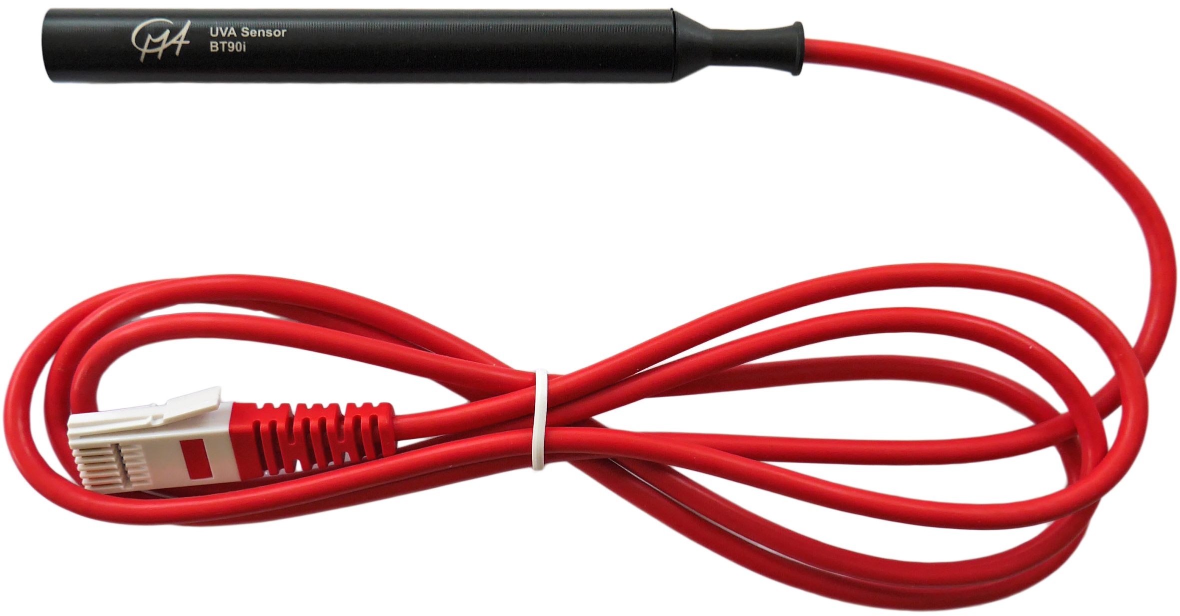
UVA SENSOR BT90I

USER'S GUIDE



CENTRE FOR MICROCOMPUTER APPLICATIONS

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Short description

The UVA sensor is an ultraviolet light sensor, which primarily responds to UVA radiation (approx. 220 to 370 nm).

The UVA sensor is built around a UV sensitive Schottky photodiode. The diode produces a current proportional to the UV intensity. The signal from the diode is amplified through a transimpedance amplifier and sent to the output.

Sensor recognition

The sensor has a memory chip (EEPROM) with information about the sensor: its name, measured quantity, unit and calibration. Through a simple protocol (I2C) this information is read by the CMA interfaces and the sensor is automatically recognized when it is connected to these interfaces. If your UVA sensor is not automatically detected by an interface, you have to manually set up your sensor by selecting it from the Coach Sensor Library.

Calibration

The CMA UVA sensor BT90i is supplied calibrated. The output of the sensor is linear with respect to the light intensity. The supplied calibration function is:

$$\mathrm{I}\left(\frac{\mathrm{W}}{\mathrm{m}^2}\right) = 5.319 \cdot \mathrm{V_{out}}(\mathrm{V})$$

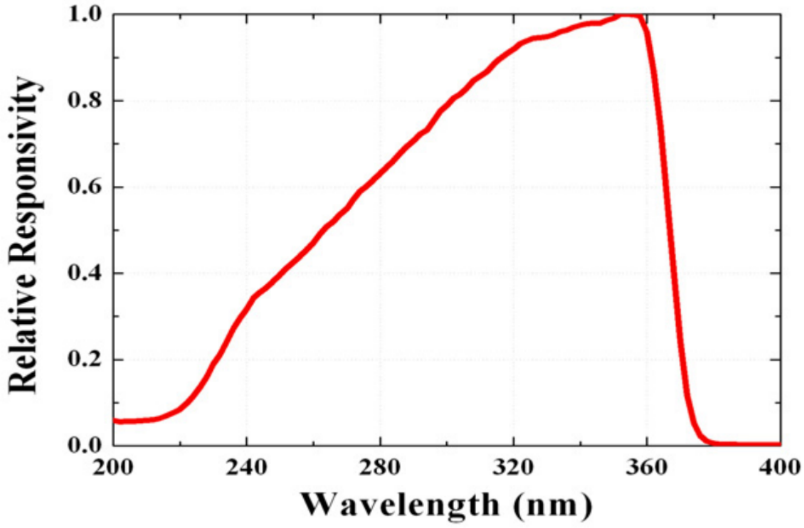
The Coach program allows selecting the calibration supplied by the sensor memory (EEPROM) or the calibration stored in the Coach Sensor Library. For better accuracy the pre-defined calibration can be shifted.

