Types Sensor and Transducer

Proximity

Proximity

Basic Principle: -

- To detect the pressure of a component without physical contact. Sensors used for this application are known as proximity switches

- The approach of an object changes:
    - Back pressure : pneumatic sensor
    - Inductance : Inductive / Magnetic sensor
    - Capacitance : capacitive sensor
    - Optical proximity sensors
    - Ultrasonic proximity sensors

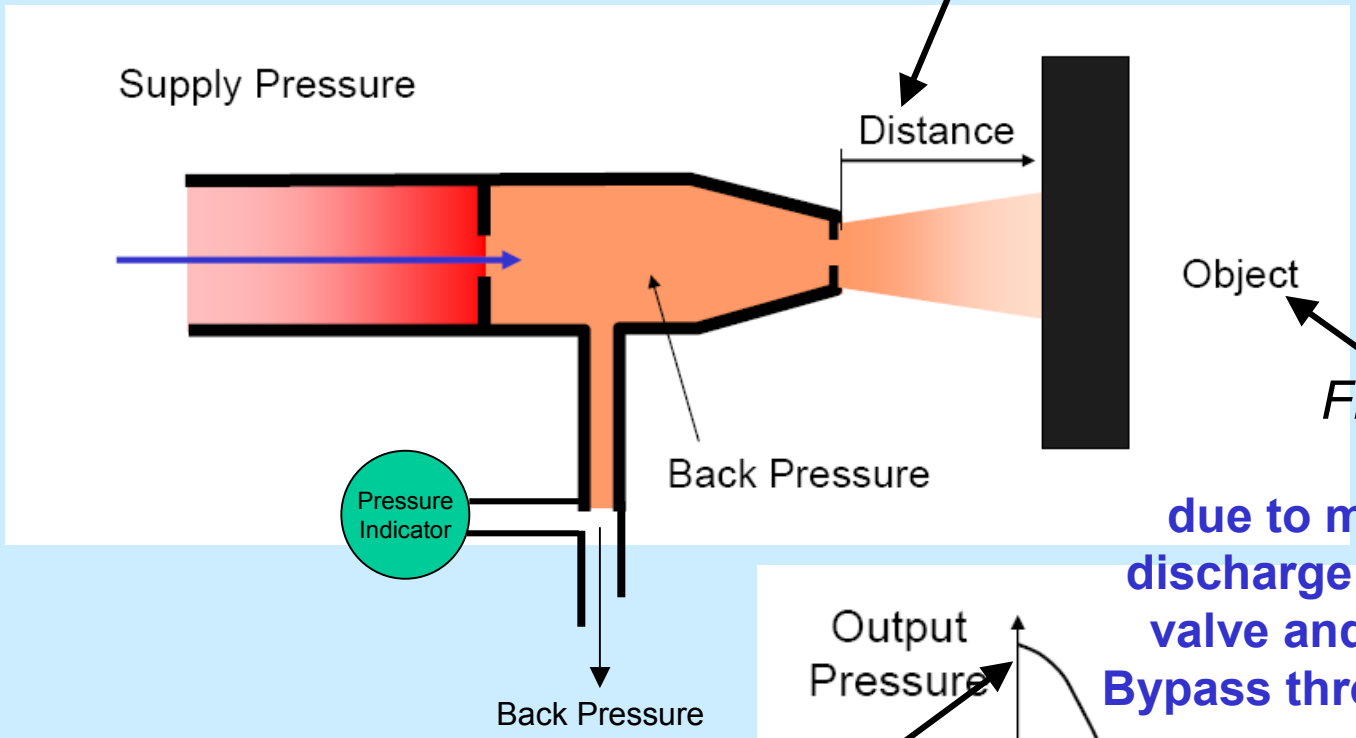
- Proximity switches are available in several different forms including, Optical Proximity sensors and electro – magnetic induction sensors.

Proximity

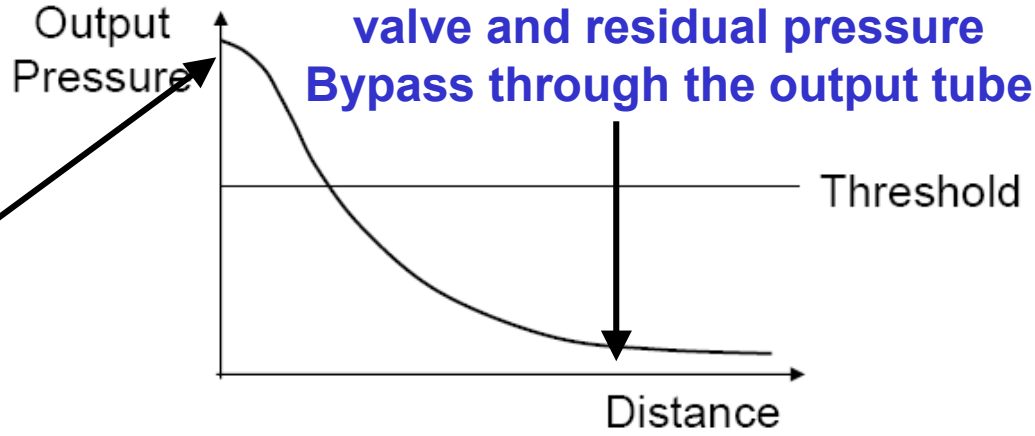
PNEUMATIC PROXIMITY SENSOR

Back pressure proximity sensor

Distance is typically of 0.025 mm



due to maximum pressure discharge Through the nozzle valve and residual pressure Bypass through the output tube

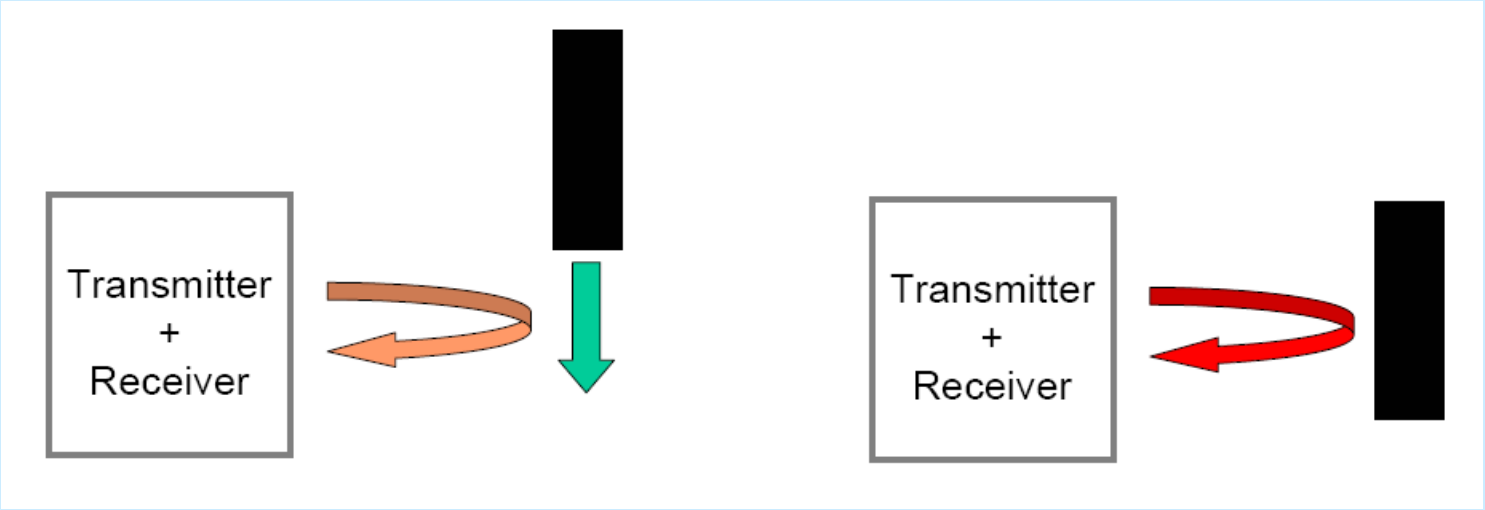


When distance is at 0 mm the back pressure is max that is supply pressure

Proximity

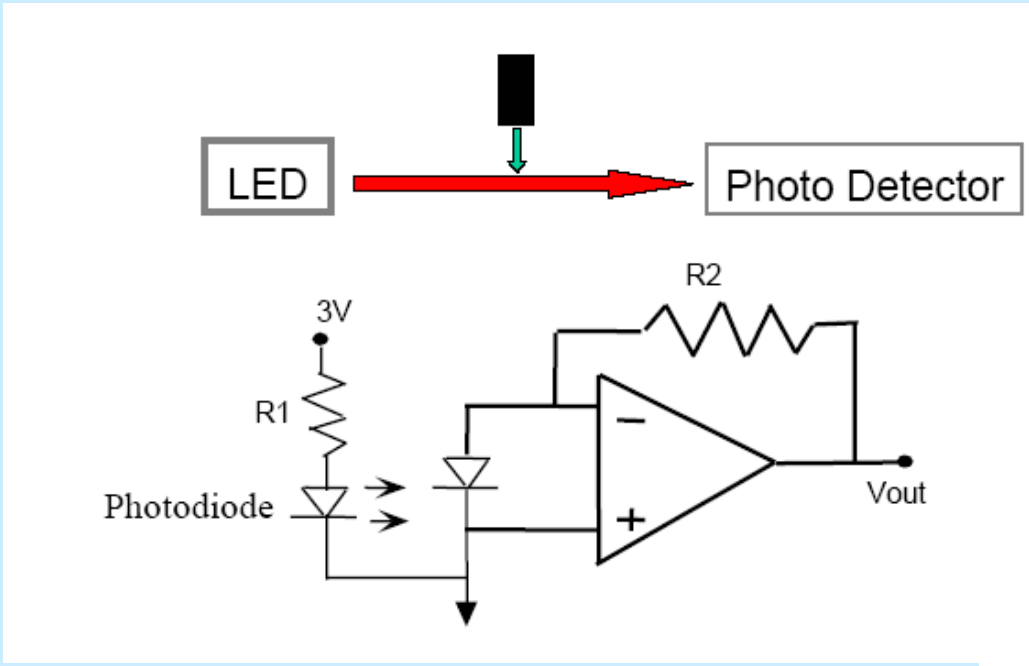
OPTICAL PROXIMITY SENSOR

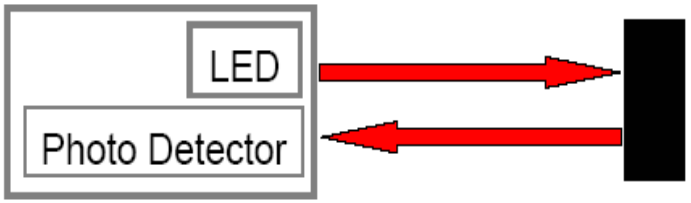
- Optical proximity sensors can operate in two modes.
  - Reflection of a transmitted light beam
  - Interruption of a transmitted light beam



Proximity

- Interruption of a transmitted light beam is preferable as the reflection depends on the ambient lighting and surface texture of the object to be detected.

