DEEPAK GUPTA

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Vibration Detector

The piezoelectric sensor is used for flex, touch, vibration and shock measurement. Its basic principal, at the risk of oversimplification, is as follows: whenever a structure moves, it experiences acceleration. A piezoelectric shock sensor, in turn, can generate a charge when physically accelerated. This combination of properties is then used to modify response or reduce noise and vibration. Piezo Electric Buzzers/ speakers can also be used for robotic sensors, these could be used to detect pressure, touch or even vibrations, these type of sensors are used in automobile security systems and for industrial sensing applications. Piezoelectric sensors have proven to be versatile tools for the measurement of various processes. They are used for quality assurance, process control and for research and development in many different industries. Piezo Crystals used in these devices are unique in a way to where when voltage is applied, the crystals resonate and produce sound, on the other hand, if the piezo disc is bent, tapped or pressure is applied, you will see it produce a voltage. Several materials can be used to make piezoelectric sensors, including tourmaline, gallium phosphate, salts, and quartz. Most electronic applications use quartz since its growth technology is far along. More than likely, an op amp will be used to interface these sensors to an A/D converter, either discrete or on a microcontroller. One tip is to choose a high-input-impedance op amp to minimize current.

Operational Amplifiers or Op-Amps are usually high performance linear amplifiers with an amazing variety of uses and applications.The circuit shown is a simple vibration detector built using a Piezo crystal and OP-AMP 741. It has high input resistance and high gain bandwidth product, good enough to easily handle the vibration ranges of piezoelectric sensors.

This helps minimize current from the potentially high-voltage inputs from the piezoelectric sensors. In order to interface to a TTL circuit we have to make sure the voltage output of the sensor stays within the 5 volts range of our TTL circuit.Therefore two back to back ZENER DIODES of 5.1V are connected to prevent the voltage output of the piezo element from going above 5 volts. When not activated the out put from the piezo sensor will be low and so do the output of the IC.When the piezo sensor is activated its output voltage goes high.

Signal conditioning in a single stage can prepare the input from the shock sensor directly into an A/D converter. Op-amp circuits can be designed to operate in voltage mode or charge mode. Charge mode is used when the amplifier is remote to the sensor. Voltage mode is used when the amplifier is very close to the sensor.