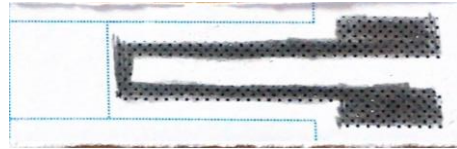


## GRAPHITE FLEX SENSOR

### General features

- Low Cost
- Easy-to-use
- Easy-to-build



### Description

This flex sensor is based on graphite. The sensor is composed of graphite deposited on a sheet of paper. The graphite is deposited with a Criterium pencil and HB hardness. Crocodile clips play the role of contact between two points of graphite from which the voltage is read.

In order to acquire the resistance values, we connected the sensor to an amplifier circuit and to an Arduino UNO board. The resistance of the graphite is deduced from the architecture of the amplifier circuit and the measured voltage.

When the paper is folded, the properties of the graphite will change. When the graphite atoms get closer together, the current flows more easily and the resistance decreases. Conversely, when the atoms move away from each other, the current flows less easily and the resistance increases. Through a linear law and the value of the initial resistance, the radius of curvature can be measured.

It is possible to use this sensor with other pencils with different hardness. In this case, the linear law will not be the same as the one presented in this document.

### Pin Description

- Arduino UNO' pin for the assembly



Pin's number	Usage
Digital 2/3/4	Rotatory encoder SW/ DT/ CLK
Analog A4/A5	OLED Screen SDA/SCL
Digital 10/11	Bluetooth RX/TX
Analog A0	Voltage measured at amplifier output
5V/GND	Supply voltage and ground

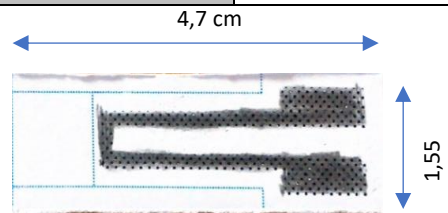
- Graphite sensor's pins



Pin's number	Usage
1	Voltage measurement
2	Voltage measurement

## Specifications

Type	Nanoparticle based sensor
Materials	<ul style="list-style-type: none"> <li>Paper</li> <li>Graphite</li> </ul>
Sensor type	Passive
Curvature measurement	Resistive measure
Time response	Until 1 second



## Standard Use Condition

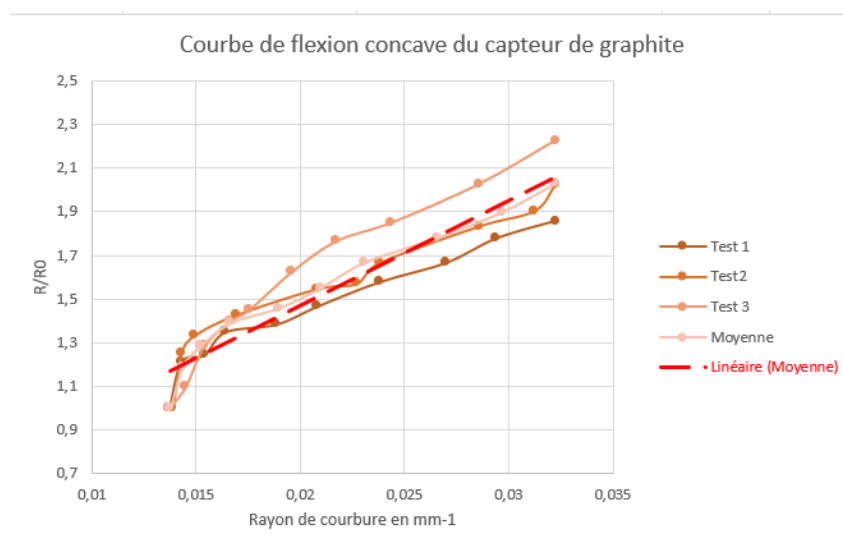
	Unit	Typical value
Temperature	°C	20±5
Humidity	%	60±5

## Electrical characteristics

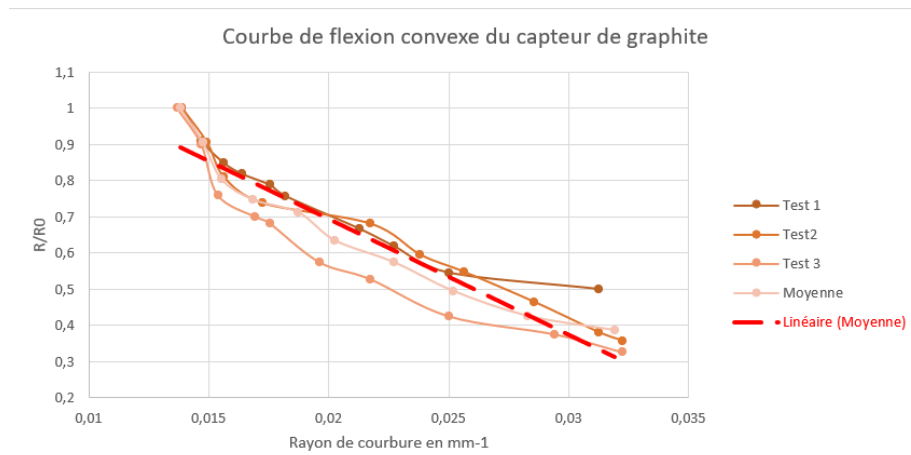
	Unit	Value		
		Min	Typical	Max
Graphite sensor resistance	MΩ	10	~ 40	+inf
Graphite sensor current	nA	-	100	-
Graphite sensor voltage	V	0		5

## Graphite sensor characteristics

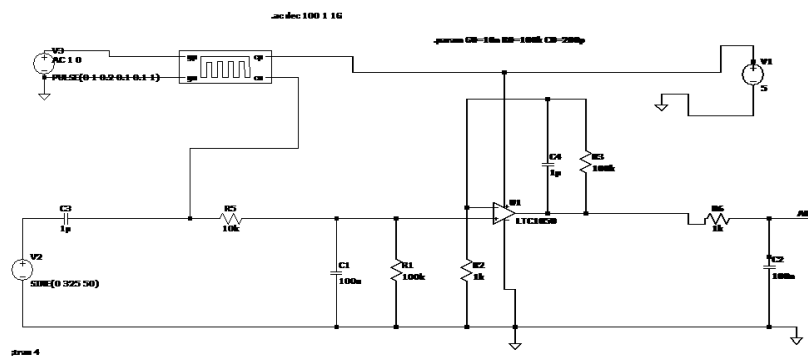
- Compressive deflexion:**



- **Under compressive deflexion:**



### **Analogic circuit used for the measurement**



With this circuit, we can extract useful information from the nanoparticle sensor. The outcoming tension tension is amplified by a LTC1050 operational amplifier. The ADC tension can be connected to the Arduino. Three low pass filter are used to avoid the HF, the 50Hz and the alimentation noises.