It is quite difficult to calibrate a UV sensor to read in absolute units, since you must have a source of known UV intensity and spectral distribution. More often you will simply want to calibrate the sensor in terms of a relative intensity. In that case, you will point the sensor at a UV source (most often the sun) and define that intensity as 100%. To perform this kind of calibration, complete the following steps for a two-point calibration:

- In Coach, select the sensor you are using in the Sensor Library and drag it to the position the sensor is connected on the panel, replacing the automatically detected sensor icon.
- Right click on the sensor icon and choose "Edit Properties".
- Set the unit to "%" and the maximum to 100.
- The first point is your zero, with no light striking the sensor. Cover the tip of the UV sensor with a clean opaque object. Enter 0 (zero) in "Y0" (first calibration point). Set "X0" of this point to the voltage that is measured (shown in the dialog).
- Now allow full UV intensity to strike the sensor. Since the orientation of the sensor affects the reading, it is best to hold the sensor in place with a ring stand or other clamp. To point the sensor directly at the sun, make the shadow of the sensor tube as small as possible. Enter 100 in "Y1" (second calibration point) and enter the measured voltage in "X1".

Sensitivity of the sensor

The sensor is sensitive over a range of wavelengths from 230 nm to 380 nm, with peak sensitivity at 352 nm.



Practical information

The wavelength region from 320 to 400 nm is commonly called UVA radiation, and 280 to 320 nm is called UVB radiation. Wavelengths shorter than 280 nm fall into the UVC spectrum.

Plants and animals respond differently to the three types of UV radiation. Although very harmful to plants and animals, UVC radiation is nearly completely absorbed by the ozone in the Earth's atmosphere. Some UVB radiation makes it through the atmosphere, although the degree of absorption depends critically on the angle of the sun and the amount of ozone along the light path. UVB radiation is thought to be responsible for reddening of the skin (erythema), cataracts, and skin cancers. UVA can also cause these effects on human skin, but to a lesser extent. It is generally agreed that UVB radiation is the primary danger to humans, but increasingly UVA is being shown to cause delayed, but significant, damage to skin and eyes.

There are several ways of measuring UV light intensity and exposure. The usual irradiance unit is $\frac{W}{m^2}$, but a simplified UV index system is also in use.

The UV index is based on the potential damage caused by specific wavelengths of light, using a weighting called erythemal, assuring that the index value remains proportional to the intensity of damaging radiation. An erythemally weighed UV intensity of 2.5 $\frac{W}{m^2}$ corresponds to a UV index of 10. The CMA UV sensors are not erythemally calibrated and so cannot be easily used to estimate the UV index directly, but given a single source, should give readings proportional to it.

Suggested experiments

The CMA UVA sensor BT90i can be used in a variety of experiments, such as:

- Measure the UV intensity as a function of time throughout the day. Do you need to adjust its position and orientation? When is sunscreen the most vital?
- Measure the UV transmittance of various sunglasses and regular glasses. Do your sunglasses protect your eyes from both UVA and UVB? Can you get sunburn through a car window?
- Measure the UV transmittance of fabrics, both wet and dry. Does a wet T-shirt provide much solar protection?
- Measure the transmission of UV through different numbers of layers of transparent polymer.
- Measure the protection offered by different types of sunscreen.

Technical Specifications

Sensor kind	Analog, generates an output voltage between 0 – 5 V
Measurement range	0 .. 25 $\frac{W}{m^2}$
Calibration	$I\left(\frac{W}{m^2}\right) = 5.319 \cdot V_{out}(V)$
Measuring element	GUVA-T21GH by GenUV; linear
Angle tolerance	5°
Sensitivity range	220 nm .. 370 nm at 10% sensitivity 265 nm .. 365 nm at 50% sensitivity Peak sensitivity at 352 nm
Rising time	3 ms
Connection	Analog (right-handed) BT connector

Warranty:

The UVA sensor BT90i is warranted to be free from defects in materials and workmanship for a period of 24 months from the date of purchase provided that it has been used under normal laboratory conditions. This warranty does not apply if the sensor has been damaged by accident or misuse.

Note: *This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.*

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