Light Gate *Vision*
for the LogIT Microsense® system

Overview
The Microsense® Light Gate Vision is a digital sensor (sensing either on or off) which uses a high intensity LED producing a visible beam aimed at a detector and mounted in a robust frame with a gate gap of 70mm.

Light gates are primarily designed for use in timing and counting experiments through software such as LogIT Lab, iLog, Insight, Junior Insight etc.

Light gates can be used to record the start, finish and duration of an event and using this timing relationship the software can calculate time, speed, acceleration, etc.

Some software packages or data loggers (eg DataVision CX, Voyager) also enable the Light Gates to be used to count the number of times an event occurs over a period of time eg. birds coming in and out of a box, number of revolutions of a wheel etc.

In Use
The built-in detector 'looks' at the light sent from the LED emitter and so detects when an object breaks the beam. The indicator LED on the side of the gate will illuminate when the beam is broken to enable easy setup. Most opaque objects which are more than approx 6mm across can be used to break the beam, although the following should be considered:

The object used to break the beam should ideally have a matt finish, matt black works best, so that it does not reflect external sources of light back into the sensor.

It is best to have the object pass as near as possible to the detector to avoid the danger of stray light affecting operation. The detector is mounted on the same side as the lead. If using the Light gate outside in direct sunlight, it may be necessary to mount it in such a way that direct sunlight does not enter the detector or reflect of the passing object.

The light gate(s) can either be hand held or mounted on a suitable stand. The mounting rod supplied can be used as shown with clamp stands or the light gate can simply be placed onto the stand uprights and clamped using the locking screw.

The use of a standard camera tripod can also be utilized should the light gate need to be mounted in a more unusual position or situation.

The resources shown overleaf are also available in PDF form at www.logitworld.com

Designed and manufactured in Great Britain.

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.

Instructions & Resources

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Specification

Clearance gap:	70 mm (between beam and detector)
Mounting hole diameter:	13mm
Tripod/Clamp upright locking thread:	1/4 inch Whitworth

LogIT data loggers

There are now a wide range of LogIT models available and Light Gate Vision will work with all models which support LogIT Microsense® sensor inputs (at the time of writing this is all LogIT's except for the Explorer Primary range).

Most LogIT's with screens default to displaying the Light gate counts in frequency Hz (counts per second), except LIVE with a CheckIT which just shows 0 or 1 (on or off). Some have built in facilities which will enable you to do basic timing on screen while others, such as DataVision, have more sophisticated time, speed and acceleration analysis displayed on the built in graphic screen. All LogIT's allow connection to a computer for live timing and analysis on screen using appropriate software as above.

Care

The LED in each light gate is powered by the data logger and because these use quite a lot of power we strongly recommend that you always use a mains power pack or USB power for the data logger when using light gates where possible.
Do not attempt to dismantle gates or plugs.
Only use these light gates with a Microsense® compatible data logger - please note it is not possible to use or adapt non Microsense® light gates for use with LogIT.
Light gates are not waterproof - do not allow them to get damp or wet.

Trouble shooting

Your software and/or LogIT with display may need updating to support this sensor, which is usually available over the internet free of charge.
If the sensor is not recognised by your software or LogIT (for example if the data logger displays ???) you need a software update.

LogIT Lab will also update the LogIT data logger - if you are using different data logging software you can download an evaluation version of LogIT Lab to update your LogIT(s):

• Visit the LogIT website www.logitworld.com
• To upgrade your data logging software click on the 'Downloads' tab followed by 'Software Updates'. The installation instructions are available from the same page.
• To upgrade the data logger, select the logger from the list on the left of the page followed by the 'Support' tab and then select 'Logger Updates'.
Follow the on screen instructions.

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Inelastic Collisions

Subject: Physics

Overview:

A common example of a perfectly inelastic collision is when two snowballs collide and then stick together afterwards. This is an example of conservation of momentum as described by the following equation:

$$m_1v_1 + m_2v_2 = (m1 + m2)v_f$$

m_1 = mass of object 1; v_1 = velocity of object 1.
m_2 = mass of object 2; v_2 = velocity of object 2. V_f = Final velocity of both objects together.

By using a linear Air track (or suitable ramp and cars), the Physics of Inelastic collisions and the conservation of momentum can be investigated by allowing a moving object to collide with a stationary one and 'stick' together. The inital Velocity of the single object can be obtained using one light gate and the two objects then pass through a second light gate giving the combined objects Velocity.

Aim:

By using two light gates investigate an inelastic collision and prove the theory of conservation of momentum.

