

Discussion 31: Sensing Technologies - Notes

TOPIC 1: Sensing Vs Switching

Today's world is chock full of "sensors" many of which aren't sensors! In general most would define a sensor as a device that senses some physical property about its environment. However, a sensor also has the requirement of returning an analog electrical signal. On the other hand a switch is something that returns a digital electrical signal. Many switches are based on a sensor of some type but internally it is converted to a switch with the use of electronics. For example a light sensing night light that comes on only at night is not a sensor but a switch as it either senses enough light to turn the night light on or it doesn't. Conversely, a temperature sensor returns an electrical signal of some sort based on the temperature of its environment. However, a temperature switch would turn on above (or below) a certain threshold temperature. So, in short a switch means on or off, a sensor means continually varying.

TOPIC 2: Infrared Distance Sensing

Infrared Distance sensors work in a very similar way to your TV remote except that they include both a transmitter and a receiver within. Here the transmitter sends out a certain frequency of infrared light and if there is something nearby it is reflected off of the object and back to the sensor. Back at the sensor the amount of reflected light received is converted to a voltage level and sent to the user of the information.

TOPIC 3: Magnetic Sensing - The Hall-Effect Sensor

The Hall-Effect Sensor uses an effect on the flow of electrons in the presence of a magnetic field to detect the magnitude of the magnetic field in its environment. Commonly the hall-effect sensor is coupled with a magnet to sense passing metal objects. The most common use in industry is a gear tooth sensor. Check out an example gear tooth sensor from Allegro Microsystems, [the AT5667LSG](#).

On the more interesting side, they can also be used as a feedback device in a magnetic coil to regulate a magnetic field and allow levitation.

TOPIC 4: Temperature Sensing

In industry there are two common types of temperature sensors, Resistive Thermal Devices (RTD) and Thermocouples.

RTDs operate because we know that the electrical resistance of materials change with temperature. Most of these devices are made of platinum and are fairly accurate because the resistance of platinum is known very precisely at all temperatures around 500 - 600 degrees celcius and below.

Thermocouples are very cheap but not as accurate as the RTD in the temperature range given above. The thermocouple works because two dissimilar metals are attached together causing a small voltage to be generated. This voltage is read and depends on the temperature of the two metals. You likely have a thermocouple on your furnace and in your hot water heater. Thermocouples come in many types including K, J, T, S, E, N, B, R, C, and M. They differ by the two metals used to make the device and in their most accurate temperature range.

TOPIC 5: Light Sensing

Light sensing is common in simple applications such as lights that come on when it is dark (street lights for example). Photoresistors, photodiodes, and phototransistors are all types of light sensors. These devices all change properties based on the intensity of light on the devices. For instance the photoresistor has lower resistance with high light levels.

One small error I need to point out on the above video; they are not called calcium sulfide photoresistors but Cadmium Sulfide Photoresistors. After all, you can't trust everything on youtube!
You should now be prepared to answer these questions:

1. A sensor is a device that produces a(n) _____ voltage.
2. A switch is a device that produces a(n) _____ voltage.
3. The voltage output in an infrared distance sensor is based on the _____ received at the sensor.
4. The AT5667LSG has ____ pins.
5. The maximum supply voltage of the AT5667LSG is ____ volts.
6. RTD stands for _____.
7. A thermocouple works using two _____ metals.