

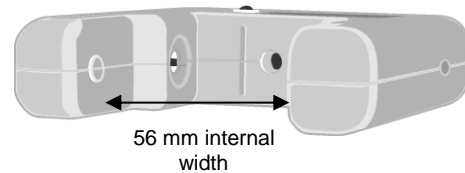
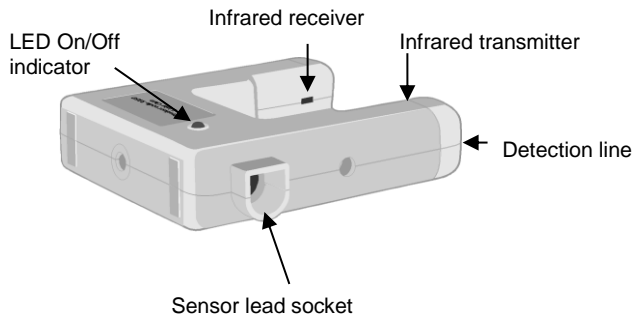
Vu Light gates (pair)

Light gates are digital switch-type sensors that have two states, ON and OFF. The most common use of Light gates is in timing experiments.

The Light gates are supplied as a pack of 2 and can be used singly or in pairs. They connect to Vu via a jack to mini DIN sensor lead (part number 2398) suitable for use with the Vu data logger.

The Light gate has an infrared transmitter and receiver that will detect solid objects as they pass through the 'gate' and break the beam. This will allow Vu to detect the elapsed time for individual events or a series of events.

Product No. 2330PK

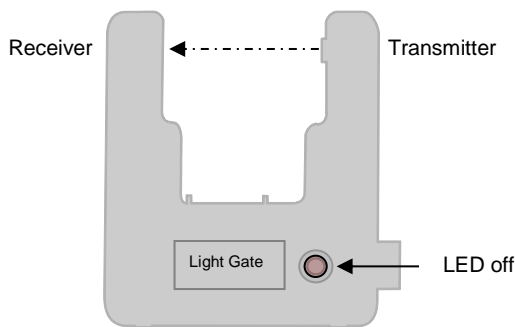


Connecting

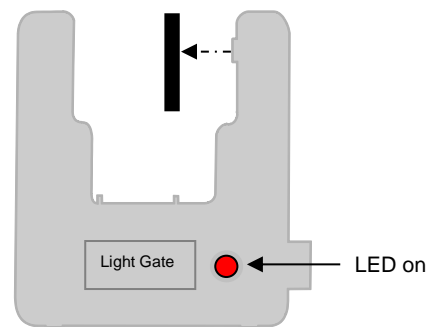
If Light gates are used for **Timing** operations and only one Light gate is used, it must be connected to input **A**. If two Light gates are used they should be connected to input **A** and **B**.

- Connect the jack plug end of the sensor cable to the input socket on Vu.
- Connect the other end of the sensor cable to the shaped socket on the Light Gate.
- Vu will detect that the Light gate is connected and will either show as On/Off or as a percentage value, depending on the mode used.
- Position the Light gate and check that when the object passes through the Light gate it will block the infrared beam

The red LED On/Off indicator visible in the plastic mounting will light when the infrared beam is blocked.



The Light gate is in the OFF position.



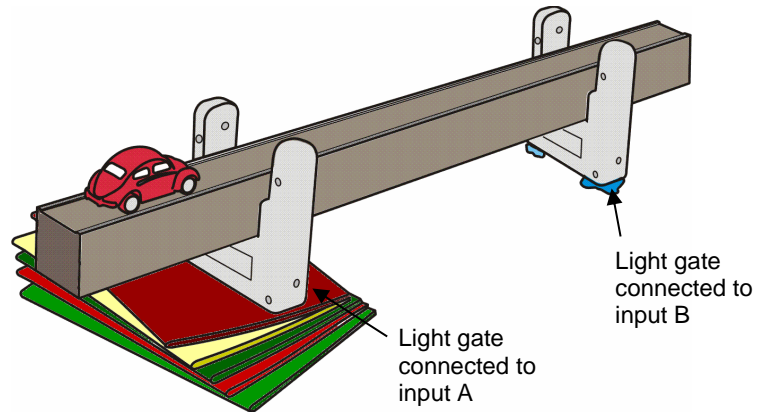
When the beam is interrupted the Light gate is in the ON position.

