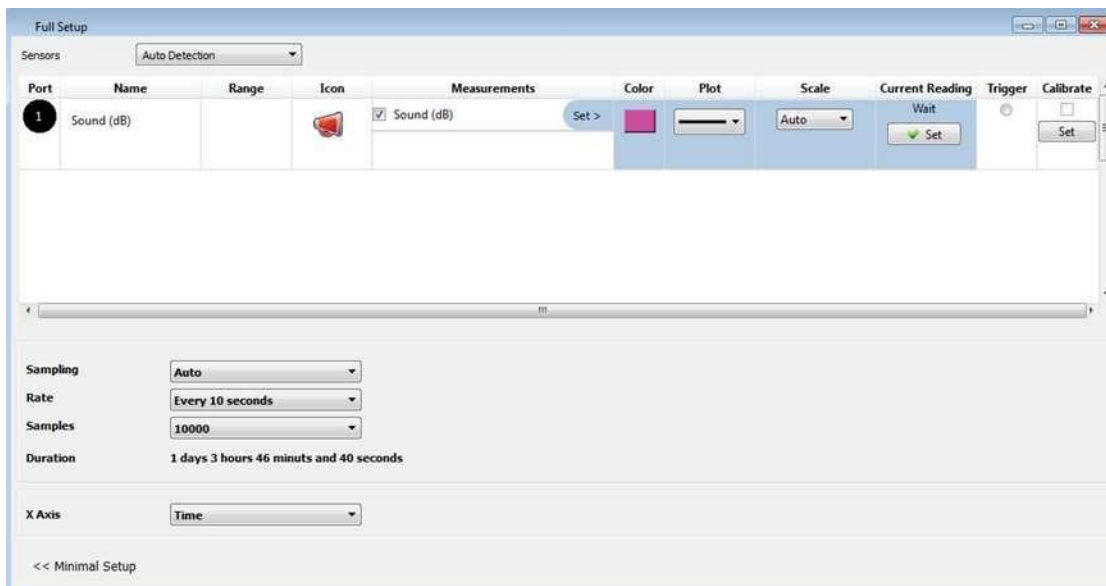
8. Select the desired range
9. Tap V to confirm the settings
10. You are ready to start an Experiment

Desktop

1. Pair your einstein™ LabMate with your PC, MAC, or Linux machine via Bluetooth, or connect it via the USB cable(found in the einstein™ LabMate box).
2. Insert the sensor cable into one of the sensor ports
3. Launch MiLABEX™ and then Click LAB start an Experiment
4. MiLABEX™ will automatically detect the sensor and show it in the Current Setup Summary window



5. Click Full Setup, located at the bottom of the Current Setup Summary window to program the data logger's sample rate, number of samples, units of measurement, and other options



6. You are ready to start an Experiment

Experiment set up

For reference, the chart below lists a number of common locations and sound sources and their average decibel ratings:

Sound Source	Sound Level (dB)
Library	40
Normal conversation	60
Noisy office	80
Subway train	100
Rock concert	120
Night club	110
Car horn at a distance of a few meters	110

An example of using the Sensor

Sound Level at a School

In this experiment we will map the sound levels at a school

1. Choose several locations in the school. Make sure to include locations where different activities take place.
2. Take readings with the sound sensor at each of these locations at different times of day (if using the einstein™ Tablet+ the Location sensor can be used to automatically map out your locations).
3. Prepare a map of your school noting the different sound levels at different times

Troubleshooting

If the Sound sensor isn't automatically recognized by MultiLab4/ MiLAB, please contact Fourier Education's technical support.

Technical support

For technical support, you can contact the Fourier Education's technical support team at: Web: www.einsteinworld.com/support
Email: support@fourieredu.com

Copyright and Warranty

All standard Fourier Systems sensors carry a one (1) year warranty, which states that for a period of twelve months after the date of delivery to you, it will be substantially free from significant defects in materials and workmanship.

This warranty does not cover breakage of the product caused by misuse or abuse.

This warranty does not cover Fourier Systems consumables such as electrodes, batteries, EKG stickers, cuvettes and storage solutions or buffers.

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