

# Motion Sensor

for the LogIT Explorer system



## Overview

The Motion sensor sends bursts of sound waves at ultrasonic frequencies (twice the frequency that we can hear) and measures the time it takes for the waves to bounce off a solid object and return to calculate the objects distance.

The Motion sensor measures distance which can be plotted against time to show movement, speed etc and does not require any batteries as it takes it's power from the Explorer.

## In Use

The Motion sensor is very easy to use, just plug it into any Explorer socket and the illuminated graphics will light as follows:-

Right arrow = Object moving towards Motion sensor

Left arrow = Object moving away from Motion sensor

Pause icon = Object is stationary

No icon lit = Object out of range or no echo received

If in use you see some odd 'peaks' on the graph, this may be because the sensor cannot 'see' the object being measured. Just like your eyes or a camera, the Motion sensor 'sees' more the further away it is from an object, so ideally you should use large flat objects like sheets of card for positive and accurate results. It is not a good idea to use any material which absorbs sound such as felt or clothing as this can also produce incorrect or erratic readings. If tracking the movement of pupils, get them to hold a piece of card as this gives the sensor a good flat surface to 'see'. Do not use more than one Motion sensor near another as the sound waves will interfere with each other and cause incorrect readings.

For further experiment ideas, you may like to make a fairground height monitor or even a method of measuring the height of pupils as they enter a room.

**Range:** The range of this sensor is 200 to 2500 mm when used at 20°C - this is because the motion sensor measures the reflection of sound waves and speed of sound varies with temperature.

## Care

Do not place the Motion sensor close to ears and be aware that the high frequency waves could upset some animals.

The Motion sensor should not be exposed to moisture or extremes of temperature. It should never be dismantled and objects should not be passed through the grill of the transmitter/receiver. Take care not to knock or drop the Motion sensor.

## Explorer upgrades

This sensor was released in December 2005 and your Explorer and/or datalogging software may need to be upgraded to support it. This is easy and free of charge and instructions can be found on the LogIT web site at [www.logitworld.com](http://www.logitworld.com)

To upgrade Explorer, select the Explorer icon and then select 'System Updates' from the list on the left of the page and follow the update instructions.

LogIT Lab users will automatically update their software when they update their Explorer as the process involves downloading a new version of LogIT Lab and then a subsequent download from LogIT Lab to Explorer.

Junior Insight users need to download the update for Explorer as described above and also a sensors update for Junior Insight. To do this, select the 'Support' tab and then 'Sensor updates' from the list at [www.logitworld.com](http://www.logitworld.com). Select your version of software and follow the on screen instructions.

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

## Instructions & Resources



DCP Microdevelopments Ltd  
Bryon Court  
Bow Street  
Great Ellingham  
Norfolk  
NR17 1JB  
Tel: 01953 457800  
Fax: 01953 457888  
email: [support@dcpmicro.com](mailto:support@dcpmicro.com)

# "Parking sensor "



**Sensor:** Motion sensor

## Overview:

This simple experiment allows pupils to make a parking sensor which will produce an audible warning when a car gets too close to a wall. It requires the LogIT Explorer Controller set in order to produce the control of the buzzer contained in the controller kit.

It is hoped that pupils will get a visual reinforcement of distance and how the motion of the 'car', by being plotted on a graph, will be a help to graph interpretation in science.

**Equipment required:** LogIT Explorer  
LogIT Explorer Motion sensor  
LogIT Explorer Controller set (buzzer to be used)  
Clamp stand (optional)

## Hazards:

Take care if using clamp stands that they cannot fall off the bench.

This experiment can be done on the floor if space allows.

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 procedure.

## Setup:



1. Connect the Explorer controller to channel 1 of Explorer.
2. Connect the buzzer to the controller.
3. Connect the Motion sensor to channel 2 of Explorer.
4. Mount the sensor in a clamp stand or place on a box.
5. Connect the Explorer to the computer and start the datalogging software. If using LogIT Lab select 'Autolog' when prompted from the 'Select New Activity' screen.

