LIGHT SENSOR[1]
0..200 LUX
Description D0142i

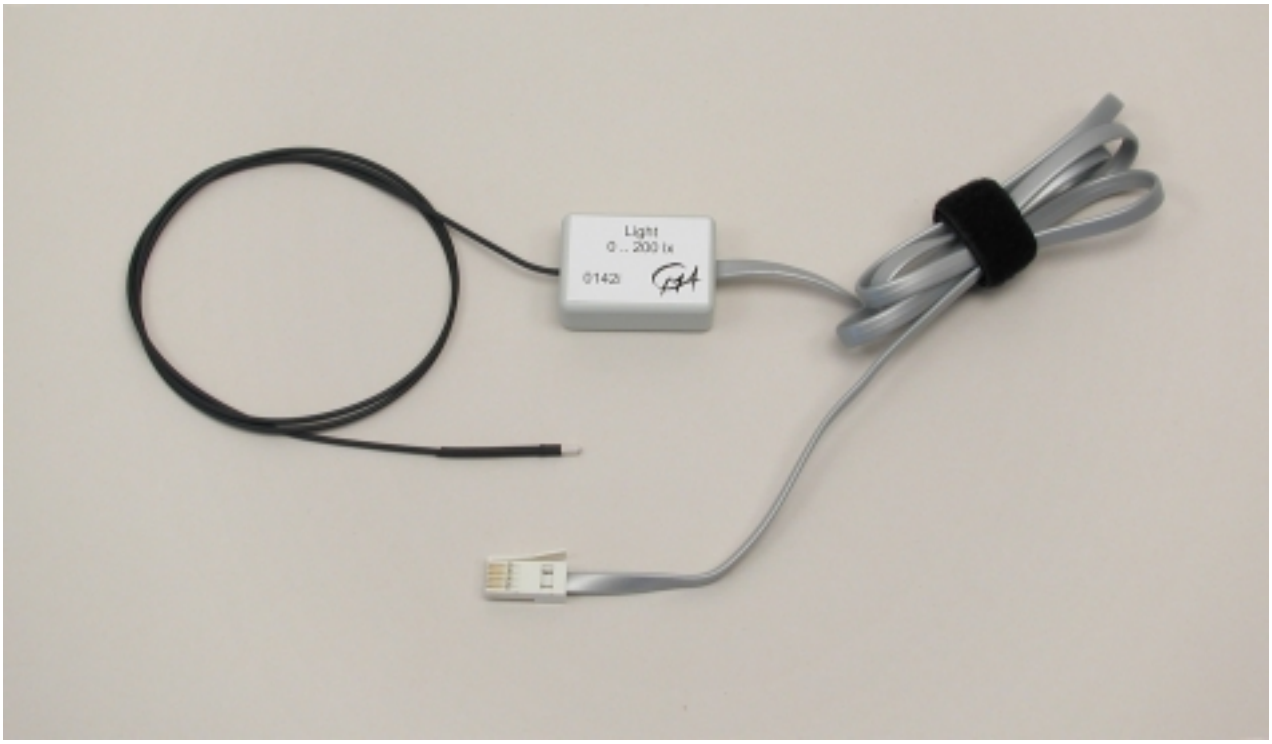

Figure 1. The Light Sensor 0..200 lux

Short description

The Light Sensor (0142i) measures light intensities in the range of 0 to 200 lux and is suitable for measurements in normal indoor situations. It consists of a phototransistor (BPX81), which receives light through a glass fibre. The phototransistor converts the measured light intensity into an output voltage adjusted to a range of 0 to 5V, which can be measured by an interface. The output of the light sensor is linear with respect to light intensity.
The sensor can also be used as a light gate. By virtue of the use of a glass fibre, the sensor can be used very flexible regarding the fixing of the fibre in the experimental arrangement.

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[1] To use the new intelligent sensors in the Coach 5 program you need to update the Coach library. This update can be found at http://www.cma.science.uva.nl/english section Support > Coach 5.

The light sensor is equipped with a BT-plug and can be connected to the following CMA interfaces:

- **U**LAB
- CoachLab
- CoachLab II
- UIA/UIB through Measuring console (via 0520 adapter[2]).

Furthermore the sensor can be used in combination with other interfaces, like Texas Instruments CBL™, CBL2™ and Vernier LabPro without the need of an adapter.

Intelligent sensor[3]

The light sensor is an intelligent sensor. The sensor has a memory chip with information about the sensor. Through a simple protocol (I^2C) the sensor communicates with **U**LAB and transfers its data (name, quantity, unit and calibration) to the datalogger. **U**LAB automatically displays the calibrated values on its screen. Also **U**LAB communicates the information to the Coach software. The sensor is delivered with a standard calibration.

Suggested experiments

The light sensor can be used in a variety of measurements of changes in light intensity such as:

- darkening of a solution caused by a chemical reaction
- changes of the light intensity of a bulb because of 50/60 Hz variation in the supply voltage
- effects caused by on/off switching,

and digital applications (as a light gate) such as:

- measuring the acceleration due to gravity (falling stick with slits)
- measuring the speed of objects undergoing collisions
- timing the period of a rotating object
- measuring the volume in titration experiments (by counting the number of falling drops).

