



## Summary of Transducers

Transducer are devices which convert one type of energy into another, such as electrical energy into light or sound, or creates an electrical output corresponding to some physical parameter

Below is a summary of transducers and sensors we have looked at in this section along with a list of the main characteristics associated with Transducers, Sensors and Actuators.

### Input Devices or Sensors

- **Sensors** are “Input” devices which convert one type of energy or quantity into an electrical analogue signal.
- The most common forms of sensors are those that detect Position, Temperature, Light, Pressure and Velocity.
- The simplest of all input devices is the switch or push button.
- Some sensors called “Self-generating” sensors generate output voltages or currents relative to the quantity being measured, such as thermocouples and photo-voltaic solar cells and their output bandwidth equals that of the quantity being measured.
- Some sensors called “Modulating” sensors change their physical properties, such as inductance or resistance relative to the quantity being measured such as inductive sensors, LDR's and potentiometers and need to be biased to provide an output voltage or current.
- Not all sensors produce a straight linear output and linearisation circuitry may be required.
- Signal conditioning may also be required to provide compatibility between the sensors low output signal and the detection or amplification circuitry.

- Some form of amplification is generally required in order to produce a suitable electrical signal which is capable of being measured.
- Instrumentation type Operational Amplifiers are ideal for signal processing and conditioning of a sensors output signal.

## Output Devices or Actuators

- “Output” devices are commonly called **Actuators** and the simplest of all actuators is the lamp.
- Relays provide good separation of the low voltage electronic control signals and the high power load circuits.
- Relays provide separation of DC and AC circuits (i.e. switching an alternating current path via a DC control signal or vice versa).
- Solid state relays have fast response, long life, no moving parts with no contact arcing or bounce but require heat sinking.
- Solenoids are electromagnetic devices that are used mainly to open or close pneumatic valves, security doors and robot type applications. They are inductive loads so a flywheel diode is required.
- Permanent magnet DC motors are cheaper and smaller than equivalent wound motors as they have no field winding.
- Transistor switches can be used as simple ON/OFF unipolar controllers and pulse width speed control is obtained by varying the duty cycle of the control signal.
- Bi-directional motor control can be achieved by connecting the motor inside a transistor H-bridge.
- Stepper motors can be controlled directly using transistor switching techniques.
- The speed and position of a stepper motor can be accurately controlled using pulses so can operate in an Open-loop mode.
- Microphones are input sound transducers that can detect acoustic waves either in the Infra sound, Audible sound or Ultrasound range generated by a mechanical vibration.
- Loudspeakers, buzzers, horns and sounders are output devices and are used to produce an output sound, note or alarm.