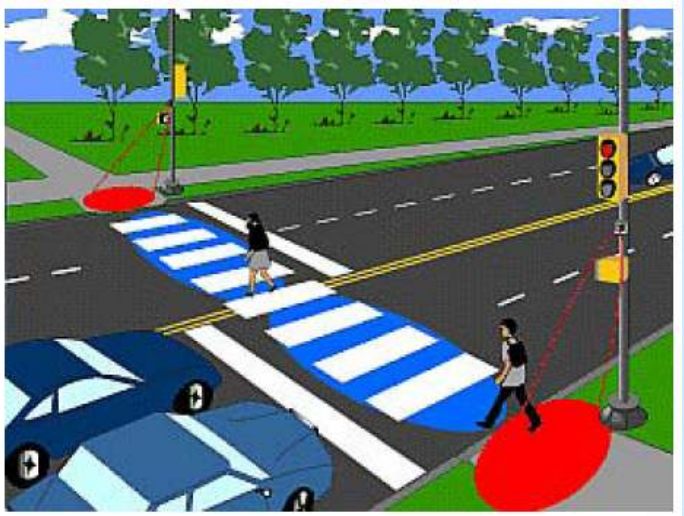


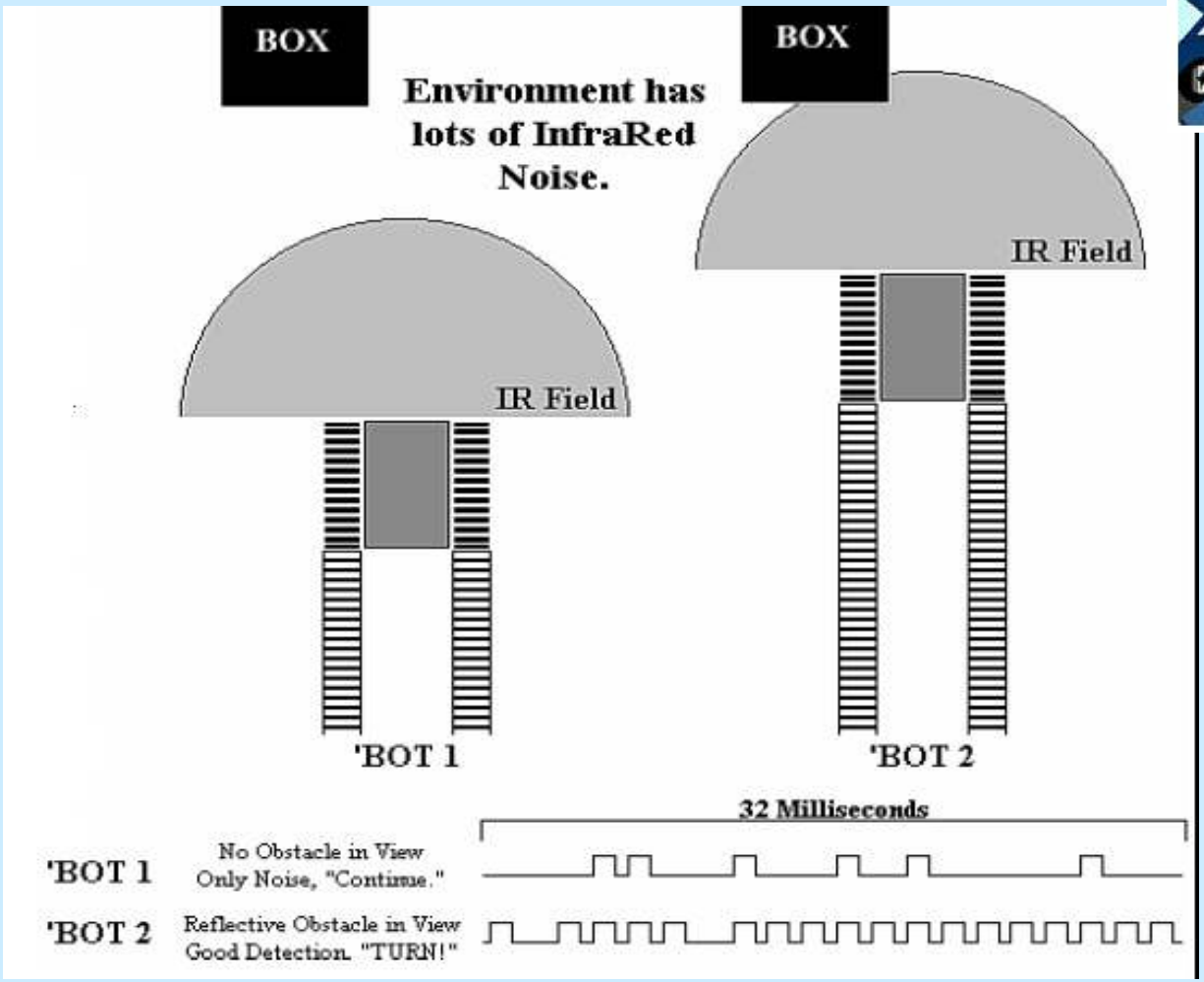


Types Sensor and Transducer

Proximity

Application

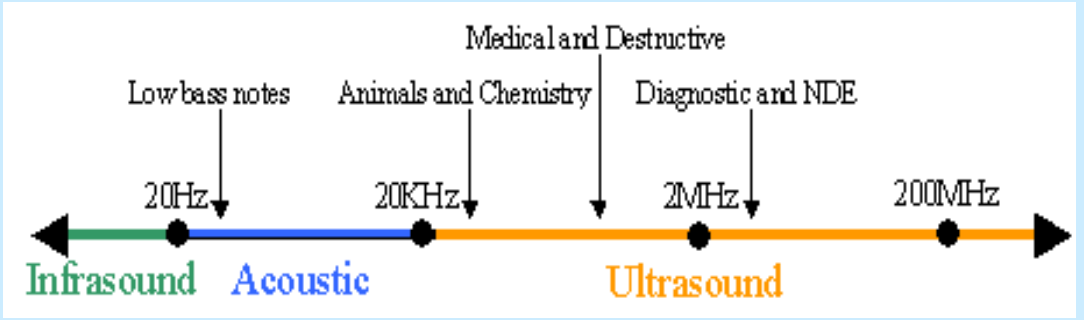


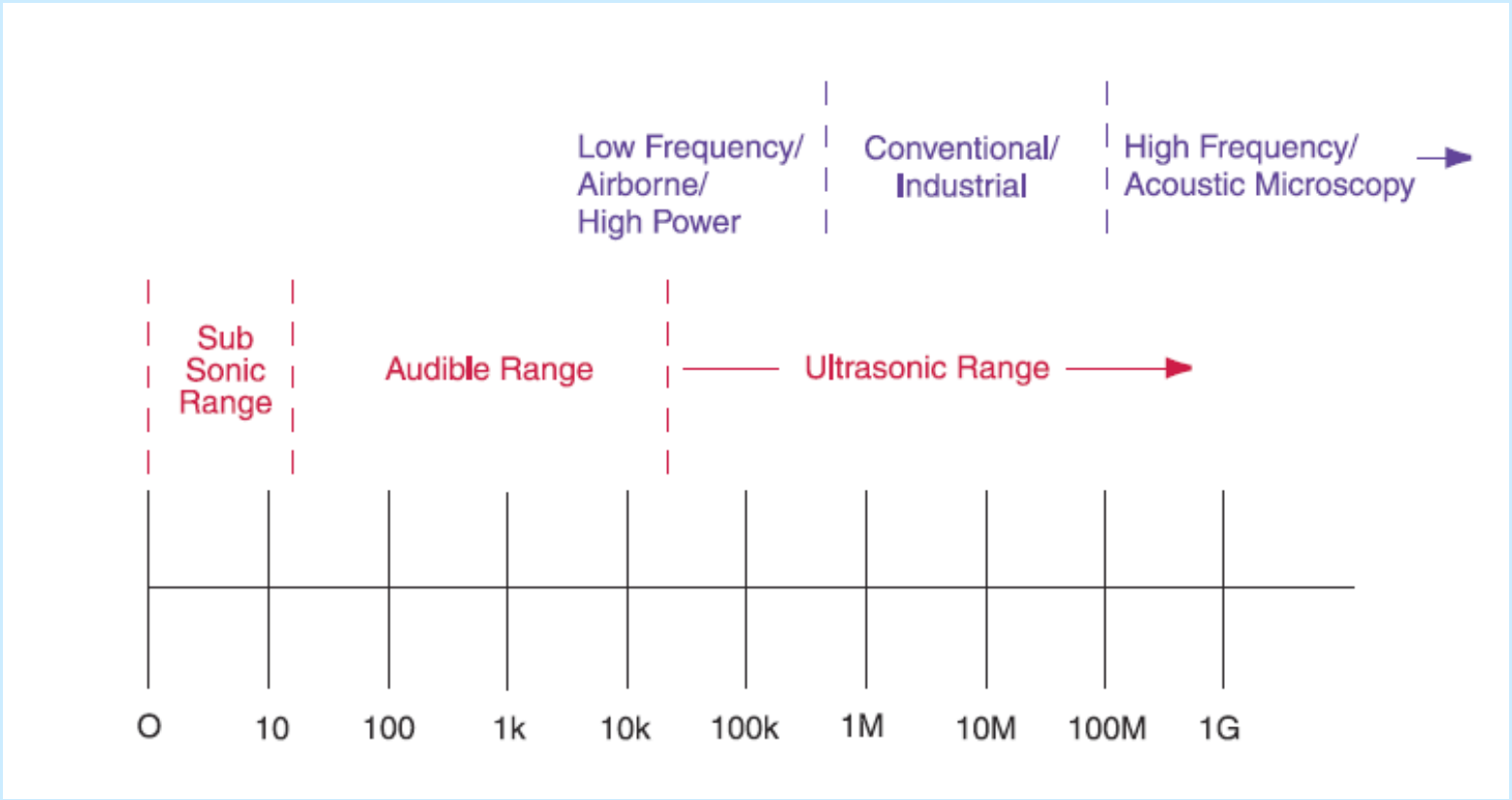


Proximity

ULTRASONIC PROXIMITY SENSOR

a. What is Ultrasound?
Sound generated above the human hearing range (typically 20KHz) is called ultrasound.

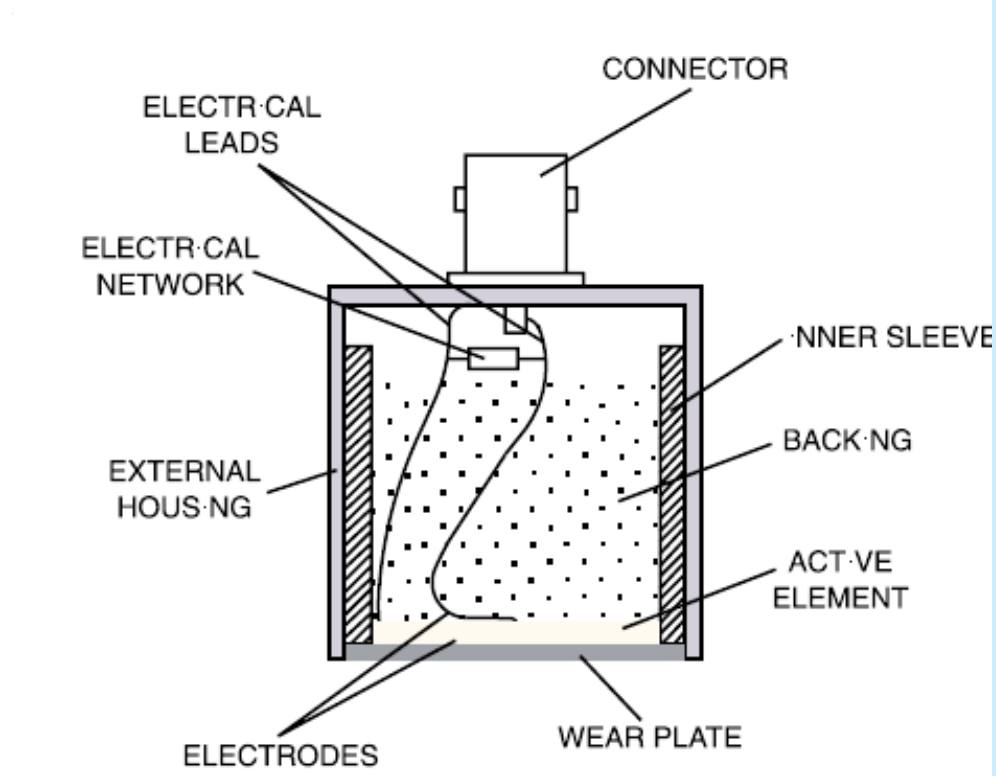




Proximity

b. What is an Ultrasonic Transducer?

An ultrasonic transducer converts electrical energy to mechanical energy, in the form of sound, and vice versa. The main components are the active element, backing, and wear plate.



- The basic purpose of the transducer ***wear plate*** is to protect the transducer element from the testing environment.

