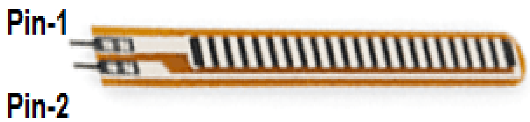
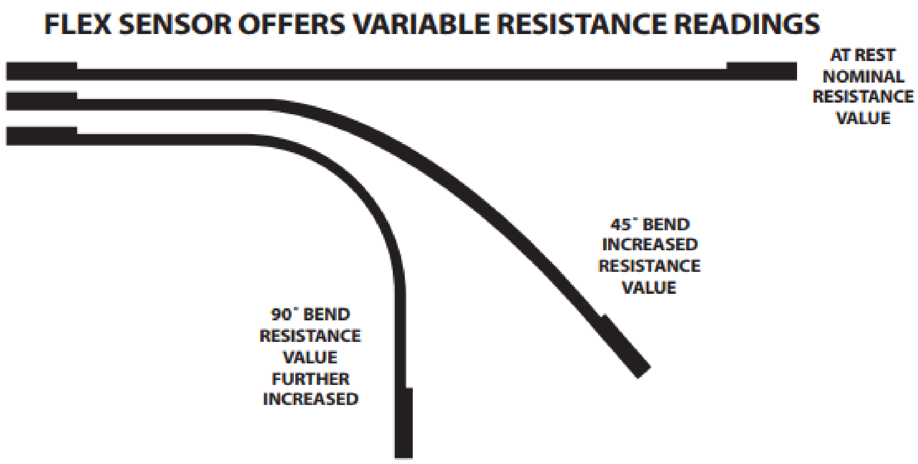
THE FLEX SENSOR

INTRODUCTION:

The Flex Sensor is variable flexible carbon resistor. As a variable printed resistor, the Flex Sensor achieves great form-factor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius—the smaller the radius, the higher the resistance value.



Although the sizes are different the basic function remains the same. They are also divided based on resistance. There are LOW resistance, MEDIUM resistance and HIGH resistance types. Choose the appropriate type depending on requirement.



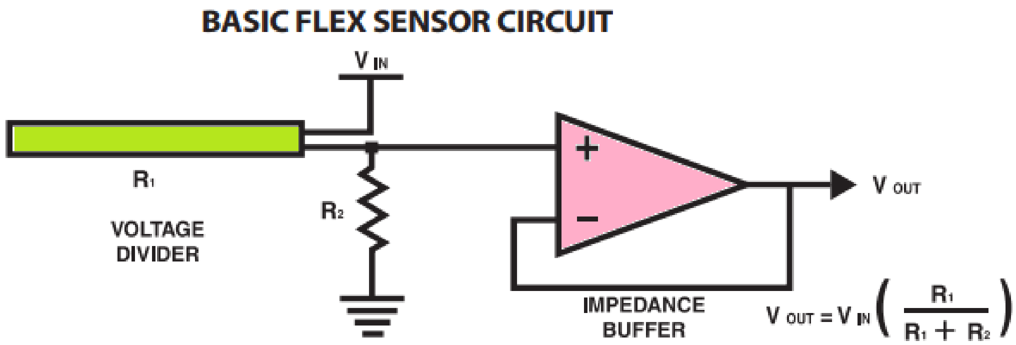
Flex sensor is a basically a variable resistor whose terminal resistance increases when the sensor is bent. So this sensor resistance increases depends on surface linearity. So it is usually used to sense the changes in linearity.

FLEX SENSOR WORKING DETAILS:

This sensor works on the bending strip principle which means whenever the strip is twisted then its resistance will be changed. This can be measured with the help of any controller. This sensor works similar to a variable resistance because when it twists then the resistance will be changed. The resistance change can depend on the linearity of the surface because the resistance will be dissimilar when it is level. When the sensor is twisted 450 then the resistance would be dissimilar. Similarly, when this senor is twisted to 900 then the resistance would be dissimilar. These three are the flex sensor's bending conditions. According to these three cases, the resistance will be normal in the first case, the resistance will be double as contrasted with the first case, and the resistance will be four-time when compared with the first case. So the resistance will be increased when the angle is increased.

Flex sensor is a completely linear it will be having its nominal resistance. When it is bent 45º angle the resistance increases to twice as before. And when the bent is 90º the resistance could go as high as four times the nominal resistance. So the resistance across the terminals rises linearly with bent angle. So in a sense the Flex sensor converts flex angle to resistance. For convenience we convert this resistance into voltage.