Calibration

The output of the light sensor is linear with respect to light intensity.
To collect data you can:

1. Use the calibration supplied in the standard library of the Coach program.
2. Use the calibration supplied by the sensor EEPROM memory (only for the **U**LAB

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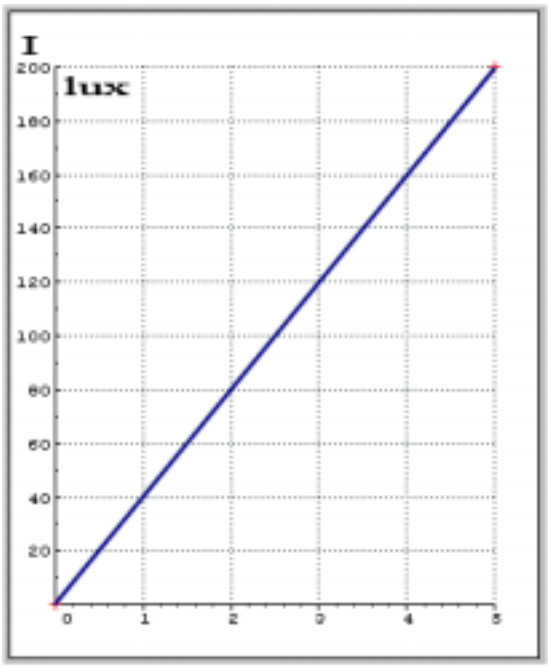
[2] The CMA adapter art. nr 0520 allows connecting sensors with BT-plugs to 4-mm inputs.
[3] At this moment only for CMA **U**LAB datalogger, in the future also for LabPro and the CBL2.

datalogger).

3. Calibrate the light sensor. The calibration can be performed in the Coach software (for details see 'Guide to Coach 5').
   The calibration is easy if you have a calibrated light meter. You simply perform a standard two-point calibration using two different light levels both measured with a calibrated, hand-held light meter.

Changing of the default calibration in EEPROM of the sensor

In the near future a special program will be available to enable replacing of the default calibration in EEPROM of the sensor by a calibration done by the user. This will be done while the sensor is connected to the **U**LAB datalogger. In this way the sensor can have its own, precise calibration.



The name of the light sensor in the sensor library of the Coach 5 program is
Light sensor (0142i) (CMA) (0..200lux).

Figure 2.
Default calibration graph of the light sensor (used in the standard Coach library and sensor memory)
$I\ (lx) = 40 * V_{out}\ (V)$

Coefficients of the calibration function:
a= 40; b= 0

Spectral sensitivity of the light sensor

The maximum sensitivity of the light sensor is at 850 nm.

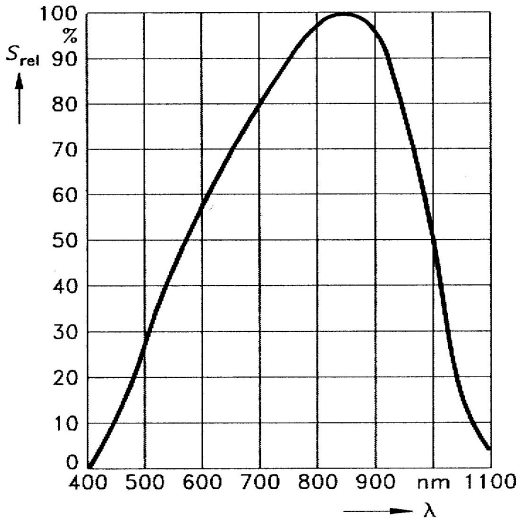


Figure 3. Spectral sensitivity of the phototransistor (BPX81).

Technical data

The light sensor is the most sensitive for light at an angle of incidence of 0° (to the perpendicular). The reading of illuminance in lux is only correct if all light comes from a direction within the angle of incidence at half sensitivity.
If light is coming from all directions, like in typical outdoor situations, the reading may be lower by a factor up to 8. In such situations 1-volt output may correspond to an illuminance of 300 lux, not 40 lux, then the range of the sensor is some 1500 lux (instead of 200 lux).

Light intensity (illuminance) range	0 - 200 lx
Voltage output range	0 – 5 V
Calibration function	I (lx) = 40 * V_{out} (V) Because of small differences in the way the phototransistor and the glass fibre are positioned in the box, and differences in the sensitivity of the phototransistors, the sensors may differ from each other in sensitivity.
Resolution using 12 bit A/D converter	0.05 lx
Angle of incidence at half sensitivity	±20°
Spectral range	440 nm - 1070 nm (10% of Spectral max) 570 nm - 1000 nm (50% of Spectral max)
Wavelength of the highest sensitivity	850 nm
Rise time	0.15 ms (bandwidth approx. 1 kHz)
Current requirement	< 4 mA
Glass fibre	Length = 100 cm; Diameter = 0.1 cm
Sensor information for Auto-ID and calibration	256 byte serial EEPROM
Connections	 BT (British Telecom) plug

This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications. Rev. 5/13/2003

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