Operating Principles

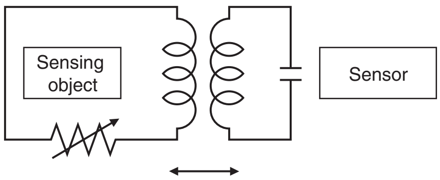
Detection Principle of Inductive Proximity Sensors

Inductive Proximity Sensors detect magnetic loss due to eddy currents that are generated on a conductive surface by an external magnetic field. An AC magnetic field is generated on the detection coil, and changes in the impedance due to eddy currents generated on a metallic object are detected.

Other methods include Aluminum-detecting Sensors, which detect the phase component of the frequency, and All-metal Sensors, which use a working coil to detect only the changed component of the impedance. There are also Pulse-response Sensors, which generate an eddy current in pulses and detect the time change in the eddy current with the voltage induced in the coil.

<Qualitative Explanation>

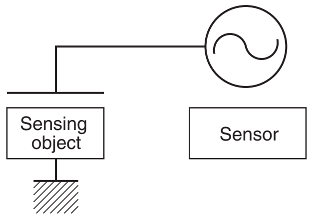
The sensing object and Sensor form what appears to be a transformer-like relationship.



The transformer-like coupling condition is replaced by impedance changes due to eddy-current losses.

The impedance changes can be viewed as changes in the resistance that is inserted in series with the sensing object. (This does not actually occur, but thinking of it this way makes it easier to understand qualitatively.)

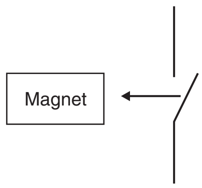
Detection Principle of Capacitive Proximity Sensors



Capacitive Proximity Sensors detect changes in the capacitance between the sensing object and the Sensor. The amount of capacitance varies depending on the size and distance of the sensing object. An ordinary Capacitive Proximity Sensor is similar to a capacitor with two parallel plates, where the capacity of the two plates is detected. One of the plates is the object being measured (with an imaginary ground), and the other is the Sensor's sensing surface. The changes in the capacity generated between these two poles are detected.

The objects that can be detected depend on their dielectric constant, but they include resin and water in addition to metals.

Detection Principle of Magnetic Proximity Sensors



The reed end of the switch is operated by a magnet. When the reed switch is turned ON, the Sensor is turned ON.

Classification

Selection by Detection Method

Items Requiring Confirmation	Inductive Proximity Sensors	Capacitive Proximity Sensors	Magnetic Proximity Sensors
Sensing object	Metallic objects (iron, aluminum, brass, copper, etc.)	Metallic objects, resins, liquids, powders, etc.	Magnets
Electrical noise	Affected by positional relationship of power lines and signal lines, grounding of cabinet, etc. CE Marking (EC Directive compliance) Sensor covering material (metal, resin). Easily affected by noise when the cable is long.		Almost no effect.
Power supply	DC, AC, AC/DC, DC with no polarity, etc. Connection method, power supply voltage.		
Current consumption	Depends on the power supply, i.e., DC 2-wire models, DC 3-wire models, AC, etc. DC 2-wire models are effective for suppressing current consumption.		
Sensing distance	The sensing distance must be selected by considering the effects of factors such as the temperature, the sensing object, surrounding objects, and the mounting distance between Sensors. Refer to the set distance in the catalog specifications to determine the proper distance. When high precision sensing is required, use a Separate Amplifier model.		
Ambient environment	Temperature or humidity, or existence of water, oils, chemicals etc. Confirm that the degree of protection matches the ambient environment.		
Physical vibration, shock	An extra margin must be provided in the sensing distance when selecting Sensors for use in environments subject to vibration and shock. To prevent Sensors from vibrating loose, refer to the catalog values for tightening torque during assembly.		
Assembly	Effects of tightening torque, Sensor size, number of wiring steps, cable length, distance between Sensors, surrounding objects. Check the effects of surrounding metallic and other objects, and the specifications for the mutual interference between Sensors.		