Light Level sensor (multi-range)

(Product No. 3124)

Range 1: 0 to 1,000 Lux
Resolution: 1 Lux

Range 2: 0 to 110% Transmission

Range 3: 0 to 10,000 Lux
Resolution: 5 Lux

Range 4: 0 to 100,000 Lux
Resolution: 43 Lux

Range 5: 0 to 1,000 Lux fast
Resolution: 1 Lux

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Introduction

The *Smart Q* Light level Sensor uses a photodiode which produces a voltage proportional to light intensity. It is sensitive to light in the range from 350 nm to 700 nm. The Sensor has a built in infrared rejection filter, giving it a spectral response similar to that of the human eye.

The *Smart Q* Light level Sensors are equipped with a micro controller that greatly improves the accuracy, precision and consistency. They are supplied calibrated and the stored calibration is automatically loaded when the Light Sensor is connected.

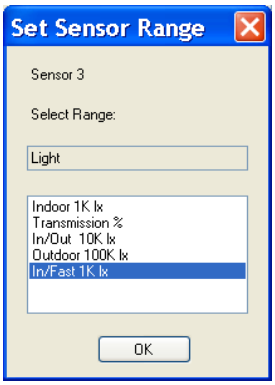
Connecting

- Push one end of the sensor cable (supplied with the **EASY**SENSE unit) into the hooded socket on the sensor with the locating arrow on the cable facing upwards.
- Connect the other end of the sensor cable to an input socket on the **EASY**SENSE unit.
- The **EASY**SENSE unit will detect that the Light Level sensor is connected and display values using the currently selected range.

Ranges

The Light Level sensor can record using five different ranges. If the light level is above, below or near to the maximum or minimum value on the current range, alter the currently selected range of the sensor.

Altering the currently selected range:



- Connect the Light Level sensor to the **EASY**SENSE unit
- Start the **EASY**SENSE program and select one of the logging modes from the Home page. Select **Sensor Config** from the **Settings** menu.
- Select the Light Level sensor from the list and click on the **Change Range** button.
- The current range will be highlighted. Select the required range and click on OK.
- Close Sensor Config. Click on New and then Finish for the change in range to be detected.

The range setting will be retained until changed by the user. With some **EASY**SENSE units it is possible to change the range from the unit. Please refer to the **EASY**SENSE unit's user manual.

Information about ranges:

All the ranges apart from In/Fast 1K Lux have a smoothed response to filter out unwanted signals of high frequencies e.g. to smooth the flicker from fluorescent lamps. These can be a source of interference to a Sensor in general use.

(1) 1 K Lux: 0 to 1000 Lux - *filtered*

This is a general-purpose range suitable for use at indoor light levels and therefore laboratory based experiments.

Investigations

- *Inverse square law*
- *Studies of the light intensity in various parts of the school*
- *Studies of plant growth*
- *Rates of reaction*
- *Transparency of materials*
- *Efficiency of reflectors*
- *Used with an Infrared sensor to study infrared in the spectrum*
- *Investigating different sources of light and their brightness*
- *Measuring the intensity of a bulb in a simple electrical circuit*

(2) 0 – 110% Transmission - *filtered*

This range is suitable for use at indoor light level.

Investigations

- *Makeshift Colorimeter e.g. breakdown of starch by amylase*

(3) In/Out: 0 to 10 K Lux - *filtered*

This mid-range makes it normally the most suitable for use with strong artificial lights e.g. a desk lamp.

Investigations

- *Effectiveness of polarised filters and sunglasses*

(4) Outdoor: 0 to 100 K Lux - *filtered*

This wide range makes it ideal for outdoor use (in sunlight) and environmental monitoring.

Investigations

- *Environmental monitoring*
- *Weather study to monitor sunrise and sunset times*
- *The effect of light intensity on photosynthesis*
- *Monitoring sunlight while testing the performance of a Photovoltaic panel*

(5) In/Fast: 0 to 1 K Lux fast

This Light Sensor is not filtered and has a fast linear response so can monitor rapid variations in light intensity, which cannot be observed with the eye e.g. fluctuations in the light intensity of a bulb due to voltage fluctuations. An **EASY**SENSE unit capable of fast logging is required to monitor such rapid events.

Note: Setup files that were created by using the 3123 Light level sensor will not recognise the Light fast sensor name. Cancel 'the sensors are incorrect' warning so the check is ignored.