Primary investigations

Dynamics experiments that involve calculating time and speed E.g. Which car is the fastest? What stops speedy cars going faster?

Time from A to B: Make sure that the Light gate connected to input A is at the top of the ramp so that it is triggered first, and the Light gate connected to input B is near the bottom of the ramp.

Check that the car is breaking the infrared beam by looking at the LED on the Light gate – it will shine red as the car goes through.



In this set up the Light gates are secured using blobs of Blu-Tack.

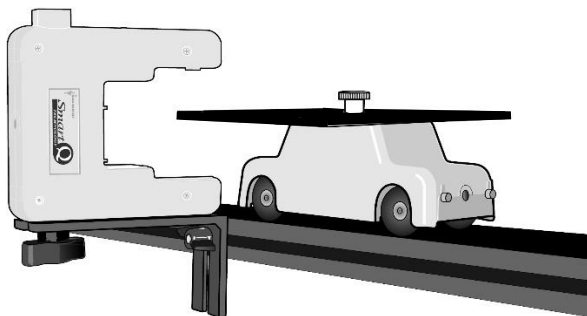
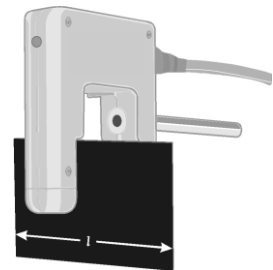
If the cars are not tall enough to break the infrared beam attach a piece of card to the top of the car.



Speed: For Vu to perform direct calculations of speed, you need to select the parameter used in an experiment i.e.

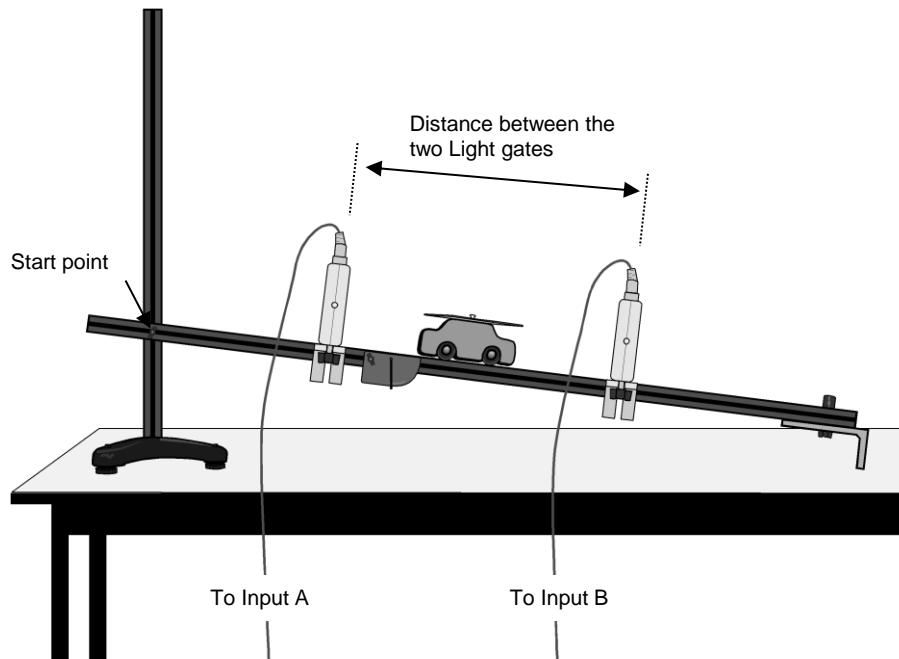
- For **Speed at A** measure the width of the object (e.g. a single interrupt card) that will pass through the Light gate beam (in mm).

$$\text{Speed at A} = \frac{\text{Length of single interrupt card}}{\text{Time}}$$



For example: This Light gate is attached to the Dynamics track. An interrupt card is attached horizontally to the cart so the solid side (single interrupt) of the card will pass through the Light gate.