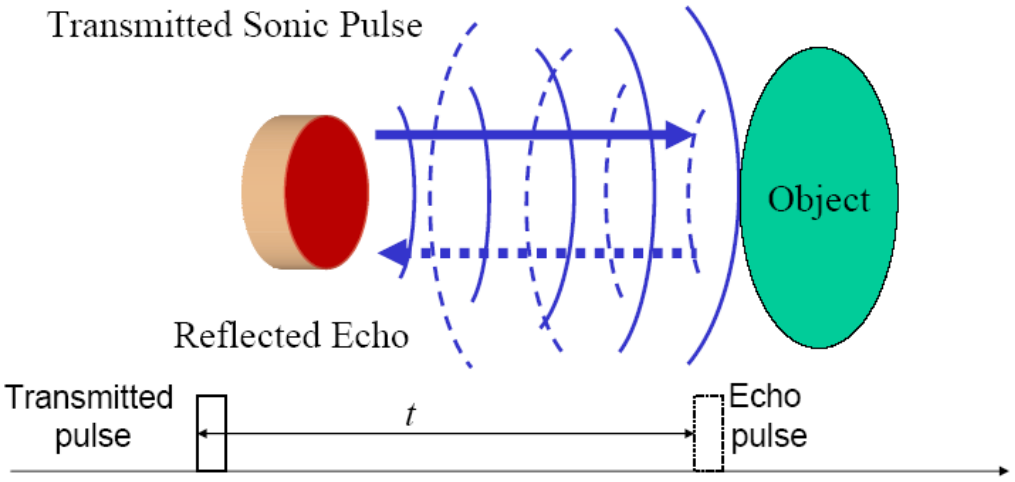
- In the case of contact transducers, the wear plate must be a durable and corrosion resistant material in order to withstand the wear caused by use on materials such as steel.

Proximity

ULTRASONIC PROXIMITY SENSOR

Principles of Operation

- Ultrasonic sensors detect objects by emitting bursts of high-frequency sound waves which reflect or echo from the target. These devices sense the distance to the target by measuring the time required for the echo to return.



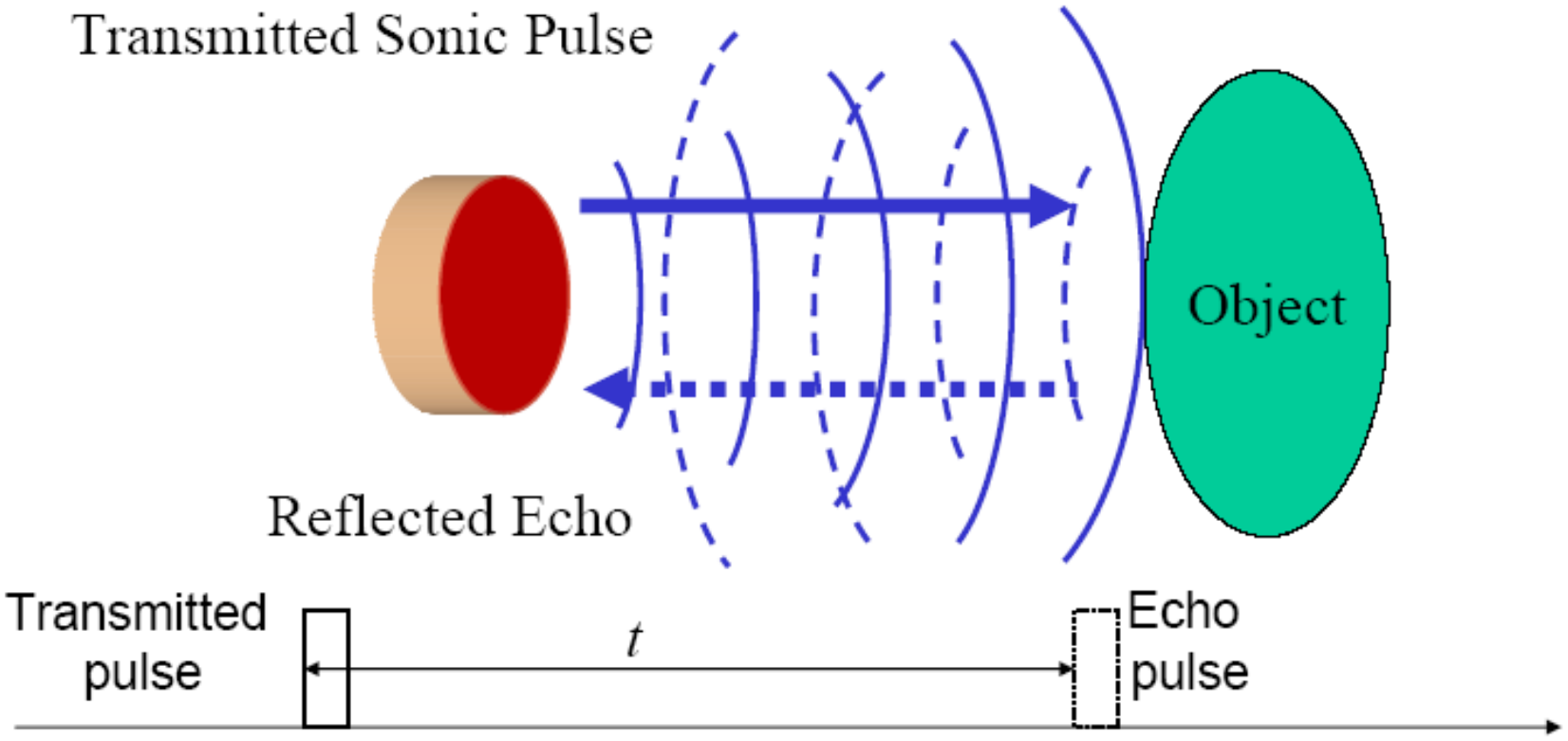
Measuring the distance ***d*** to an object by the time interval between the transmitted and reflected sonic pulses.