Investigations

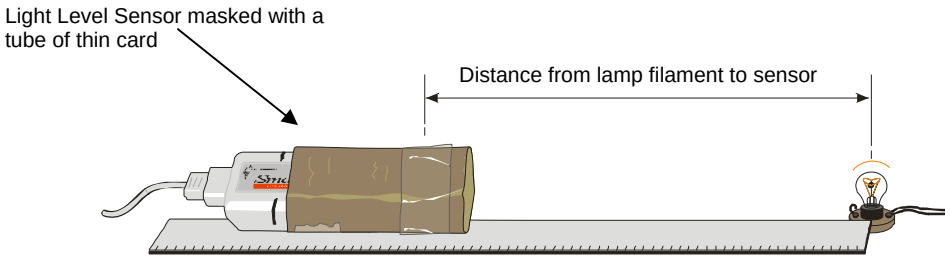
- *AC Modulations of a fluorescent or incandescent lamp or computer monitor screen due to mains frequency and the effects of on/off switching of the light.*
- *Remote control modulation patterns*
- *Investigating interference using a Laser – single and double slit diffraction (Young's slit)*

Investigations

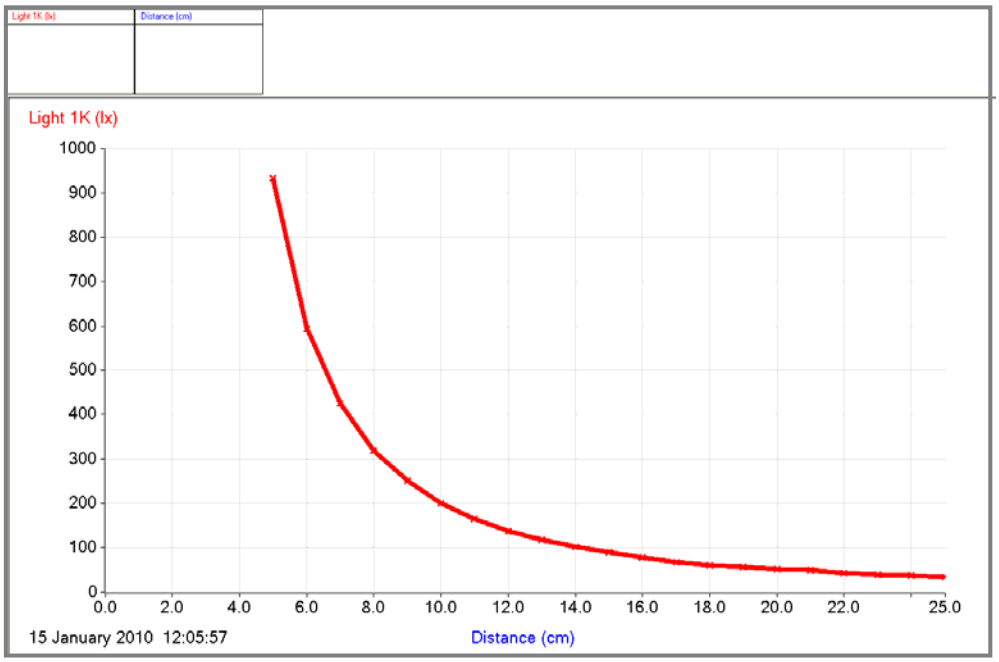
Inverse Square Law

For this activity either the 1,000 or 10,000 Lux range is used to measure the intensity from a light source as the Sensor is moved away from it.

