CI6 : Capter et mettre en forme un signal électrique

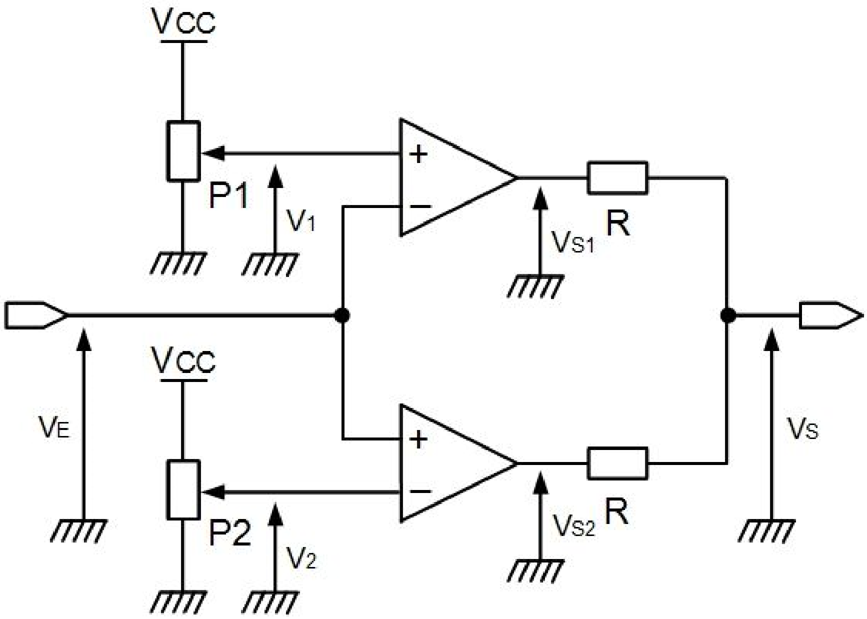
TD3 - Amplificateur d'instrumentation pour balance

Je suis capable de :

- ***Mettre en équation une structure avec AOP en régime saturé*** **O / N**
- ***Lire une documentation technique*** **O / N**

Exercice 1 : Montage comparateur à fenêtre

On donne le montage suivant :



Les ALI sont alimentés en symétrique : $+Vcc = +12v = +Vsat$ et $-Vcc = -12v = -Vsat.$

$P1$ est réglé à $2/3$ de sa course ($2/3$ de $P1$ entre la borne + et la masse), et $P2$ à $1/3$ de sa course.

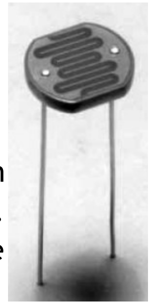
Q1 *Déterminer les seuils de basculement de l'AOP 1*

Q2 *Tracer la caractéristiques* $VS1(VE)$.

Q3 *Déterminer les seuils de basculement de l'AOP 2*

Q4 *Tracer la caractéristiques* $VS2(VE)$.

Q5 *Exprimer* VS *en fonction de* $VS1$ *et* $VS2$ *et en déduire la caractéristique de* $VS(VE)$.

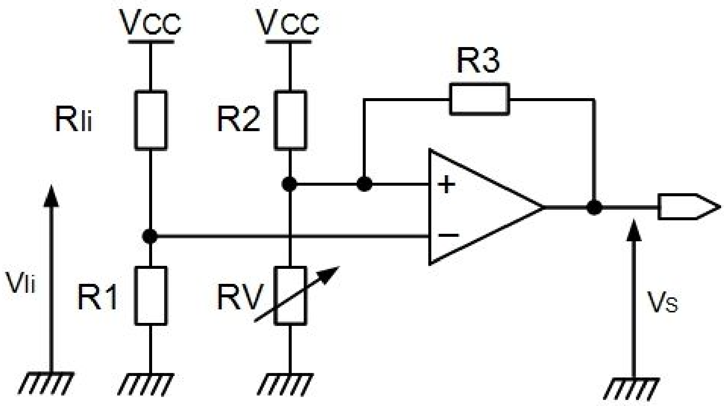


Exercice 2 : Capteur de luminosité

Une photorésistance (LDR) est sensible à la lumière. Sa résistance (ici $\boldsymbol{RIi}$) varie en fonction de l'intensité lumineuse $\boldsymbol{Ii}$ en lux. On souhaite détecter un seuil de luminosité. Pour cela, on utilise un montage comparateur à 2 seuils, muni d'une résistance variable RV, afin de pouvoir régler la valeur des seuils de détection.

L'ALI est alimenté en mono-tension :

$$+Vcc = +5v = +Vsat$$
$$-Vcc = 0v = -Vsat$$



Dans un premier temps, on peut pour simplifier supprimer $R3$.

Q1*- Donner l'expression de* VIi*, en fonction de* RIi *et* $R1$

Q2 *- On donne l'évolution de* RIi *en fonction de* Ii *dans la documentation constructeur. Tracer l'évolution de* VIi *en fonction de* Ii *pour* $R1 = 10K\Omega$ *(dans le repère fourni ci-dessous) : attention aux échelles logarithmiques !*