$2\,d = v\,t$

v = speed of sound, t= time interval

Proximity

ULTRASONIC PROXIMITY SENSOR



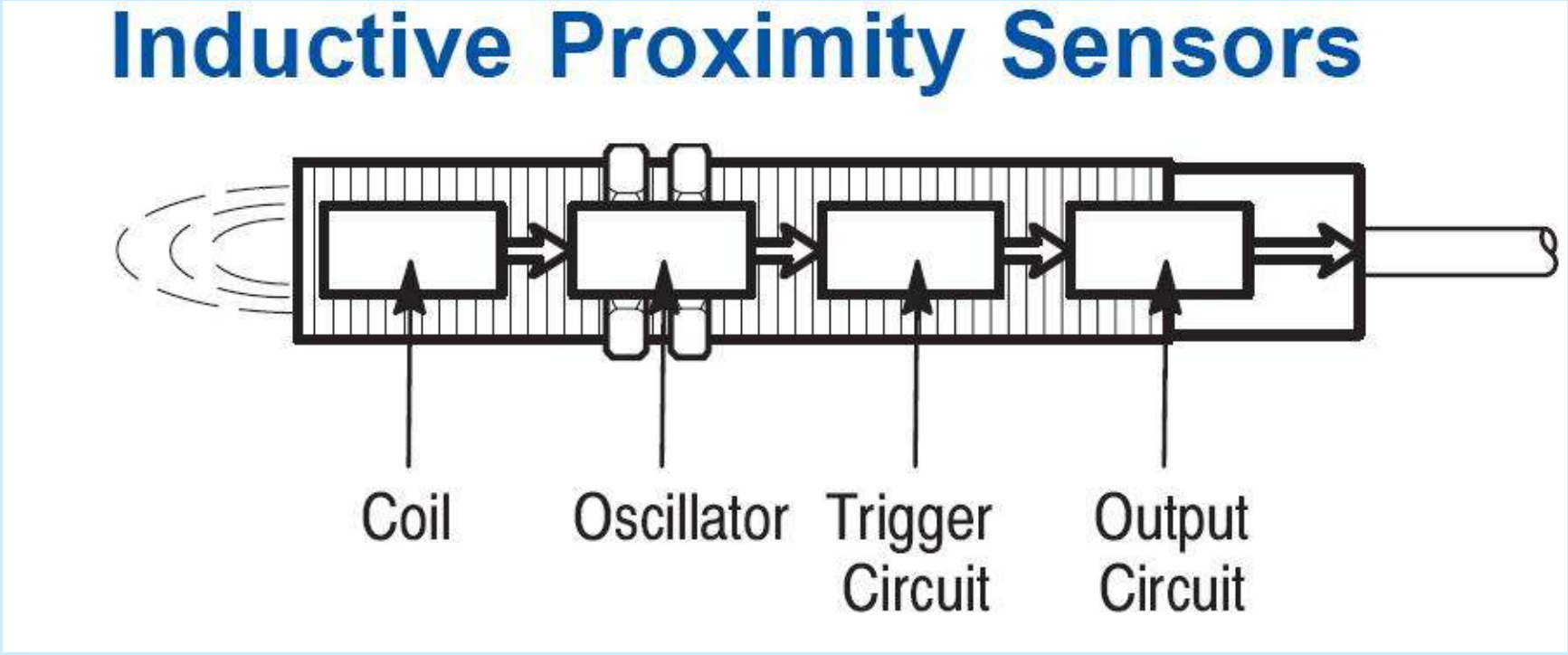
Measuring the distance ***d*** to an object by the time interval between the transmitted and reflected sonic pulses.

$$2\,d = v\,t$$

v = speed of sound, t= time interval

Proximity

- Electro-magnetic induction sensors are to sense metal objects, typically iron and steel.
- Coil inductance is greatly affected by the presence of ferromagnetic material.
- here the proximity of a ferromagnetic plate is determined by measuring the inductance of a coil.



Proximity

Principles of Operation for Inductive Proximity Sensors

- Inductive proximity sensors are designed to operate by generating an *electromagnetic field* and detecting the eddy current losses generated when ferrous and nonferrous metal target objects enter the field.

- The sensor consists of a coil on a ferrite core, an oscillator, a trigger-signal level detector and an output circuit.

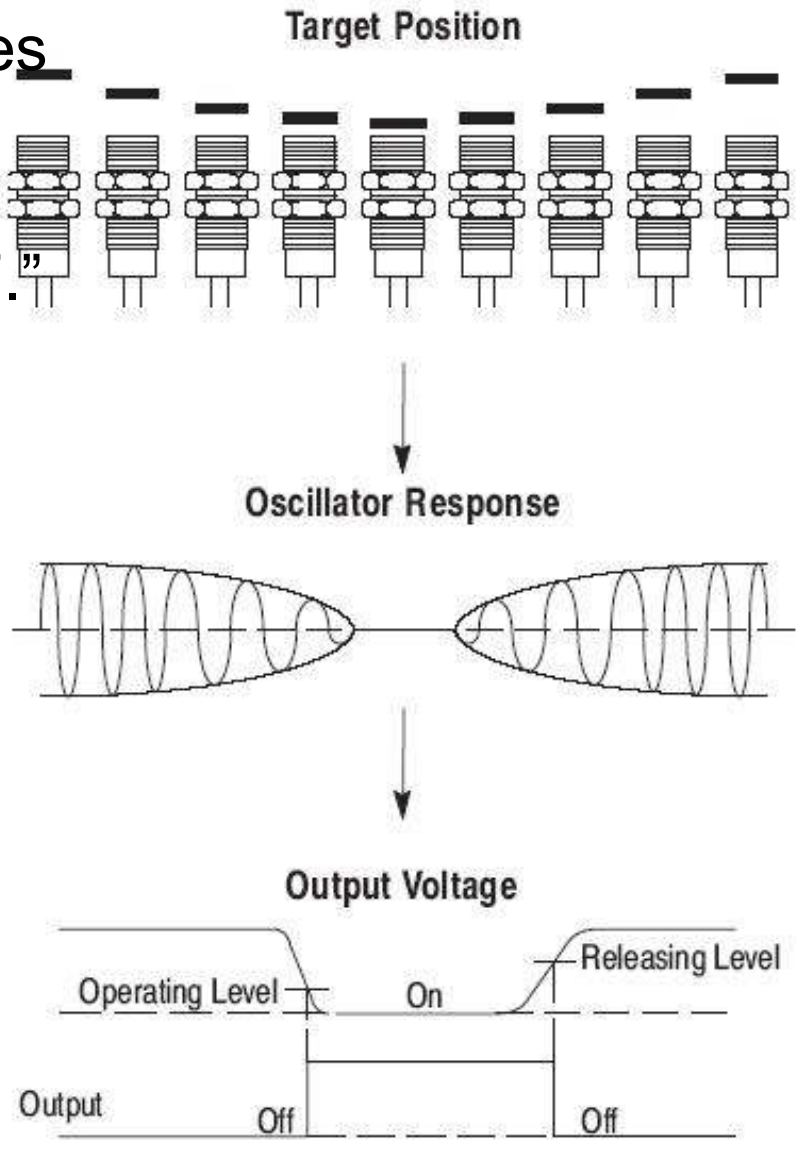
- As a metal object advances into the field, eddy currents are induced in the target. The result is a loss of energy and a smaller amplitude of oscillation.

Proximity

Principles of Operation for Inductive Proximity Sensors

- The detector circuit then recognizes a specific change in amplitude and generates a signal which will turn the solid-state output "ON" or "OFF."

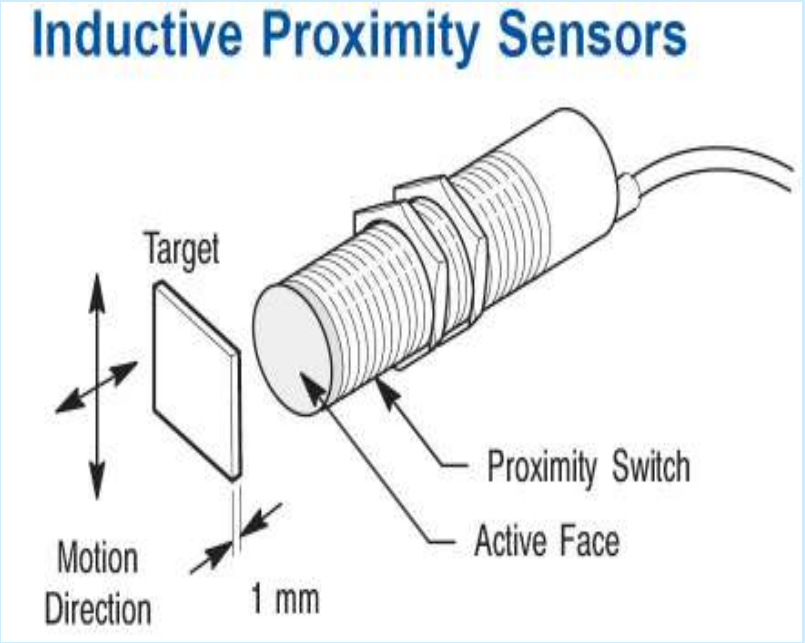
- *A metal target approaching an inductive proximity sensor absorbs energy generated by the oscillator. When the target is in close range, the energy drain stops the oscillator and changes the output state.*



Proximity

Standard Target for Inductive Proximity Sensors

- The active face of an inductive proximity switch is the surface where a high-frequency electro-magnetic field emerges.