- For **Speed A to B** measure the distance between the sensor connected to input A and the sensor connected to input B (in m).



Advanced user information

Vu can be used connected to a computer with the EasySense software to calculate Time and Speed/Velocity. If the program user level is set to 2 or 3 then the options also include Acceleration, Distance, Momentum and Kinetic Energy.

Parameters should be measured **accurately** and this value entered in the Timing Wizard. Errors caused by inaccurate measurements are far more significant than timing errors.

Sensing investigations

When a Light gate is used in a non-Timing mode e.g. Graph, it will show a value of approximately 0 – 10% when the infrared beam is not blocked (OFF) and above 90% when blocked (ON).

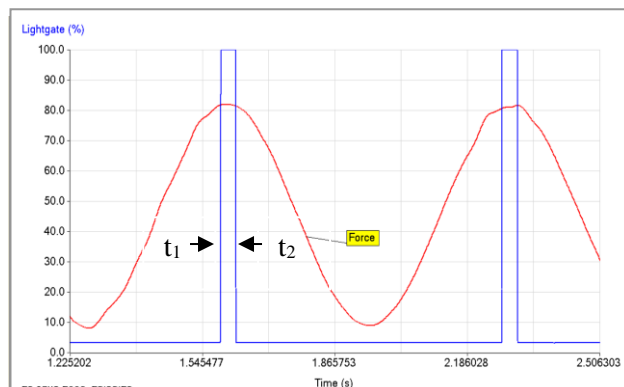
A Light gate can be used to:

1. Time the length of an event

E.g. To calculate velocity by using **Interval** to determine the length of time the Light gate was interrupted.

$$\text{Velocity } V = \frac{\ell}{t_2 - t_1}$$

Where ℓ = length of the interrupt card
 $t_2 - t_1$ = the interval time



2. Mark an event on a graph

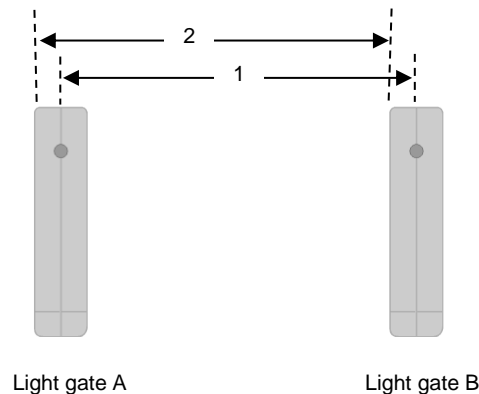
For example when measuring the heat of neutralisation in a reaction between a strong base and a strong acid, start logging before the acid is added so the initial temperature of the base is shown on the graph then the Light gate can be used to mark the point at which the acid is added.

3. To trigger a recording

A Light gate can be used to trigger the start of a recording.

Advanced user practical information

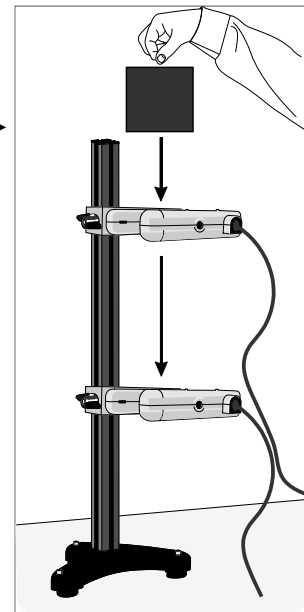
- Measure the length of the object or interrupt card that passes through the infrared beam as accurately as possible. If measurements are not accurate all the calculated data will be systematically high or low. This measurement can be the most critical part of the investigation.
- The segment length of a double interrupt card is used twice when calculating 'Acceleration at A' so any measurement error will be doubled. If two Light gates are used to calculate acceleration - 'Acceleration from A to B' – the interrupt card's length is only used once to calculate the final velocity so the results should be more accurate.
- When measuring the distance from one Light gate to another either measure:
 1. From the detection line of one Light gate to the detection line of the other or
 2. The leading edge of one Light gate to the leading edge of the other.



