

## How to use a SOLEMS detection cell for lux measurement

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Applicable to lux measurements with a product type C01/XX/YY (singl sensor cell)  
See *LIGHT DETECTION CELLS data sheet*.

### 1. Principle

The parameter used to measure light is the short circuit current  $I_{sc}$  of the cell, or photocurrent under 0 Volt, because it is directly proportionnal to light intensity (E).

$$I_{sc} = a \times E$$

In orde to get a signal in voltage, easier to measure, impossible at the very short circuit point because  $V=0$ , a charge resistance ( $R_c$ ) will be placed in parallel, so that :

- the load current at this impedance ( $I_m$ ) is very near the short circuit current
- the voltage ( $V_m$ ) at this impedance is easy to measure.

$$V_m = R_c \times I_m$$

*Remark. This charge resistance  $R_c$  can be the entry impedance of an amplifier. .*

To keep the linearity law given before, the following rule should be applied :

**$V_m$  must remain below 100mV at the maximum light intensity ( $E_{max}$ ) of the required sensor's range.**

This is due to the intensity-voltage chartacteristics of SOLEMS detection cells- see below -

As soon as this rule is fullfilled,  $I_m$  and  $I_{sc}$  can be considered identical on the hole range from 0 till  $E_{max}$ .

$R_c$  can be determined the following way :

$$R_c = V_m \text{ (required value } < 100\text{mV)} / I_{sc} \text{ (short circuit current at } E_{max}\text{)}$$

This way, the measured signal  $V_m$  will be directly proportional to à E :

$$V_m = a \times E \quad \text{from 0 to } E_{max}$$

Caution : In order to measure precisely some flux up to 100 000 lux or more, it can be better to lower the light intensity received by the cells that can sometimes show a current saturation at high light illumination. Ask us for advice in that case.

### 2. Application

**$I_{sc}$  calculation at a given light intensity.**

$$I_{sc} = S_a \times J_0 \times E / 100000$$

where :  
 $I_{sc}$  is in milliamps  
 $S_a$  = active area of the sensor in  $\text{cm}^2$   
 $J_0$  = current density at 100 000 lux : 9 milliamps/ $\text{cm}^2$   
 $E$  = light intensity in lux

The active area is the surface in the center of the cell, between the 2 contact inactive areas (xsee drawing below).

Example : Detection cell with an active area of 1.45cm<sup>2</sup> at 1000 lux (our curve below)

$$I_{sc} = 1.45 \times 9 \times 1000 / 100\,000 = 0.13\text{mAmps or } 130\mu\text{Amps}$$

For othe light intensities, we would get  $I_{sc} = 13\mu\text{A}$  at 100 lux, 1.3mA at 10 000 lux, 13mA at 100 000 lux etc. ...

### Charge resistance choice

To scan the domain 0 – 1000 lux with this cell ; we wxant to get  $V_m$  (measured voltage) equal to 100mV for 1000 lux (max light intensity)

$$\text{So } R_c = 100\text{mV} / 130\mu\text{A} = 10^{-1} / 1.3 \cdot 10^{-4} = 770 \text{ ohms}$$

Therefore, with following items :

- Detecxtion cell with an active area of 1.45cm<sup>2</sup>
- Charge resistance of 770 ohms,

it is possible to measure th light intensity by a direct voltage measurement in the range 0-1000 lux.

$$E = 1000 \text{ lux} \rightarrow V_m = 100\text{mV}$$

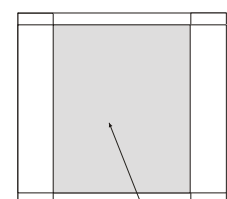
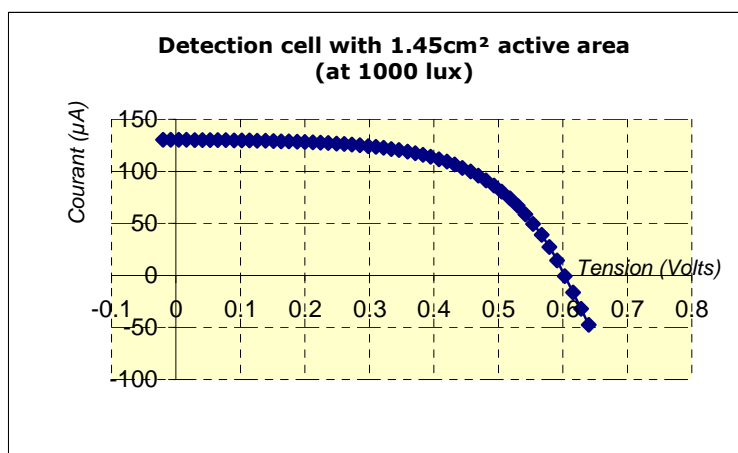
$$E = 500 \text{ lux} \rightarrow V_m = 50\text{mV}$$

$$E = 100 \text{ lux} \rightarrow V_m = 10\text{mV ...etc...}$$

Above 1000lux, the signal will slowly come to saturation, and it will never go above 0.8V, which is the open circuit voltage of the cell at the maximum illumination of 100 000 lux.

### General remark :

**The values of this memo are indicative. For a more precise measurement, it is necessary to test the final circuit in real test conditions, and compare values to a reliable calibrated luxmeter.**



Active area