LUX Sensor
for the LogIT Microsense® system

Instructions

Overview
The Microsense® LUX sensor is intended for high resolution light intensity measurement in the range 0 to 25000 LUX. It is primarily designed for monitoring and recording trends and changes in environmental levels of natural light. It is fitted with an eye response filter and incorporates a built-in linear amplifier for optimum resolution across the range.

In Use
As with all Microsense® sensors the LUX sensor is very straightforward to use with the data logger and software displaying light intensity directly in LUX (x10).

The sensor device itself is a precision photo diode with a built in filter matched to the spectral response of the human eye. This has a fast response which can be used to detect and measure rapid changes of light.

Because of this response the *flicker* of a.c. electric lighting (e.g. mains powered lamps or fluorescent tubes) can be seen as a ripple or 'noise' on the resultant trace and will affect readings and traces accordingly.

To measure illuminance the LUX sensor window should be aimed at a large white surface where the source of light to be measured is evenly reflected.

Specifications
Range:	0-25000 LUX
Peak spectral response:	565nm
Resolution:	typically 10 LUX
Nominal accuracy:	+/- 9%
Radiant sensitive area:	7.5 mm^2
Calibration point:	5000 LUX (natural)

Care
The sensor is not water or weatherproof and should be protected from damp and hostile environments. Do not point it directly at the sun and take care not to scratch or break the delicate glass window.

Do not attempt to disassemble - there are no user serviceable parts inside.

Example Applications
Inverse square law.
Experiments requiring calibrated measurement.
Light intensity of very low powered lasers.

Other light sensors
A higher range LUX level sensor (0 to 100,000 LUX) is also available for use outside the laboratory for basic environmental investigations in bright sunshine.
SPX LUX sensor (0 - 100,000 LUX)

"Perfect curtains"

Subject: Physics

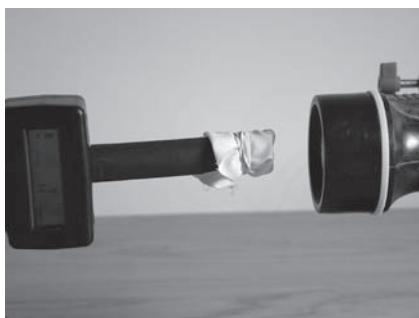**Sensor: LUX Sensor**

Overview:
Have you ever woken up in the morning with the light from the sun coming through your window curtains?
When you need to get up this is fine but if you worked at night and slept during the day (or were Count
Dracula!) this might not be so good. This experiment uses the LUX sensor to measure how much light is blocked
by different materials.

Equipment required: LogIT Datalogger
LUX Sensor
Tube of cardboard to simulate the room
Range of different materials to test
Tape/elastic band to attach to the 'window'
Light source such as a torch, low wattage lamp or sunshine

Hazards:
Do not look directly into sources of light as damage to the eye could result.
Do not allow pupils or materials to touch the light source.
Always check your local regulations or the school advisory service such as CLEAPSS or SSERC for
guidance on the use of any hazardous materials or chemicals.

Setup:

1. Place the small tube over the LUX sensor to form the room.
2. Place the light source at the end of the tube.
3. Measue or mark the distance from the light source to the
    end of the tube. Keep this distance constant for each
    material.

Note: The use of the tube over the LUX sensor prevents
         any stray light from entering the LUX sensor without
         passing through the material first.

Method:
1. Connect the sensor to the datalogger.
2. Run the datalogging software and setup the 'snapshot' facility to take individual readings.
3. Discuss which materials will block the most light and which will let the most through.
4. Choose a piece of material and write down its description.
5. Place the material over the end of the tube fixing with an elastic band.
6. Point the material at the light source and take a reading via the software.
7. Repeat for each material being tested.

Note: If computers are limited, you can use the remote snapshot facility on most LogIT dataloggers.
         The results can then be downloaded to the computer for further analysis.

Results:
• Which material kept out the most light?
• Which material let the most light through?
• Would the best material at blocking light be suitable for curtains?
• Decide how best to show the results found.

Going further
• Try moving the light source closer or further away.
• Try using two pieces of material stuck together.
• Design a shower curtain. What are the different properties requred for a shower curtain over a room's
  curtain? How might you investigate these properties?

"Rates of reaction"

Subject: Chemistry

Sensor: LUX sensor

Overview:

When Sodium Thiosulphate and Hydrochloric Acid are reacted together, a precipitation of sulphur is produced and the solution becomes cloudy. By measuring the light intensity through the solution, timing how long the precipitate takes to form, the rate of reaction can be found. The products of this reaction are Sodium Chloride, Sulphur, Water and Sulphur Dioxide.