Proximity

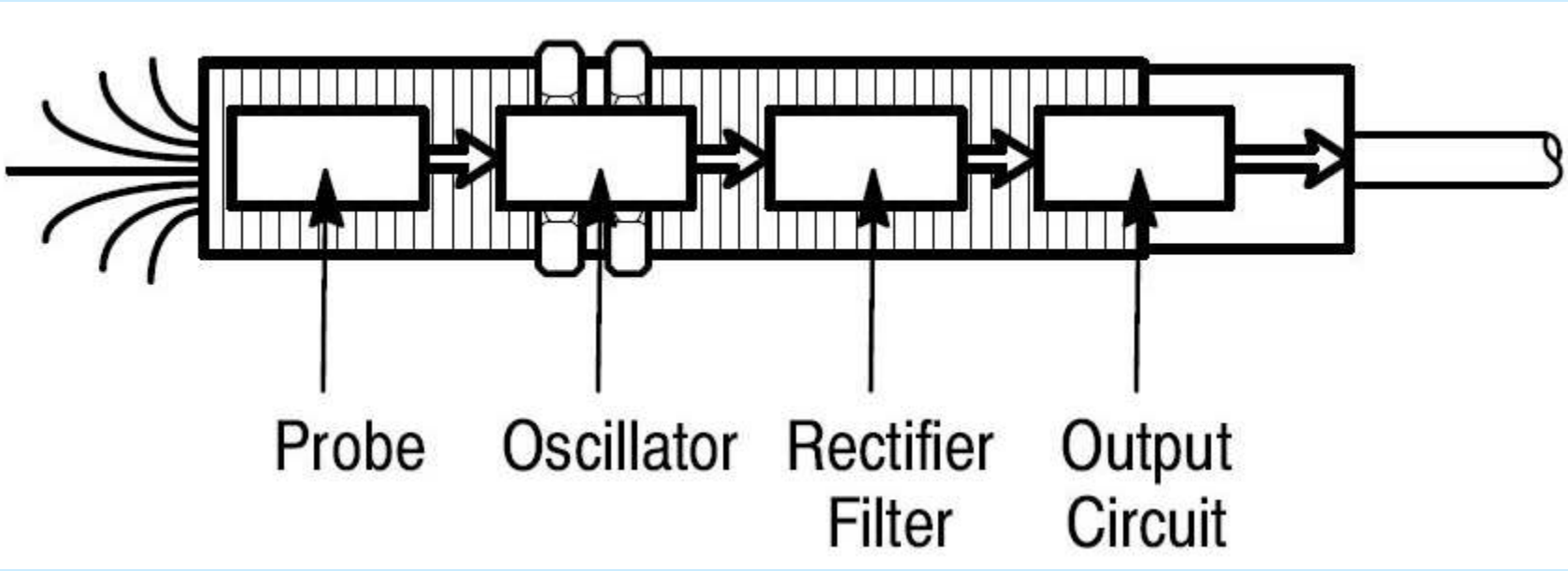
- Flat targets are preferable
- Rounded targets may reduce the sensing distance
- Nonferrous materials usually reduce the sensing distance for all-metal sensing models
- Targets smaller than the sensing face typically reduce the sensing distance
- Targets larger than the sensing face may increase the sensing distance
- Foils may increase the sensing distance.

Proximity

CAPACTIVE PROXIMITY SENSOR

Principles of *Operation*

- Capacitive proximity sensors are designed to operate by generating an *electrostatic field* and detecting changes in this field caused when a target approaches the sensing face.
- The sensor's internal workings consist of a capacitive probe, an oscillator, a signal rectifier, a filter circuit and an output circuit.



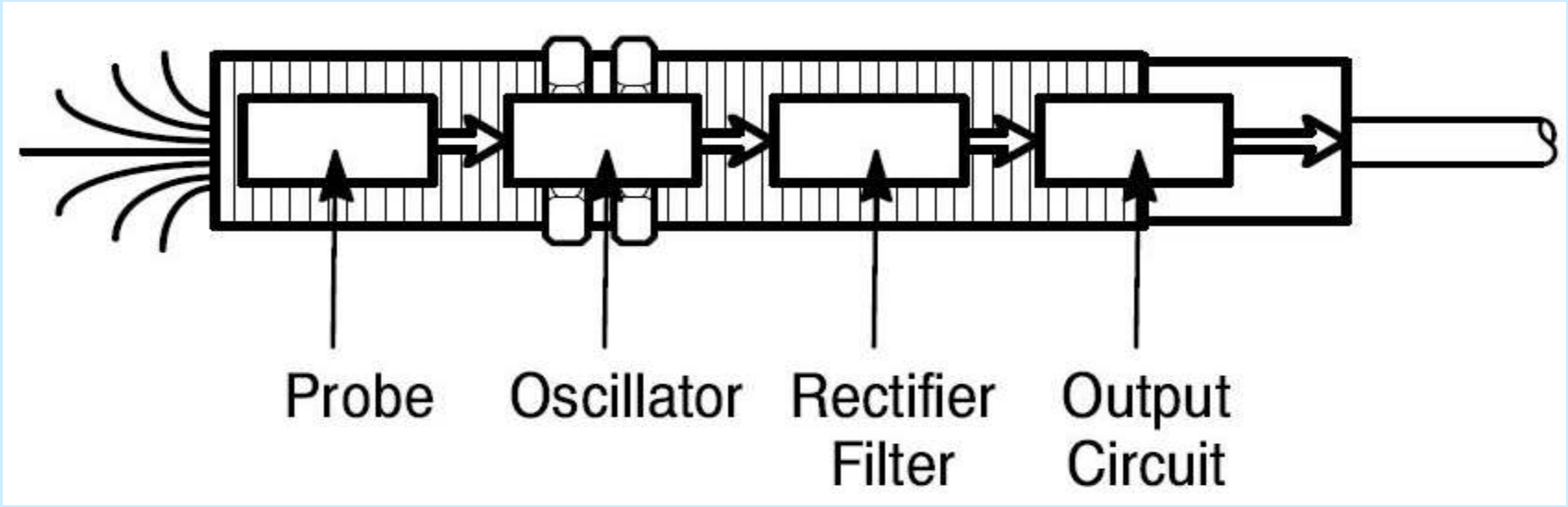
Types Sensor and Transducer

Proximity

Principles of Operation

• In the absence of a target, the oscillator is inactive. As a target approaches, it raises the capacitance of the probe system. When the capacitance reaches a specified threshold, the oscillator is activated which triggers the output circuit to change between “on” and “off.”

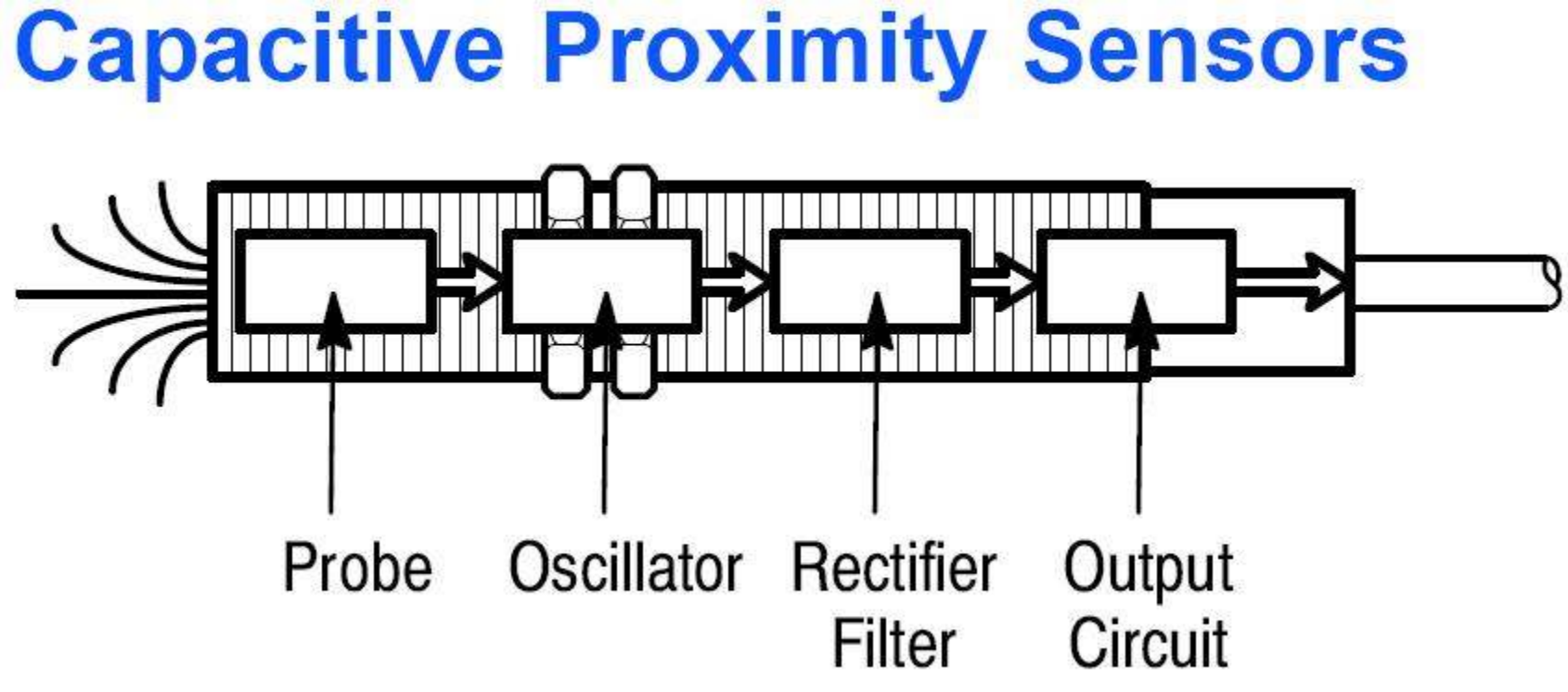
• The capacitance of the probe system is determined by the target’s size, dielectric constant and distance from the probe.