Note: You need to set up the control options. Select 'Logging' from the menu bar at the top of the screen (Insight users select 'Set-up') then select 'Control' from the drop down menu. Select 'Turn output 1 on' from the drop down list and type in a number to represent the distance (in mm) at which you want the buzzer to sound. Make sure 'Enable' is checked and then click 'OK'. You can select a distance above or below the entered value. Insight users can also select a time for how long the buzzer should sound for.

## Method:

When ready click 'Start' to begin logging.

Pupils can then move the sensor to and from a wall. When the buzzer sounds, pupils should look at the graph being plotted and see how the graph relates to the physical distance from the wall.

When the car has moved forwards and backwards a few times, stop logging.

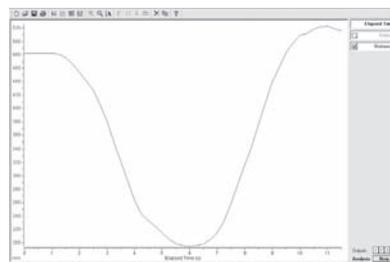
## Results:

Look at the graph.

How does the resultant graph relate to the motion of the car?

Can you spot from the graph when the buzzer might have gone off?

You could ask pupils to explain how the graph shows the movement of the car. Can they decide whether the car was moving forward or backward from the graph?



## Going further:

From the graph, can your more advanced pupils calculate the speed of the car.

What happens to the graph if the car moved in the same way but moved at different speeds? You could ask pupils to predict what the graph might look like.

You could use the bulb in the controller to make a visual alert for the driver.

# "Motion and friction"



**Sensor:** Motion sensor

## Overview:

By using a ramp and a model car, the motion sensor can be used to plot a distance time graph showing the movement of the car as it travels down the ramp. By adding layers of material, the friction of the ramp can be increased and the car's movement can be compared to those where the friction is less.

It is hoped that this will show pupils how friction can effect the speed of the car and also by overlaying the graphs, how the graph changes as the speed of the car is altered.

**Equipment required:** LogIT Explorer  
LogIT Motion sensor  
Ramp  
Toy car  
Card  
Modelling clay  
Clamp stand (optional)  
Materials to be placed on the ramp. eg. carpet, fine cloth etc

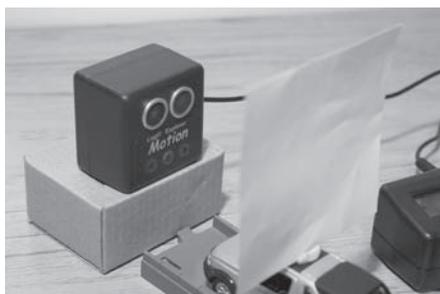
## Hazards:

Take care if using clamp stands that they cannot fall off the bench.

This experiment can be done on the floor if space allows.

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 procedure.

## Setup:



1. Put the ramp in front of the Motion sensor at a small angle.
2. Connect the Motion sensor to channel 1 of Explorer.
3. Mount the sensor in a clamp stand or similar at least 200 mm in front of the closest point that the car will reach.
4. Place a piece of card at least 10 cm square on top of the model car with the modelling clay.
5. Connect the Explorer to the computer and start the datalogging software. If using LogIT Lab select 'Autolog' when prompted from the 'Select New Activity' screen.

Note: The Motion sensor needs to be aimed at the card on top of the model car. If the sensor misses for any reason, then large 'peaks' will be seen on the graph where no reflected signal was recorded.

## Method:

1. Put the car at the top of the ramp.
2. Start logging and release the car down the ramp.
3. Stop logging and note the material used.
4. Select 'Logging' and select 'Overlay' from the top menu.
5. Put a different material on the ramp.
6. Start logging and release the car from the same place as before.
7. Repeat from stage 3 for each sample.