Equipment required: LogIT Datalogger
LUX sensor
Small test-tube and cotton wool (used to seal the tube)
Pipette or small burette
0.15 Molar Sodium Thiosulphate
1 Molar Hydrochloric Acid
Distilled water
Paper towels to dry the test tube
Light source such as a torch
Piece of black card

Hazards:

Children must be supervised at all times.
Goggles must be worn.
Avoid inhalation of any gas given off if not contained in the test-tube.
Always check your local regulations or the school advisory service such as CLEAPSS or SSERC for guidance on the use of any hazardous materials or chemicals.

Setup:

In this procedure the amount of Acid was kept constant at 1 ml. You can increase/decrease the amount of acid depending on time.
The concentration of Sodium Thiosulphate was altered by adding varying amounts of distilled water.

Sodium Thiosulphate (ml)	3	2.5	2.0	1.5	1.0
Distilled water (ml)	0	0.5	1.0	1.5	2.0
Hydrochloric Acid (ml)	1	1	1	1	1
Total volume of liquid (ml)	4	4	4	4	4

For this experiment, you need to make a tube of cardboard to channel the light to the LUX sensor.

Method:

1. Connect datalogger to the computer.
2. Set up the datalogging facility time span between 5 and 15 minutes.
3. Carefully measure out 3 ml of Sodium Thiosulphate and place it into the test-tube.
4. Start logging and after about 15 seconds, add 1 ml of Hydrochloric Acid. (The dropping of the acid should be enough to mix the reactants.)
5. Keep collecting data until the light level no longer drops ie. the reaction has finished.
6. Stop logging and then repeat for the different concentrations shown in the above table.

Note: It is important to clean the test-tube thoroughly with distilled water between readings.
The reaction time can be obtained from the graph from where the plot starts to fall to where the plot levels off again. The rate of reaction can be expressed as:- Rate of reaction = 1 / Time taken

Results:

What do the results show about how the rate of reaction can be changed?
How does this method ensure it was a fair test?
Why was it important to ensure the test-tube was thoroughly cleaned each time?

Going further:

How might the temperature affect the reaction rate?
How might this experiment relate to reactions at home?

Chemistry

"Eutrophication"

Subject: Biology

Sensor: LUX Sensor

Overview:

When eutrophication occurs in streams and ponds, it is usually a result of human activity where the amount of nitrogen and phosphorus inorganic plant nutrient levels have been artificially increased due to fertilizer wash off from fields. This process without human interference, normally happens over a long period of time as dead organic matter accumulates.

Where an increase in either the phosphorus or nitrogen nutrients occurs then an algae bloom can result. Anyone who has set up an aquarium at home knows that this can be a real problem as the light struggles to reach plants and fish at the bottom, particularly if it is a deep tank.

This procedure uses the LUX sensor to monitor the light transmission through the water samples to see when algae is formed and what effect differing levels of liquid fertilizer has on the algae formation.

Equipment required: LogIT DataLogger
1 LUX level sensor
Some 2 litre plastic drink bottles
Liquid household fertilizer
Test tubes and black card
Pond water
Aquarium fluorescent light or lights (You can of course use natural sunlight)
Distilled water
Large cardboard box to cover the water bottles

Hazards:

Water samples must never be consumed.

Always check your local regulations or the school advisory service such as CLEAPSS or SSERC for guidance on the use of any hazardous materials or chemicals.

Setup:

1. Fill 5 plastic bottles with pond water.
2. Label the bottles 1 to 5.
3. Put 5 ml of liquid fertilizer into bottle 1 and add 5 ml increments to bottles 2, 3 and 4. (ie. bottle 4 has 20 ml of liquid fertilizer) Don't add any to bottle 5.
4. Put an aquarium fluorescent tube or lamp over the bottles in a large cardboard box.

Method:

1. Each day, take some liquid out of each bottle and place in a test tube. (You could simply use the bottles if they are clear enough)
2. Shine a light through the test tube, place the LUX sensor in a black tube as shown.
3. Monitor the light transmission using the light sensor daily as shown in the photo using 'snapshot mode'. (You can note the results in a spreadsheet)

Note: You might like to use more bottles so as to have repeat data on each of the fertilizer concentrations.

Results:

Hopefully the results will show an algae 'bloom' occurring either sooner or later in the bottles and the time taken should relate to the levels of fertilizer in the water.

Going further:

You may like to monitor a real aquarium. If so, do so with a newly set up one as these very often develop algae problems early on in their life.

Try monitoring an aquariums light, pH and dissolved oxygen levels. Can produce some interesting results.

Biology