

# Sound Wave Sensor

for the LogIT Microsense® system



## Overview

The sound waveform sensor is designed for displaying audible sound waves in the range of 100Hz to 20,000Hz.

The sensor incorporates an electret condenser microphone plus a signal conditioning amplifier and is compatible with any LogIT Microsense® input, although it is especially ideal for use with DataVision because the high speed Oscilloscope mode can display live Sound Waves on the Screen. The Sound Wave sensor can also be used with the LogIT Voyager and Black Box data loggers allowing high speed sounds to be captured and displayed 'live' using the Oscilloscope function of LogIT Lab.

## In Use with DataVision

To use the sensor with DataVision in oscilloscope mode, plug it into Microsense® sensor input channel 1 - the display should show mV.

Then select the oscilloscope mode from the menu.

The display should now show the sound waveform - you can add or remove grid, change timebase parameters etc on the DataVision - see instructions and on-screen help for details.

## In use with Voyager/Black Box

Plug the sensor into any channel.

Select the 'Oscilloscope' function from the 'Select New Activity' screen in LogIT Lab.

Alternatively, you can use 'Setup' to capture fast events using the 'Fast Triggered' option but you must use channel 1 for the Sound Wave sensor.

If your version of LogIT Lab does not support either of these features, please see [www.logitworld.com](http://www.logitworld.com) for updates to the software.

## Care

Do not insert this sensor into anything other than a LogIT Microsense® compatible input. Take care not to drop the sensor or expose to wet, damp or extremes of temperature.

## Example Applications

- Amplitude and Frequency of sound.
- Display different tuning fork frequencies.
- Difference of frequency responses
- Visually show difference between loud and quiet sounds
- Speed of sound

## Instructions & Resources

The resources shown overleaf are available in PDF form at [www.logitworld.com](http://www.logitworld.com)



Waste electrical and electronic products must not be disposed of with household waste. Please recycle where facilities exist. Check with your Local Authority or Retailer for recycling advice.



[www.logitworld.com](http://www.logitworld.com)

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# "Monitoring Sound waves"

**Subject:** Physics

**Sensor:** Sound Wave sensor

## Overview:

Sound waves are longitudinal waves which consist of particles oscillating in the same plane as the direction that the sound wave is travelling. These waves can be examined using an oscilloscope and a microphone. By using a Sound Wave sensor, sound waves can be examined and the changes in frequency and amplitude demonstrated easily.

**Equipment required:** LogIT Black Box or Voyager (we used a Black Box)  
Sound Wave sensor  
Selection of tuning forks (we used two)



## Hazards:

Students should be supervised at all times.  
Always check your local regulations or the school advisory service such as CLEAPSS or SSERC for guidance on the use of any hazardous material or source.

## Setup:

1. Connect Black Box to the computer using the USB cable.
2. Connect the Sound wave sensor into any channel of Black Box.
3. Start LogIT Lab software.
4. Click 'Setup' then select 'Fast with trigger (sensor 1 only)' and click 'Next'
5. Select '100 microseconds for 20 milliseconds' as the log rate and interval then click 'Next' followed by 'Finish'.

Note: When you click 'Finish' the software will wait until an event occurs which will trigger the recording of data. If you find that the readings are not smooth and are a little spiky, try decreasing the timing interval to 50 microseconds as the spikes are caused by missing data. If you find the readings are too rounded with not enough peak's, then increase the logging interval.

## Method:

1. Strike the first tuning fork. (You will get a false reading on the screen as the strike is picked up)
2. Hold the vibrating tuning fork in front of the sound wave sensor and press 'R' to re-record the sound.
3. Click on the green icon to start the next recording.
4. Select 'Overlay' from the pop up menu.
5. Strike the tuning fork and place in front of the sound wave sensor as before.
6. Click the green icon to collect the readings and overlay the original graph.
7. Repeat from step 3 for additional tuning forks.

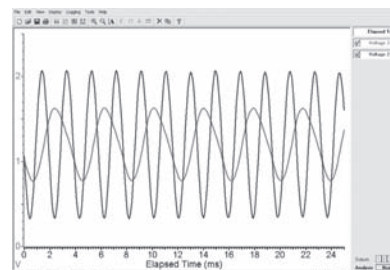
Note: In this experiment we used two tuning forks which were an octave apart. One of 256 Hz and one at 512 Hz. From the results, students can see the difference in frequency as one is twice the other. The amplitude can be investigated by using one tuning fork but striking it harder to increase the amplitude.

## Results:

What do the results show?  
How can you tell one tuning fork's frequency is higher than the other?  
Are the readings accurate? How can you check this from the graph?