Note: *This investigation is best done in a room with the lights dimmed.*



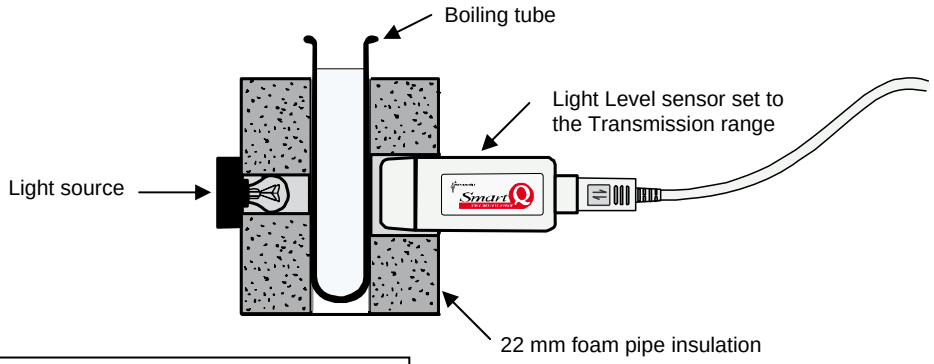
- Lay a metre rule along the work surface. Connect the Light level Sensor to the **EASY**SENSE unit and place alongside the metre rule. Position the light source at the end of the rule pointing at the Light Sensor.
- Open the **EASY**SENSE program and select **Snapshot** from the Home page.
- Select **Pre-log Function** from the **Tools** menu. Select a **Preset** function, with **General** from the first drop-down list and then **Asks for Value** from the second list. Next. Type in 'Distance' as the name and enter the units to be used e.g. cm. Finish.
- Select **Test Mode** from the **Tools** menu. Switch on your light source. If the value is near or above the maximum value either alter the range or move the Light Sensor away from the light source until the Sensor's value is within range.
- Click on the **Start** icon. Click in the graph area to take a snapshot measurement and type the distance between the Sensor and light source into the 'enter value box'. OK.
- Move the Light Sensor further away from the light source and record another measurement. Repeat these steps until the value from the light source becomes too low. Click on **Stop** to finish recording.
- To display Light level readings against Distance, select the **Options** icon, then **X-Axis** and then **Channel**, OK. If necessary, click in the area below the graph until Distance is displayed on the X axis.



The breakdown of starch by the enzyme amylase (diastase)

Iodine is added to starch to make a dark blue solution. Saliva contains amylase enzymes that catalyse the breakdown of starch. If amylase is added to the iodine treated starch solution the dark blue colour will become lighter so light travels through it more easily.

The Light Sensor should be set to the % Transmission range.



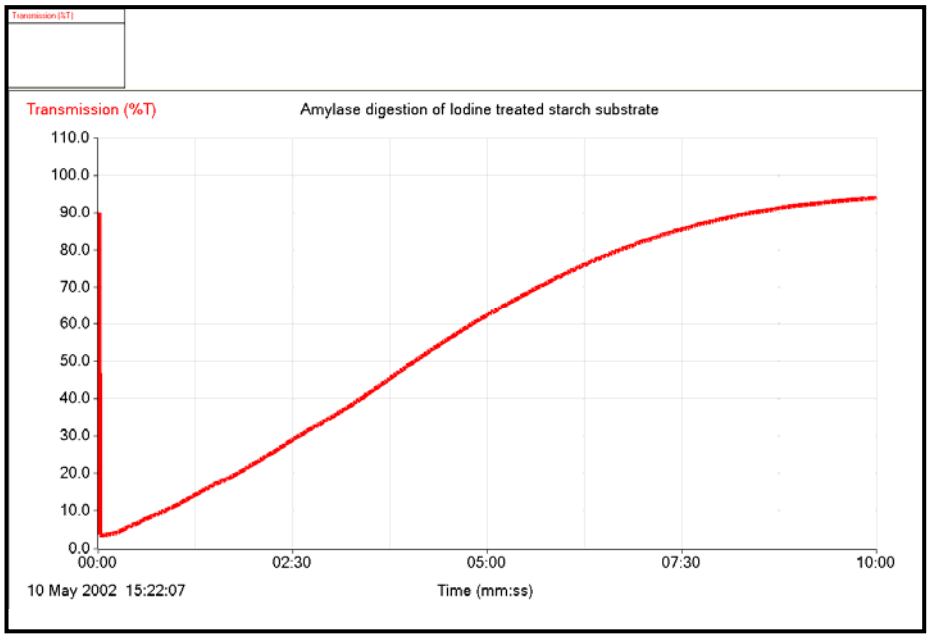
Use:
(1) A fresh solution of soluble starch in a pH 7 buffer 0.2% w:v.
(2) Dilute standard bench iodine *(2.5% iodine in 5% potassium iodide w:v)* twenty fold with water
(3) 1% amylase.

Liquid fungal amylase (Termamyl) is available from the National Centre for Biotechnology Education: http://www.ncbe.reading.ac.uk

Assemble the apparatus as shown in the diagram and turn the light source on.

