

SOUND SENSOR¹

-45..+45 PA

Description D017i



Figure 1. The Sound sensor (-45 .. 45 Pa)

¹ To use the new intelligent sensors in the Coach 5 program you need to update the Coach library. This update can be found at <http://www.cma.science.uva.nl/english> section Support > Coach 5.

Short description

The Sound Sensor (017i) is a microphone followed by an internal amplifier. This microphone is mounted at one end of the box. The sensor measures variations in air pressure caused by a sound wave. Because of the high sensitivity, the sensor is very much suited to detect short pressure pulses. This offers the possibility to measure the speed of sound.

The sound sources that can be used with the microphone are tuning forks, electronic keyboards, and musical instruments. You may also investigate a human voice or a whistle. When you use the sound sensor make sure the sound level is in the correct range to produce good wave patterns. If the sound is too loud, the wave pattern will be “clipped off” at the top or bottom. In such a case move the microphone further from the sound source, or turn down the volume of the sound.

Within a certain range, the sensor can also be used for dB-measurements. It can be done in one of the following ways:

1. determining the average sound pressure p (root mean square average) and calculating the sound pressure level in decibels from:
 $L_p = 20 \log (p/p_0)$ where $p_0 = 2.5 \times 10^{-5}$ Pa
2. measuring the output of the sensor via a rectifying circuit and calibrating readings in decibels (calibrating with a calibrated decibel-meter).

The sound sensor is equipped with a BT-plug and can be connected to the following CMA interfaces:

- ULAB
- CoachLab II

Furthermore the sensor can be used in combination with other interfaces, like Texas Instruments CBL™, CBL2™ and Vernier LabPro without the need of an adapter.

Intelligent sensor²

The sound sensor is an intelligent sensor. The sensor has a memory chip with information about the sensor. Through a simple protocol (I²C) the sensor communicates with ULAB and transfers its data (name, quantity, unit and calibration) to the datalogger. ULAB automatically displays the calibrated values on its screen. Also ULAB communicates the information to the Coach software.

The sensor is delivered with a standard calibration.

² At this moment only for CMA ULAB datalogger, in the future also for LabPro and the CBL2.

Suggested experiments

The sound sensor can be used in a variety of experiments with sound waves such as:

- measure wave patterns (frequency and amplitude of sound)
- demonstrate beat patterns
- compare waveforms from various musical instruments
- measure the speed of sound through air and other materials
- display the Fourier transform (FFT) of a sound.

Calibration

The output of the sound sensor is linear with respect to the pressure. To collect data you can:

1. Use the calibration supplied in the standard sensor library of the Coach program.
2. Use the calibration supplied by the sensor EEPROM memory (only for the ULAB datalogger).

The name of the sound sensor in the sensor library of the Coach 5 program is **Sound sensor (017i) (CMA) (-45..45Pa)**.

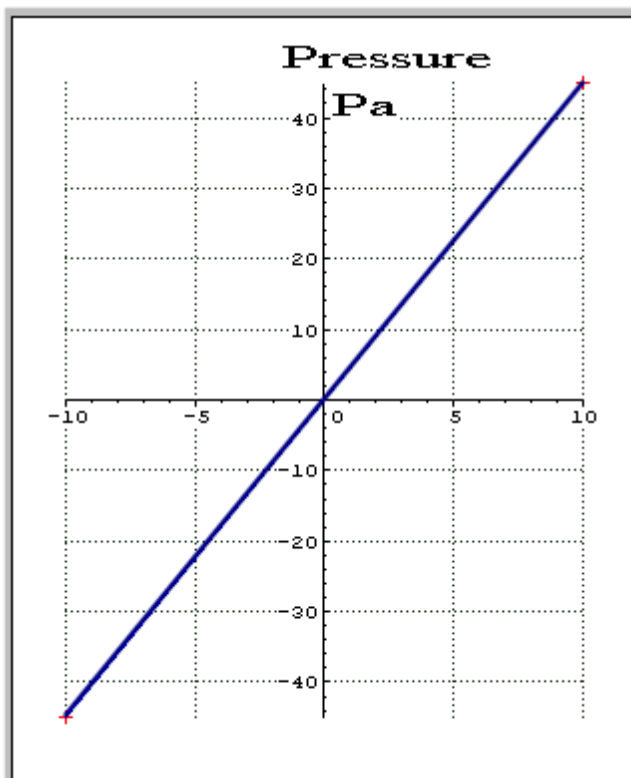



Figure 2.

Default calibration graph of the sound sensor (used in the standard Coach library and sensor memory)

$$p \text{ (Pa)} = 4.5 * V_{\text{out}} \text{ (V)}$$

Coefficients of the calibration function:
a= 4.5 ; b= 0.

Technical data

Input range	± 45 Pa (0.45 mbar) up to 124 dB
Voltage output range	± 10 V Note: When no sound is detected the output is 0 V.
Calibration function	p (Pa) = 4.5 * V_{out} (V)
Resolution using 12 bit A/D converter	22 mPa (0.22 μ bar)
Frequency range	50 Hz - 12000 Hz
Current requirement	< 5 mA
Sensor information for Auto-ID and calibration	256 byte serial EEPROM
Connection	 BT (British Telecom) plug

This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.

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