Proximity

Principles of Operation

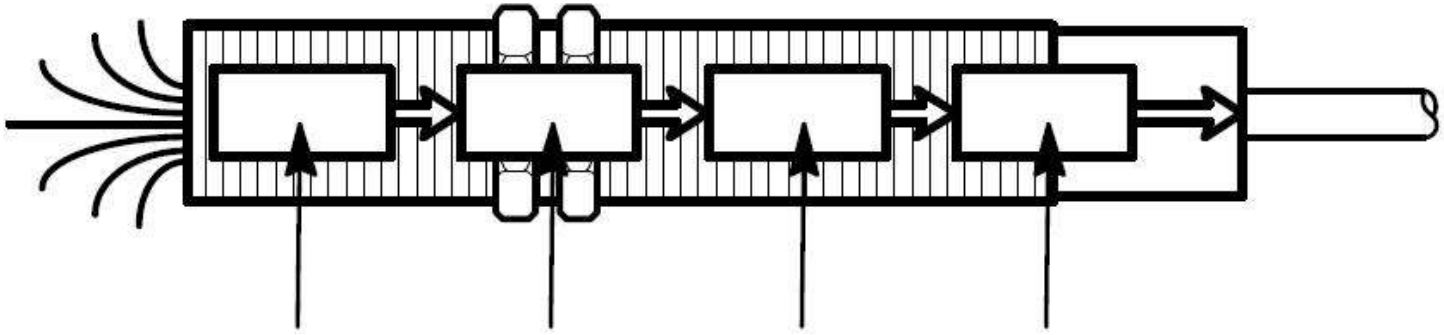
• The larger the size and dielectric constant of a target, the more it increases capacitance. The shorter the distance between target and probe, the more the target increases capacitance.