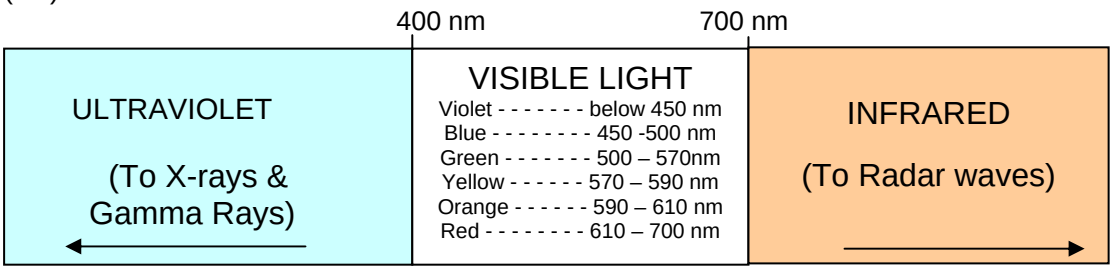
1. Open the **EASY**SENSE program and select **Graph** from the Home page. Select a recording time of **5 minutes**.
2. Fill the boiling tube with water. Select **Test Mode** from the **Tools** menu and adjust the light source and sensor so the Light sensor gives a reading of approximately 100% transmission. Deselect Test Mode.
3. Empty the boiling tube and add 10 cm^3 of the 1% amylase solution to the boiling tube.
4. Click on **Start** to begin logging and immediately add 20 cm^3 of the iodine and starch mixture to the (the addition should mix the starch with the amylase).

Note: Be prepared to change the strength of solutions or the time of the experiment. Enzymes give different levels of activity.



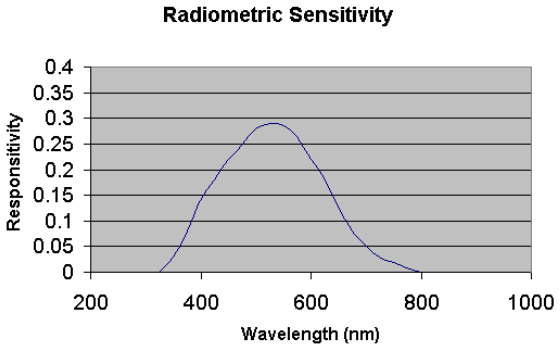
Theory

Light is produced by the release of energy from the atoms of a material when they are excited by heat, chemical reaction or other means. It travels through space in the form of an electromagnetic wave – a form of radiant energy. There are many kinds of energy, including ultraviolet, infrared rays, radio waves and X rays. We only see a minute part of the radiant energy spectrum – the part that is called visible light. Each type of radiation has its characteristic wavelength, which is defined as the distance a wave travels in one cycle. The wavelength of UV, visible light and IR waves are very small and are measured in nanometres (nm) i.e. billionths of a metre.



The Light Sensor utilises the photometric system of measurement that defines light in terms of how it is perceived by the human eye. The eye's sensitivity is dependent on the wavelength or colour of the light. Peak sensitivity occurs in the green part of the visible spectrum while the eye's response to infrared or ultraviolet is zero.

The photodiode used in this Sensor has selected for its maximized response through the visible part of the spectrum and its built-in infrared rejection filter.



Lux measurement

Lux (Latin for "light") is the SI unit for illuminance and luminous emittance i.e. it is used to record the light incident on a surface (striking a surface) or light emitted from a surface.

Illuminance	Example
50 Lux	a 60 watt bulb at a distance of 1 metre
100 Lux	a 100 watt bulb at a distance of 1 metre
300 - 500 Lux	Office lighting
1,000 Lux	Overcast Day
20,000 Lux	Winter Sun
80,000 Lux	Summer Sun

One Lux is equal to the illumination on a surface, all points of which are one metre from a point source of one international candle (candela). One Lux is equal to 0.0929 foot-candles.

Measurement of illuminance has a 10% error, due to back scattering of light and light dispersal by particles in air.

Warranty

All Data Harvest Sensors are warranted to be free from defects in materials and workmanship for a period of 12 months from the date of purchase provided they have been used in accordance with any instructions, under normal laboratory conditions. This warranty does not apply if the Sensor has been damaged by accident or misuse.

In the event of a fault developing within the 12-month period, the Sensor must be returned to Data Harvest for repair or replacement at no expense to the user other than postal charges.

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 are fully compliant with WEEE legislation and are 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.