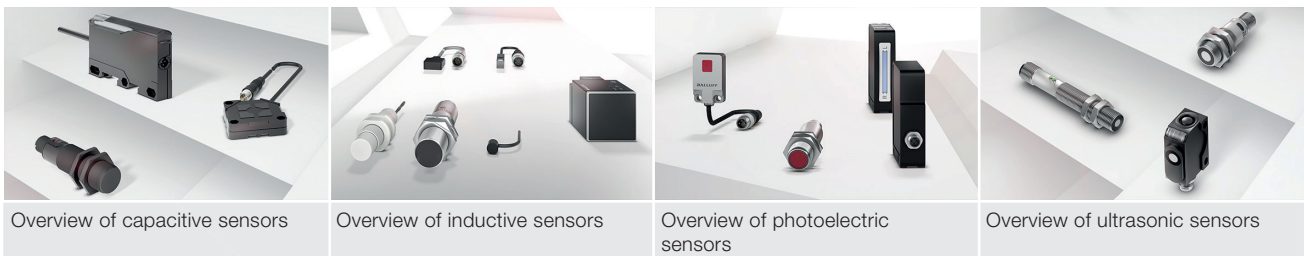**Fundamentals of Automation**

# HOW SENSORS WORK

A sensor converts the physical action to be measured into an electrical equivalent and processes it so that the electrical signals can be easily sent and further processed. The sensor can output whether an object is present or not present (binary sensors). Or the sensor reports what measuring value has been reached (analog/digital sensors).

A SENSOR CONSISTS OF THREE MAIN COMPONENTS

1. The sensing section contains the technology-based sensor. Different sensors using various technologies are available depending on your application.
2. The processing circuitry converts the physical variable into an electrical variable.
3. The signal output contains the electronics connected to a control system.

Overview of capacitive sensors    Overview of inductive sensors    Overview of photoelectric sensors    Overview of ultrasonic sensors

The various sensor technologies help you in detecting or measuring objects. Depending on the technology the sensors output a switching signal or a measurement value:

- **Inductive sensors** generate an electromagnetic field which in turn generates an eddy current in metal objects. The sensor detects this change.
- **Capacitive sensors** generate a capacitive measuring field. When an object enters it, the measuring field is changed. The sensor responds to this change.
- **Photoelectric sensors** (light curtains) always consist of an emitter and a receiver:
  - **Diffuse** types are used for direct object detection.
  - **Retro-reflective** types detect objects using a reflector.
  - **Through-beam** types have a separate emitter and receiver.
- **Ultrasonic sensors** send out a sound pulse in the inaudible range. The echo from the object is processed.
- **Magnetic sensors** detect an external magnet. The field strength generated by the magnet is processed.
- **Magnetostrictive sensors** detect the position of an external magnet using propagation time measurement.