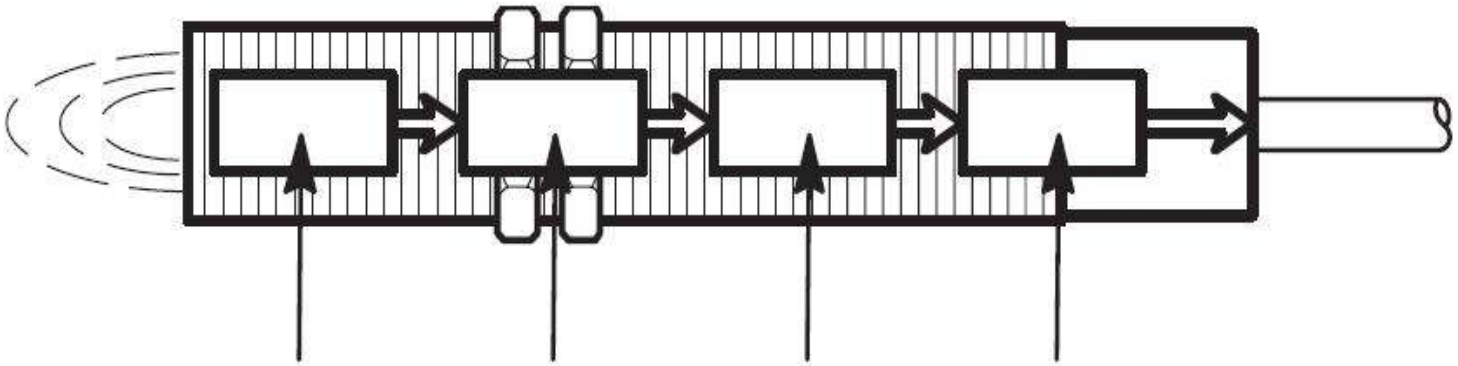
Types Sensor and Transducer

Proximity

Capacitive Proximity Sensors



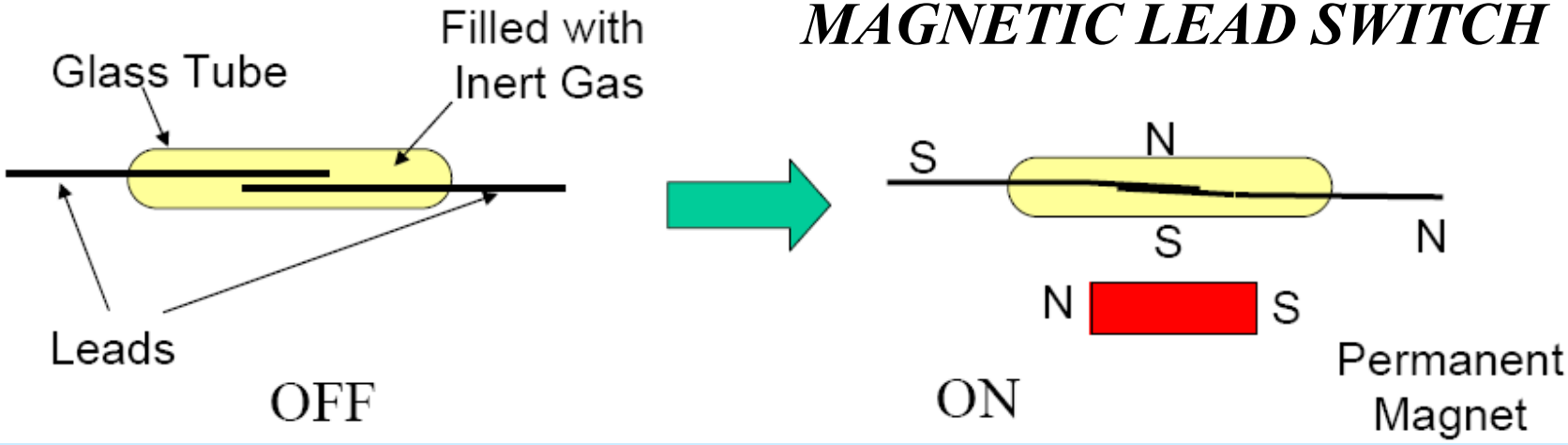
Inductive Proximity Sensors

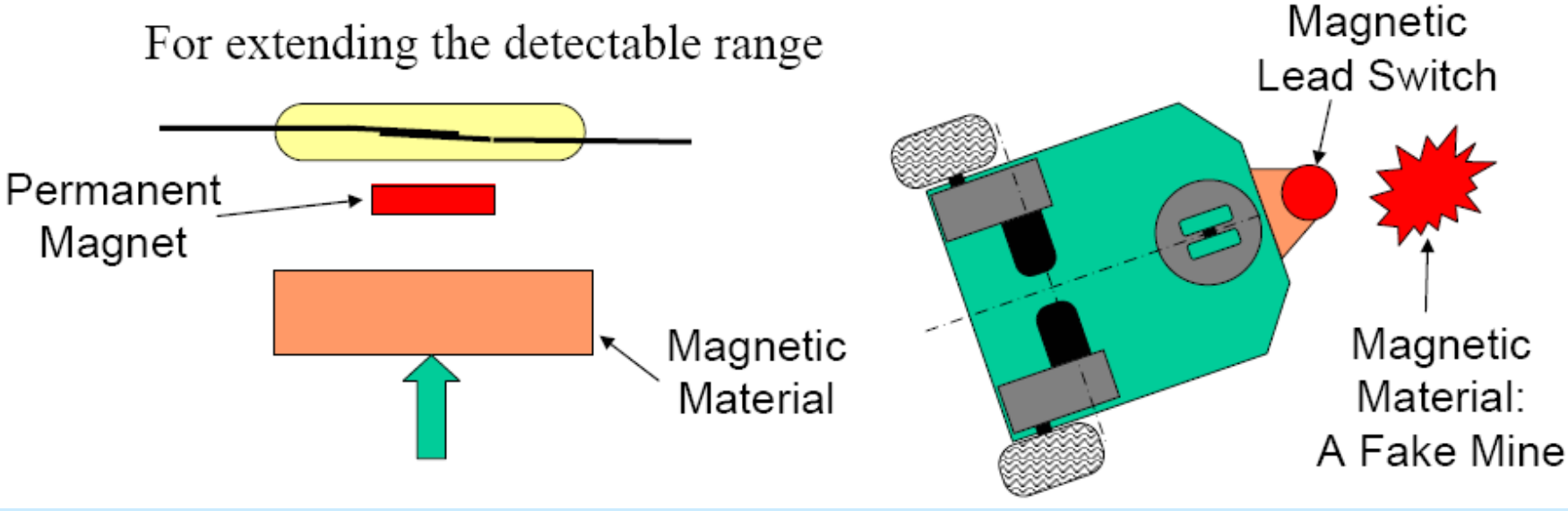


Types Sensor and Transducer

Proximity

MAGNETIC LEAD SWITCH



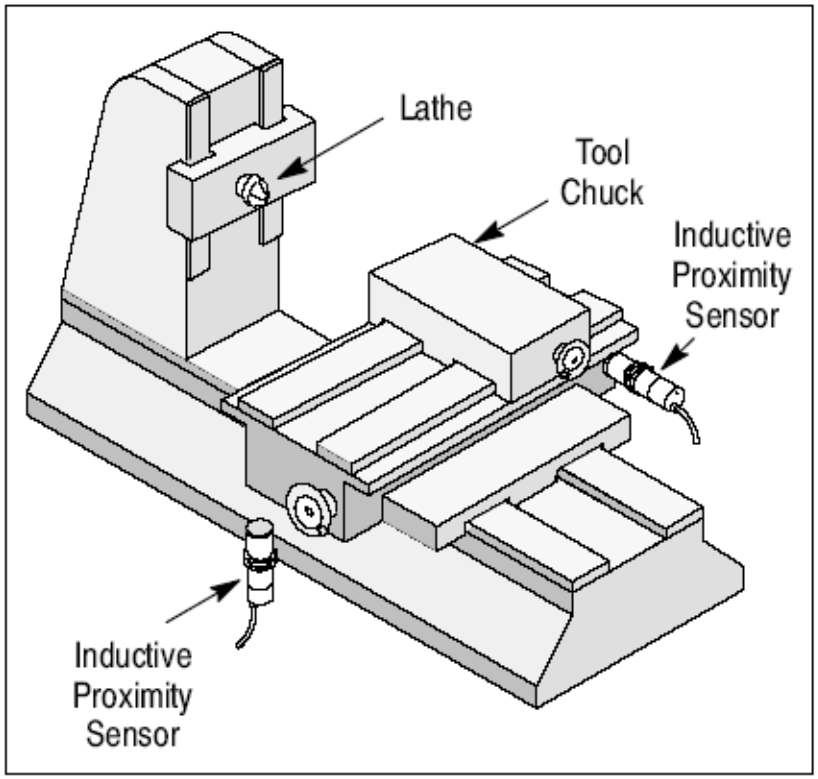


Types Sensor and Transducer

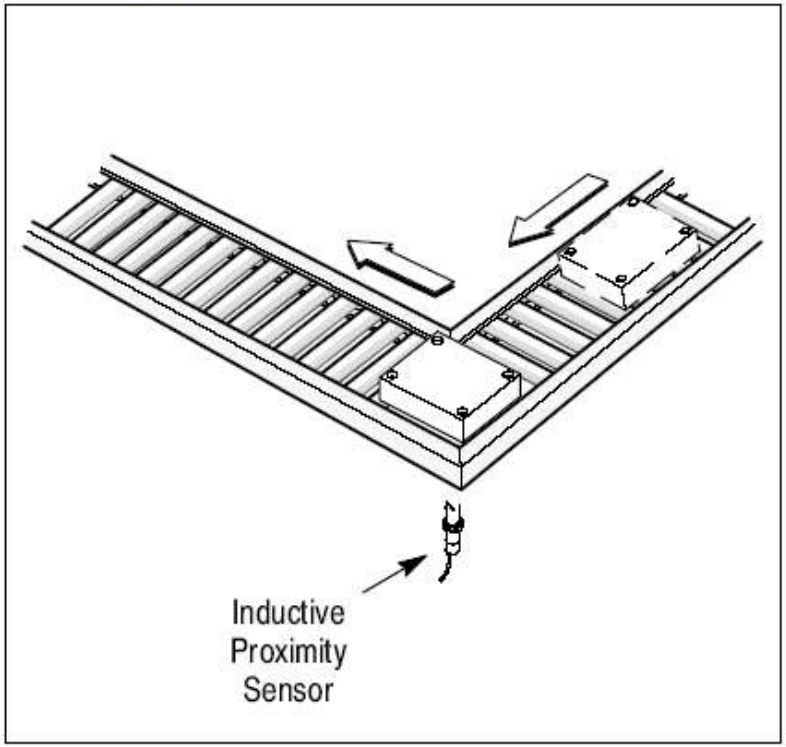
Proximity

Application

Machine Tools



Plating Line

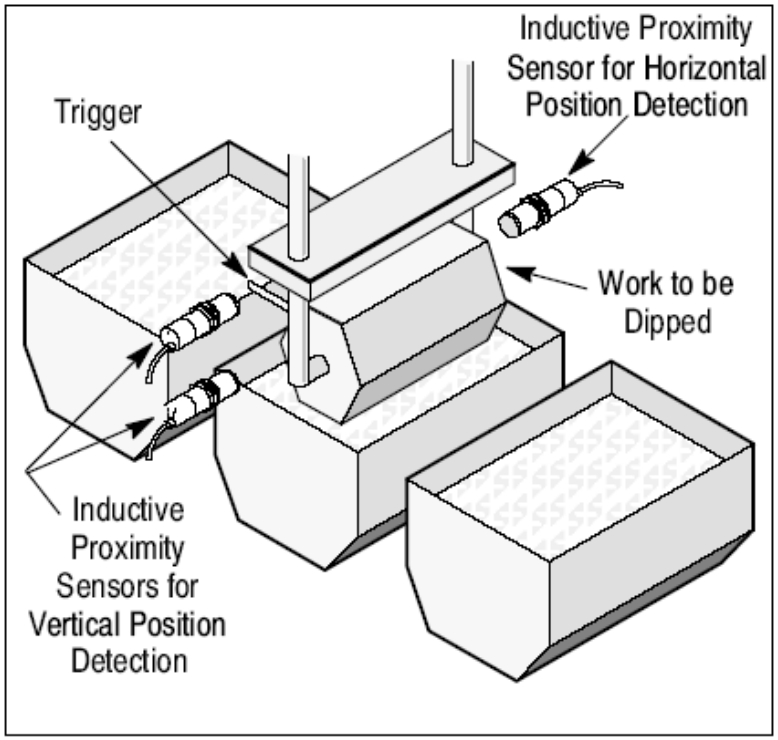


Types Sensor and Transducer

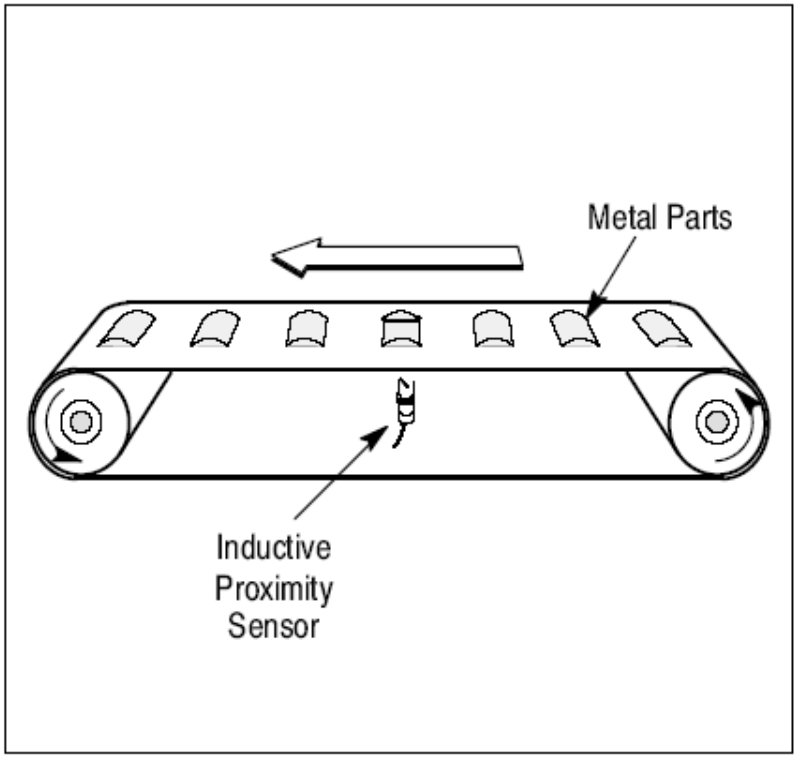