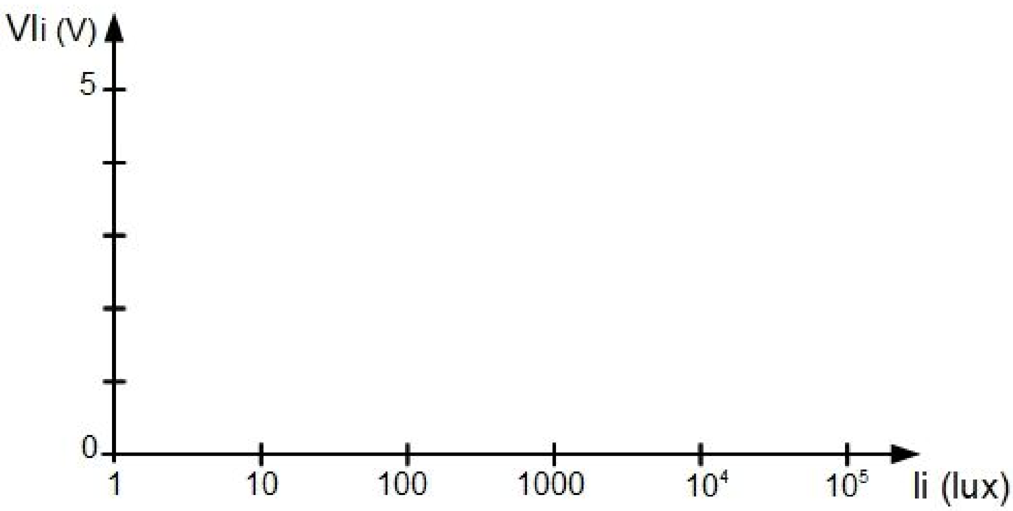
Q3 *- Déterminer le seuil de basculement en fonction de* RV, $R2$.

Q4 *- Pour* $R2 = 10K\Omega$, *calculer* RV *afin d'obtenir un seuil haut à 4v.*

Q5 *- Tracer la caractéristique* $VS(VIi)$.

Q6 *- En déduire la valeur du seuil de luminosité détecté par le montage.*

Q7 *- Refaire l'étude avec* $R3$. *Attention, on obtiendra cette fois-ci un comparateur double seuil. Pour* $R3 = 100K\Omega$, *représenter la nouvelle caractéristique* $VS(VIi)$.



Documentation technique

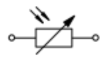
Construction
The photoresistor is attached to a fixture via an M12 x 1 thread. The fixture with the photo resistor is secured to a mounting base. The mounting base can be inserted on the Festo Didactic profile plate by means of a rotatable triple grip nut and T-head nut. The mounting base is fitted with three 4 mm sockets and a 3-pin miniature socket for the electrical connection.

Function
The photoresistor, which consists of the semiconductor material cadmium-sulphide, has a spectral responsivity similar to that of the human eye with maximum responsivity in the green spectral range of light. Photoresistors of this type are particularly suitable for the detection of visible light.
The electrical resistance changes considerably according to the illumination intensity. In the dark, the photoresistor has a high resistance and in the light a low resistance. The illumination intensity (Lux unit, in short lx) can be determined by measuring the resistance via the characteristic curve of the sensor.

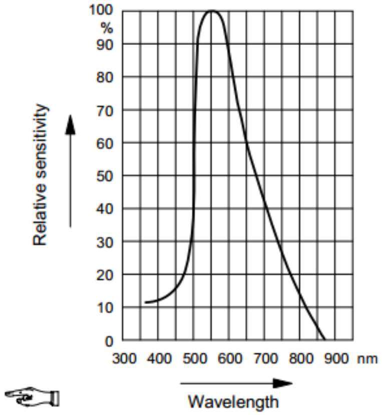
Electrical connection

The photoresistor is connected via one blue 4 mm socket and one black 4 mm socket.

Notes
When measuring using the photoresistor, the measuring current should be low in order to prevent internal temperature rise, thereby affecting the measuring results. The best way to implement this is by means of a digital multimeter.
The maximum limit values of the electrical load are to be observed when using the photoresistor as a light switch.
When determining the illumination intensity of different light sources with different spectral composition, devations from the measuring results of illumination intensity meters (lux meter) may occur. Commercially available illumination intensity meters contain an optical filter, which produces a standardised, visual evaluation of the optical spectrum to DIN 5031, Part 2.



Symbol



Spectral responsivity

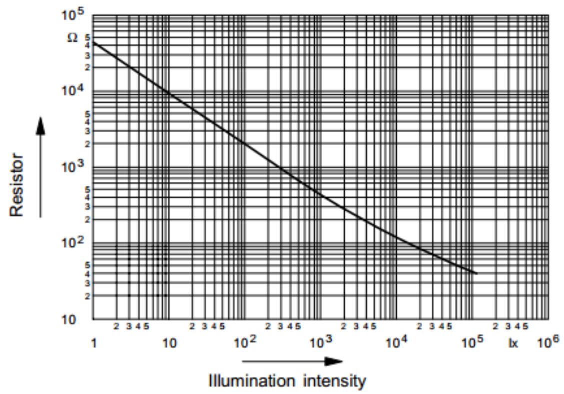
Technical data

Maximum power dissipation at 30°C Ambient temperature	250 mW
Maximum current	75 mA
Maximum peak voltage	320 V
Typical electrical resistance with illumination by tungsten lamp of 2854°K at an ambient temperature of 25°C: at 1000 lx at 10 lx	 400 Ohm 9000 Ohm
Dark resistance	> 1 MOhm
Characteristic curve in relation to resistance of illumination intensity	see diagram
Spectral responsivity	see diagram
Rise time: from darkness to 1000 lx from darkness to 10 lx	2.8 ms 18 ms
Fall time: from 1000 lx to 10-fold resistance from 10 lx to 10-fold resistance	 48 ms 120 ms

The relative spectral responsivity standard has been adapted to that of the luminous efficiency of the human eye. Although the spectral responsivity of the photoresistor is similar, there are nevertheless differences on closer inspection, which can lead to varying results.

Typical values of illumination intensity:

Moonlight	0.1 lx
Living room	200 to 500 lx
Classroom	500 to 1000 lx
Laboratories	750 to 1500 lx
Electronics production, drawing offices	1500 to 3000 lx
Sunshine with blue sky at noon	100000 lx



Dependence of resistance on irradiation