Equipment required:
LogIT Datalogger.
Datalogging software, computer.
Air track or ramp.
Balance (if mass of cars not known).
2 suitable air track cars.
Black card 10cm square.
Modelling clay or similar.
Clamp stands or similar to mount light gates.
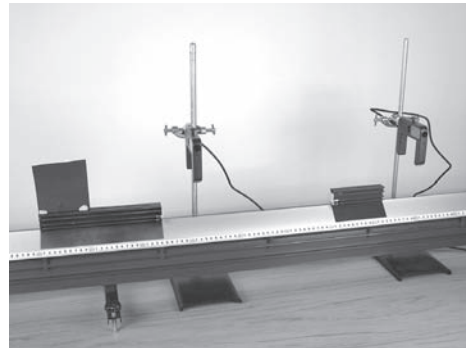
Hazards:

Children 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.

Method:

1. Fix the card onto the car which will be travelling towards the stationary car and obtain the mass of each. Attach some modelling clay or similar to enable the cars to stick together. (Remember to obtain the mass of the clay as well).
2. Mount the Light gates to clamp stands and position over the track as in the photo.
3. Connect up the data logger to the light gates and connect to a computer.
4. Place the light gates so that one of the cars is stationary between the two as shown in the photo. (ensure sure the light gate which is passed through first is connected to channel 1).
5. Start the datalogging software and select velocity at any sensor.
6. Record the velociy v_1 and final velocity ($v_1 + v_2$). (Initial velocity v_2 will be zero.)
7. Repeat for a number of readings making sure to place the second car in the same place each time.
8. Calculate the initial momentum and final momentum for each set of experimental data using the equation shown above.

Results:

- Do the values obtained match?
- Did this experiment prove that momentum is conserved?
- If there are differences in the values obtained, where might these differences have been caused?

Going further:

- How might you alter the experiment to improve the accuracy of the experiment?
- Using the same equipment, what other experiments could be performed?

Acceleration due to gravity

Subject: Physics

Overview:
A simple experiment using two light gates to measure the acceleration due to gravity. This experiment allows students to practise good experimental techniques as errors are easily observed due to acceleration of free fall being known as 9.81m/s^2

Aim:
To prove that the acceleration of free fall is 9.81m/s^2 and to look at how light gates can be used to investigate other physical concepts.

Equipment required: LogIT Datalogger.
Datalogging software, computer.
2 light gates.
Clamp stand.
Black card (10cm square).
Modelling clay or similar.
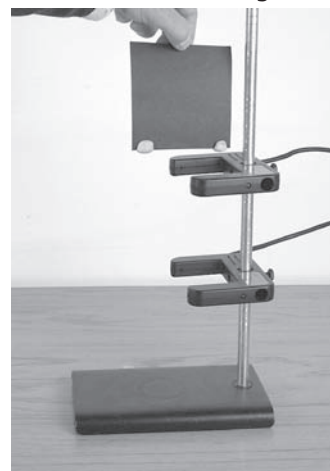
Hazards:
Take care that the object being dropped is suitable and not liable to cause injury.
Always check your local regulations or the school advisory service such as CLEAPSS or SSERC for guidance on the use of any hazardous material.

Method:
1. Connect the light gates to the data logger in channels 1 and 2 (channel 1 being the first light gate).
2. Connect the data logger to the computer and run the datalogging software. Set up 'Acceleration' from the timing menu of the software.
3. Place two equal mass pieces of modelling clay on the bottom corners of the black card.
4. Attach the light gates to the clamp stand as shown in the photo.
5. Start logging.
6. Hold the card as close to the top gate without triggering it and then drop the card.
7. The acceleration of free fall will be recorded.

Results:
- Did the results agree with the earths acceleration of free fall?
- What might be causing a problem?
- How might the problem of any inaccuracies be removed? Is this practical?
- How could you improve this particular experimental procedure?

Going further:
For more advanced students, try deriving the acceleration rather than using two light gates. This can be done using a ruler and a single light gate set to record the final velocity of the card after falling a set distance. By using the equation $v^2 = u^2 + 2as$ where 'v' is the final velocity of the card, 'u' is the starting velocity, 's' is the distance travelled and 'a' is the acceleration.
By using this method, students can also make use of a spreadsheet to calculate the acceleration each time.
Also, the relationship between the distance travelled and velocity can be examined at the same time.

Try using a different number of paper cake holders and investigate how mass affects the velocity of a falling object. As each additional cup cake holder is added, the mass can be increased and the relationship between mass and free fall velocity examined.