## Going further:

Try using two tuning forks of different frequency at the same time.  
Try using the oscilloscope function in 'LogIT Lab' to show how different sounds make different sound wave patterns.  
You can also use the oscilloscope mode to very quickly demonstrate the differences in amplitude and frequency of different sounds by whistling or talking.



# "Speed of Sound"

**Subject: Physics**

**Sensor: Sound Wave**

**Overview:**

This experiment will use the LogIT DataVision and two Sound Wave sensors to measure the speed of sound from one sensor to the other. The sound source will be a clap of the hands for simplicity. When the first sensor detects a reading from the hand clap, DataVision will Trigger and record the received sound to the second sensor. The difference in time between the first peaks of the two traces will be used to calculate the speed of sound.

**Equipment required:** DataVision CX  
2 Sound Wave sensors  
2 sensor extension cables  
Hands to clap

**Hazards:**



If using a sound source other than hand claps, make sure the source does not exceed 90dB and that pupils are not too close.

**Setup:**


1. Connect the Sound Wave sensors to the sensor extension cables.
2. Plug the extension cables into channels 1 and 2 of DataVision.
3. Place the sensor from channel 1 at the end of a table as shown in the photo.
4. Place the sensor from channel 2 a set distance (1m is a good starting point) and in line with sensor 1.




**Method:**

1. Press a key to switch on DataVision
2. Using the joypad, select  'Setup Logging'
3. Select 'Periodic Logging' from the list
4. Leave Sensor 1 and 2 as 'Automatic' and Press 
5. Using the joypad and keypad, set the following:-

Readings	[100	]
Interval	[40	]
Units	[microsecond]	

6. Press 
7. Using the joypad and keypad, set the following:-


Trigger	[Channel 1 >]	
Value	[2000 mV	] (Depending on the sound source this value can be changed)
Pre-Trigger	[10%	]

8. Press 
9. The DataVision will now wait for the Trigger. In this case a clap.
10. Stand in front of sensor 1 and clap your hands together.
11. DataVision will Trigger and display two plots on the single graph.

## Speed of Sound Calculation:

Use the right joypad button to select the first peak from Channel 1 and note the time. Call this Time 1.

Use the right joypad button to then select the first peak from Channel 2 and note the time. Call this Time 2.

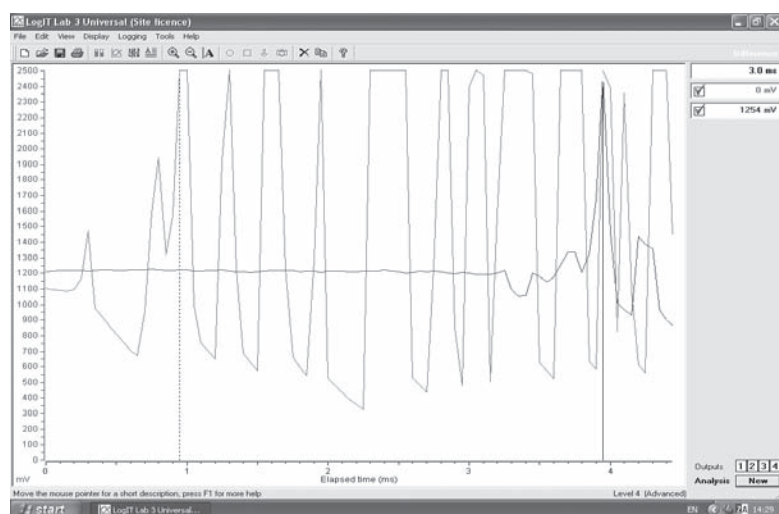
Note: To analyse the first peak of each trace, you may find it easier to remove the other trace by selecting the Sensor button on the keypad eg. to remove the second trace, simply press 

Calculate the time taken for the sound to travel from Sensor 1 to Sensor 2 by subtracting Time 1 from Time 2.

Then divide the Distance that the sensors were apart by the time taken.  
(Remember to divide the time by 1000 to convert to seconds and leave the distance in metres)

### Example:

The screen shot below is taken from LogIT Lab when the data was extracted from DataVision



Here the difference is 3.0ms

The distance was 1m

Hence the calculated speed of sound is 333m/s

### Evaluation:

The Speed of Sound in air is approximately 340 m/s

If your results do not closely match this, remember that the Speed of Sound is dependant on Temperature and how moist the air is. The colder the room, the slower the Speed of Sound and vice versa.

For example, at 20 degrees and in dry air the speed of sound is about 343m/s.

Try doing a search on the Web for 'Speed of Sound and Temperature'