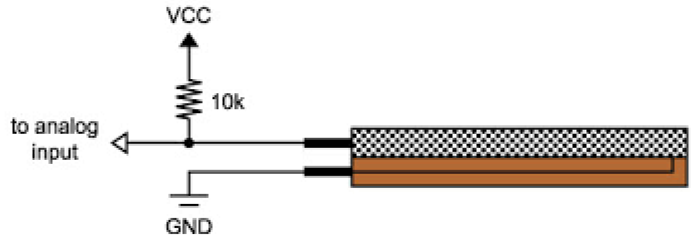
VOLTAGE DIVIDER CIRCUIT:



In this resistive network we have two resistances. One is constant resistance (R1) and other is variable resistance (RV1). Vo is the voltage at midpoint of VOLTAGE DIVIDER circuit and is also the output voltage. Vo is also the voltage across the variable resistance (RV1). So when the resistance value of RV1 is changed the output voltage Vo also changes. So we will have resistance change in voltage change with VOLTAGE DIVIDER circuit.

PIN CONFIGURATIONS:

Basically Flex sensor is a two terminal resistor type. So it is not a polarized terminals like diode.



PIN-1: Connected to positive of power supply.

PIN-2: Connected to ground

ULTRASONIC SENSOR

ULTRASONIC SENSOR WORKING

Ultrasonic sensors work by emitting sound waves at a frequency too high for humans to hear. They then wait for the sound to be reflected back, calculating distance based on the time required. This is similar to how radar measures the time it takes a radio wave to return after hitting an object.

While some sensors use a separate sound emitter and receiver, it's also possible to combine these into one package device, having an ultrasonic element alternate between emitting and receiving signals. This type of sensor can be manufactured in a smaller package than with separate elements, which is convenient for applications where size is at a premium.

While radar and ultrasonic sensors can be used for some of the same purposes, sound-based sensors are readily available—they can be had for just a couple dollars in some cases—and in certain situations, they may detect objects more effectively than radar.

For instance, while radar, or even light-based sensors, have a difficult time correctly processing clear plastic, ultrasonic sensors have no problem with this. In fact, they're unaffected by the color of the material they are sensing.

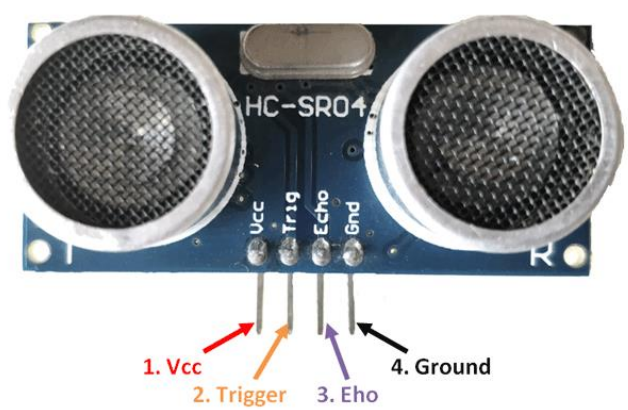
On the other hand, if an object is made out of a material that absorbs sound or is shaped in such a way that it reflects the sound waves away from the receiver, readings will be unreliable. If you need to measure the specific distance from your sensor, this can be calculated based on this formula:

Distance = ½ T x C

(T = Time and C = the speed of sound)

At 20°C (68°F), the speed of sound is 343 meters/second (1125 feet/second), but this varies depending on temperature and humidity. Specially adapted ultrasonic sensors can also be used underwater. The speed of sound, however, is 4.3 times as fast in water as in air, so this calculation must be adjusted significantly.

PIN CONFIGURATION:



Pin Number	Pin Name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

HC-SR04 Sensor Features

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

As shown above the **HC-SR04 Ultrasonic (US) sensor** is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that **Distance = Speed × Time.**

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture below

Power the Sensor using a regulated +5V through the Vcc ad Ground pins of the sensor. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on board 5V pins (If available). The Trigger and the Echo pins are both I/O pins and hence they can be connected to I/O pins of the microcontroller. To start the measurement, the trigger pin has to be made high for 10uS and then turned off. This action will trigger an ultrasonic wave at frequency of 40Hz from the transmitter and the receiver will wait for the wave to return. Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.

The amount of time during which the Echo pin stays high is measured by the MCU/MPU as it gives the information about the time taken for the wave to return back to the Sensor. Using this information the distance is measured as explained in the above heading.