Proximity

Application

Plating Line



Conveyor Belts

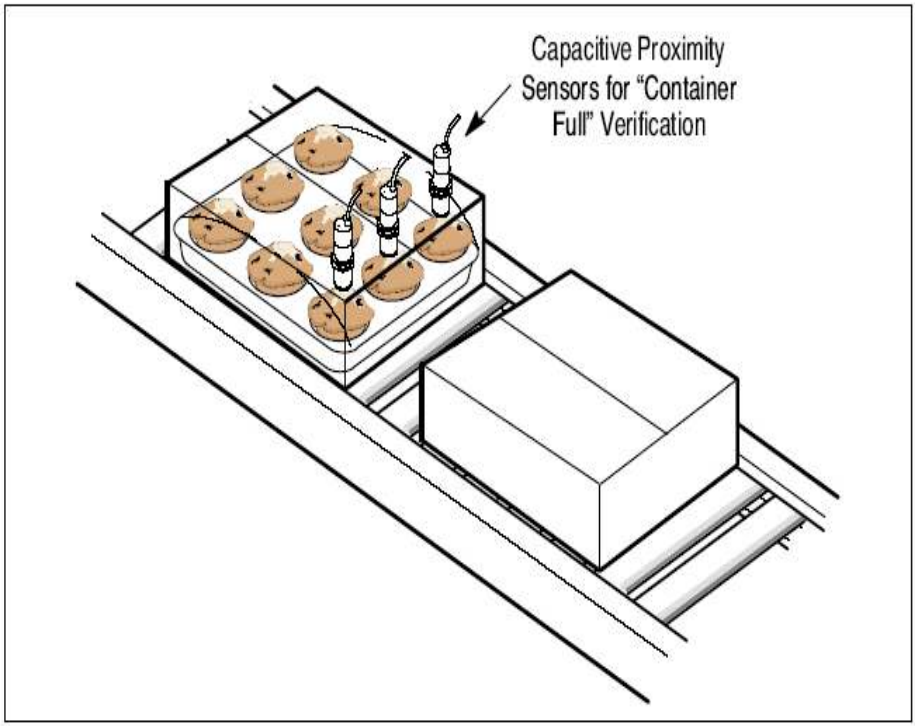


Types Sensor and Transducer

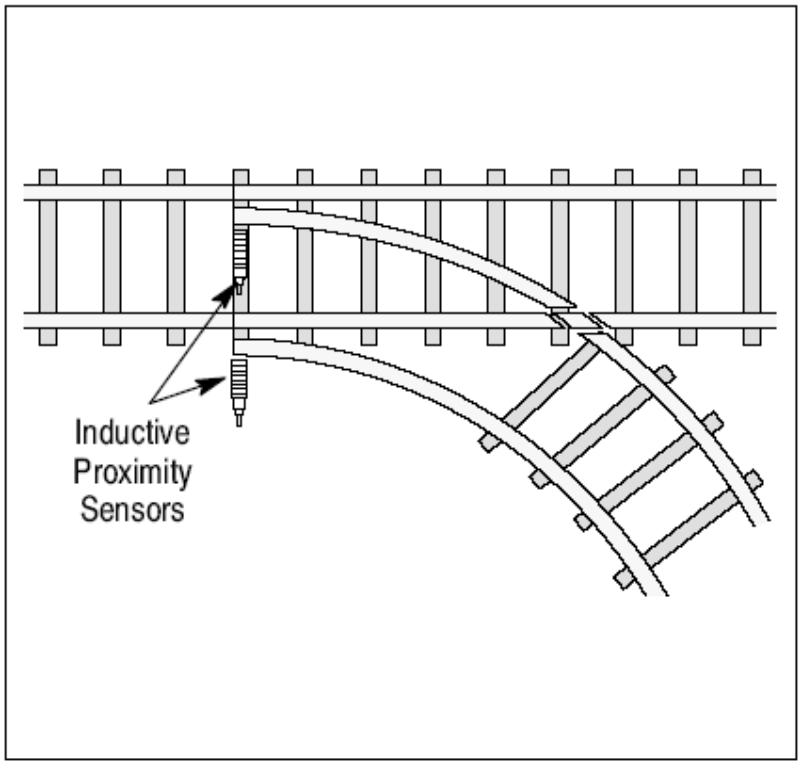
Proximity

Application

Food Processing



Railroad Yard Position Sensing

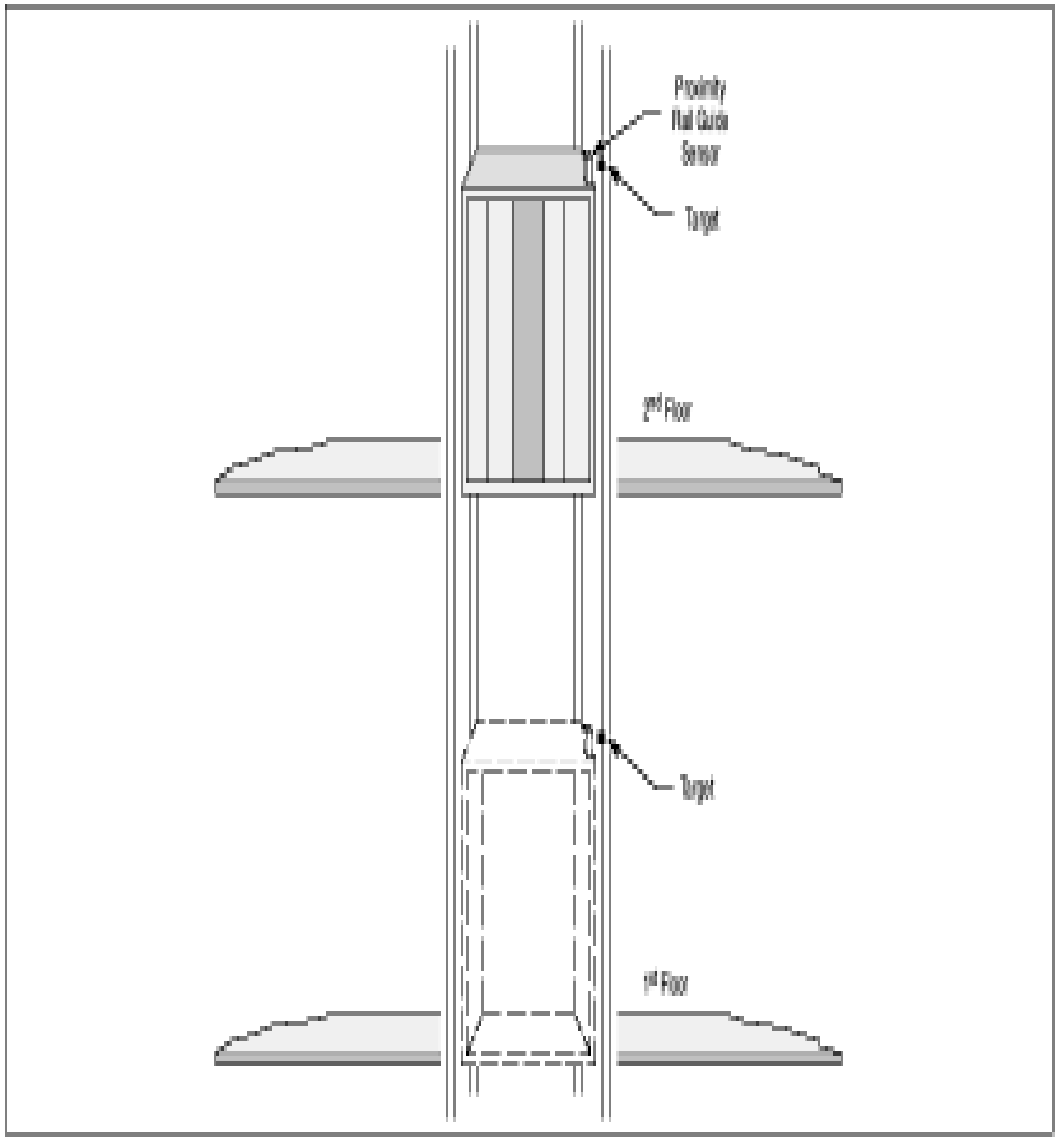


Types Sensor and Transducer

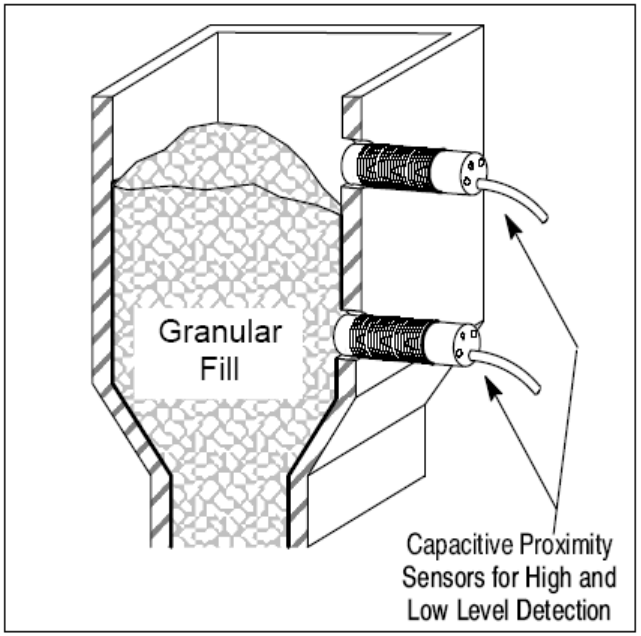
Proximity

Application

Elevator Positioning



Level Detection

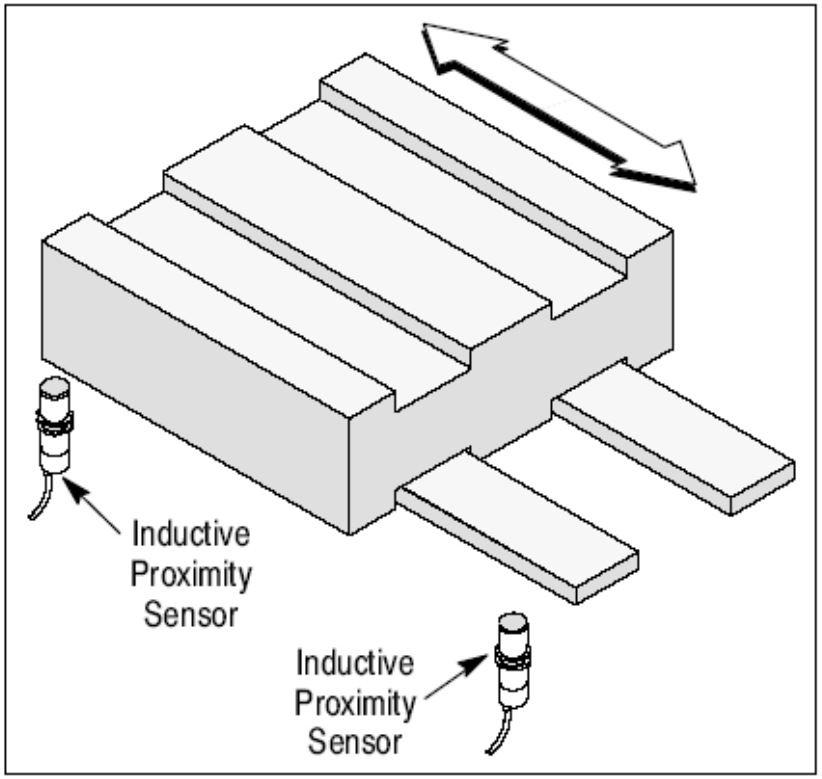


Types Sensor and Transducer

Proximity

Application

Grinding Machines



Wood Industry