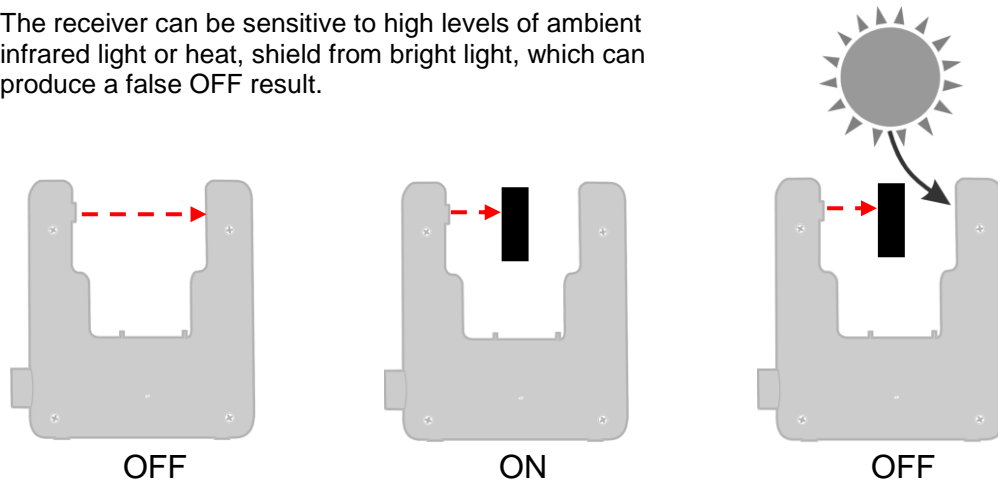
- Using a long interrupt card e.g. 10 cm, will improve the accuracy of results.
- If you are measuring the diameter of an object that is going to be dropped through a Light gate, make sure you measure the part that will actually pass through the beam.
- When two Light gates are used make sure they are aligned to each other (positioned in parallel, with back edges lined up so the void of one Light gate is in line with the void of the other Gate).

This picture shows two Light gates attached to the Dynamics System pillar set to record Acceleration due to gravity from A to B with a single interrupt card.

- Try to arrange the set-up so the object passes as close to the receiver (the slot) as possible. This reduces any possibility of a shadow changing the effective length of the object e.g. an interrupt card.
- The best material for interrupt/timing cards would be rigid, coloured black and have tidy parallel edges. Some users find that equal amounts of plasticine or Blu-Tack used on each of the lower corners of the interrupt card will lower the centre of gravity and make the card more stable and less likely to wobble when dropped.
- Ensure that the object/interrupt card cuts cleanly through the Light gate's infrared beam. If it twists at all delete the result.
- Ensure that the bottom of an object (e.g. an interrupt card) does not interrupt the Light gates beam **before** the object is released.
- If you are dropping an interrupt card through the Light gate, hold the card centrally from the same start position just above the Gate.



- If masses or plasticine are attached to the interrupt card make sure they do not protrude beyond the edges of the card. Masses should be balanced to prevent the card from twisting as it travels.
Example: to apply a weight of 20 g, use 2 x 10 g weights positioned at each side of the interrupt card.
- The receiver can be sensitive to high levels of ambient infrared light or heat, shield from bright light, which can produce a false OFF result.



If the Light gate is giving false OFF results try rotating through 180° (so any external light source is directed towards the transmitter) or close an appropriate blind in the room.

Specifications

- Infrared source: Peak at 880 nm
- Response time: Less than 5 microseconds
- Timing resolution: 10 μ s

Limited warranty

For information about the terms of the product warranty, see the Data Harvest website at: <https://data-harvest.co.uk/warranty>.

Note: Data Harvest products are designed for **educational** use and are not intended for use in industrial, medical or commercial applications.



WEEE (**W**aste **E**lectrical and **E**lectronic **E**quipment) Legislation

Data Harvest Group Ltd is fully compliant with WEEE legislation and is pleased to provide a disposal service for any of our products when their life expires. Simply return them to us clearly identified as 'life expired' and we will dispose of them for you.