## Results:

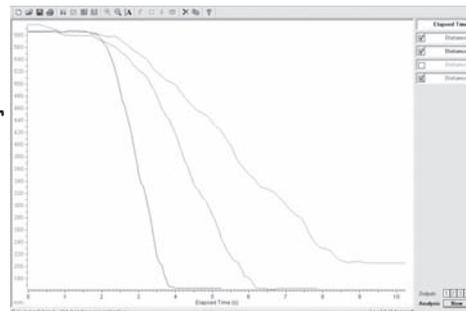
Right click the 'Distance' field on the right of the screen under 'Elapsed Time' and select 'Smooth' to smooth the graph plot.

From the plotted graphs, can the pupils see which material slowed the car the most? How can they tell?

## Going further:

From the graph, you could get more advanced pupils to see if they can calculate the speed of the car for each material.

Using the same procedure, the angle of the ramp can also be investigated to see the effect on the car's motion.



# "Sonar" (echo sounding)



**Sensor:** Motion sensor

## Overview:

An echo is a sound which is reflected off a surface and is heard after the original sound. Echoes are used to locate objects and determine their exact position. This is done by timing how long the echo takes to get back to the original position. Sonar uses this technique and the term SONAR is derived from 'SOUND Navigation and Ranging'.

Sonar is used in marine exploration to detect objects under the ocean but 'echo sounding' is a similar technique which is used by ships to measure the depth of the ocean.

This experiment tries to get pupils to identify objects in relation to the resultant graph which is produced by passing boxes of different size in front of a motion sensor.

**Equipment required:** LogIT Explorer  
1 Motion sensor  
1 sensor extension cable (optional)  
1 clamp stand  
Large tray  
Various boxes of different size to try and identify

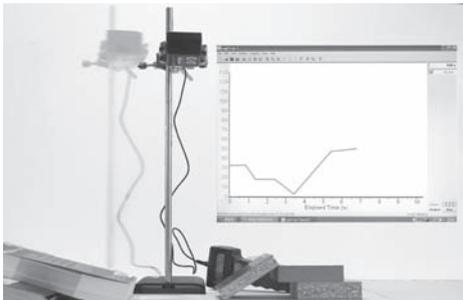
## Hazards:

Take care if using clamp stands that they cannot fall off the bench.

This experiment can be done on the floor if space allows.

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 procedure.

## Setup:



1. Arrange the boxes in a line on the tray as shown.
2. Connect the Motion sensor to channel 1 of Explorer.
3. Mount the sensor in a clamp stand or similar at least 200 mm above the highest box.
4. Connect the Explorer to the computer and start the datalogging software. If using LogIT Lab select 'Autolog' when prompted from the 'Select New Activity' screen.

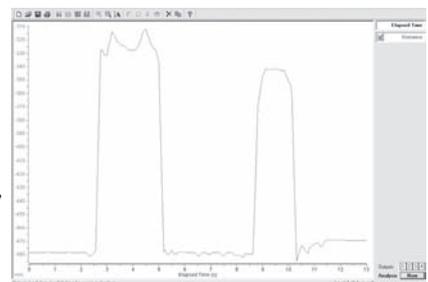
Note: You don't have to use a clamp stand as the idea is to keep the motion sensor at the same distance from the sea bed. A tall box with the sensor held onto a ruler with an elastic band may suffice. Use square edged boxes to prevent signals being reflected away from the detector as incorrect readings may result.

## Method:

1. Place the mounted motion sensor at one end of the 'sea bed'
2. Start the logging software.
3. Slide the tray at a constant speed under the sensor.
4. Stop the logging software and click on the magnifying glass.

## Results:

To get the graph to plot the correct way round, right click the 'Distance' field on the right of the screen under 'Elapsed Time' and select 'Invert'. It is also a good idea to select 'Smooth' to smooth the graph plot. Pupils should be asked to try and identify the graph plot which corresponds to each box.



## Going further:

Try moving the boxes through at different speeds and use the 'overlay' feature. What effect might this have on the resultant graph?