

Inductive Series • Capacitive Series • Photoelectric Series • Magnetic Effect Series

ISSC/Kanson Electronics offers sensors manufactured using the latest electronic technology to create the highest levels of reliability, repeatability, durability and miniaturization. The impermeable resin filled casing makes these sensors particularly suitable for operation in very harsh environments.

According to the operating principle, electronic proximity sensors can be divided into the following categories:

- inductive;
- capacitive;
- photoelectric;
- magnetic effect.

Another classification based on the output stage can be proposed:

- DC self-amplified ON-OFF;
- AC self-amplified ON-OFF;
- NAMUR non-amplified;
- analog with current output;
- analog with voltage output.

The ON-OFF models can have output polarity NPN or PNP and three different output functions: normally open (NO), normally closed

(NC) and complementary (Fig. 1).

Some models implement the output function programmability idea: based on how signal wires connect to the load, all four PNP, NPN, NC and NO output function combinations are available (Fig. 2). ISSC electronic sensors are tested for shock resistance according to the IEC 68.2.27 standard; vibration resistance testing according to the IEC 68.2.6 standard. The number of operations is virtually unlimited. The values reported by this catalog are measured in accordance with CENELEC EN 50010 standards at a 20°C temperature.

INDUCTIVE PROXIMITY SENSORS

Inductive proximity sensors are suitable for the detection of metallic elements.

The operating principle is based on a high frequency oscillator able to create an electromagnetic field in the close surroundings of the sensor. The presence of a metallic

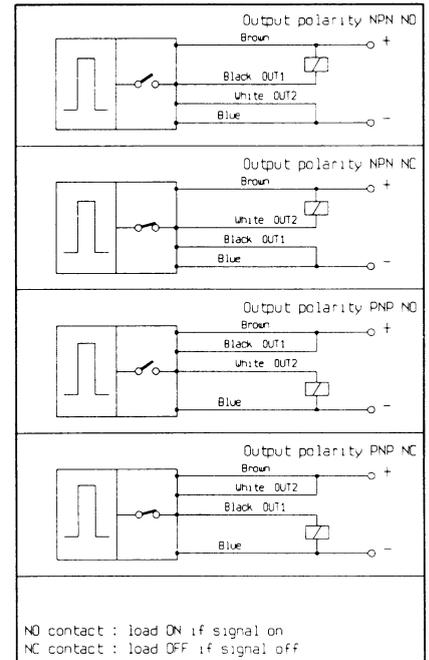


Fig. 2 - Output Function Programmability.

object (actuator) in the operating area causes a decrease of the oscillation amplitude. This happens when part of the electromagnetic energy that is transferred from the sensor to the actuator is dissipated by the effect of the Foucault Parasitic currents. The oscillation amplitude, therefore, decreases in accordance with the distance between the actuator and the sensor. This provides the sensor with analogic information about the object position (analog sensors) or can be turned, using a

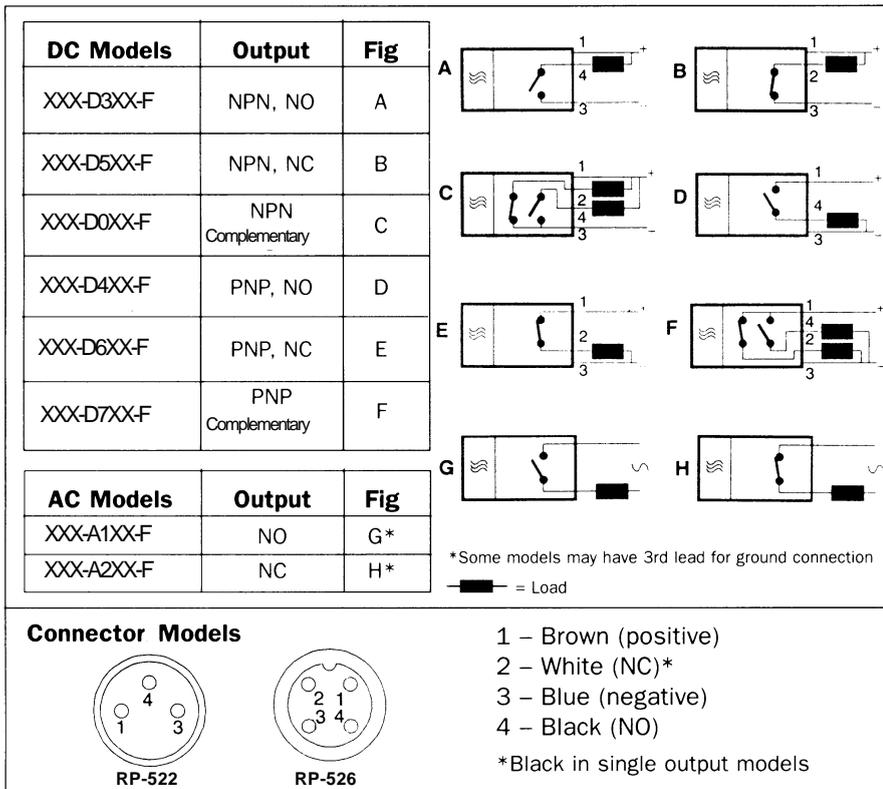


Fig. 3 - 12mm inductive sensor with integral connector

threshold circuit, into a digital signal (ON-OFF sensors).

The accuracy of the sensor depends on the actuator shape and size and is strictly linked to the nature of the metal (Fig. 5).

The cases of the inductive proximity sensors can be a metallic cylindrical, plastic or metallic rectangular, or plastic slot.

CAPACITIVE PROXIMITY SENSORS

Capacitive proximity sensors make use of the variation of the parasitic capacity that develops between the sensor and the object to be detected. When the object is at a pre-determined distance from the sensitive side of the sensor, an electronic circuit inside the sensor begins to oscillate. The rise or the fall of such oscillation is identified by a threshold detector that drives an amplifier for the operation of an

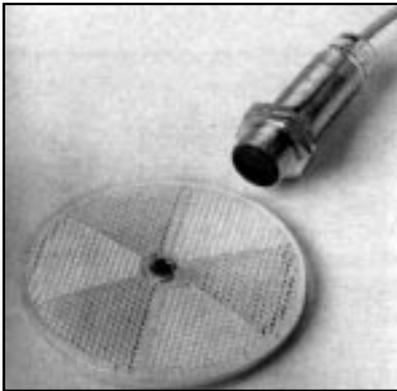


Fig. 4 - Photoelectric reflex sensor

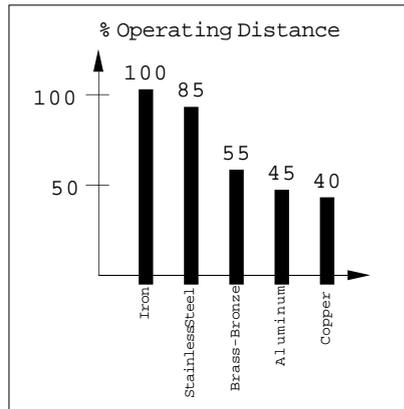


Fig. 5 - Sensitivity of an inductive sensor when different metals are used as the target.

external load.

A capacitive sensor can detect metallic and non-metallic objects (wood, plastic, liquid materials, etc.). The operating distance can be trimmed, making the sensor useful for each specific application. Capacitive proximity sensors are housed in smooth or threaded cylindrical metallic cases.

PHOTOELECTRIC PROXIMITY SENSORS

Photoelectric proximity sensors use physical properties of light-sensitive elements, changing their electrical features according to light intensity.

The light intensity variation striking the receiver depends upon the presence or absence of the object to detect. This creates an electrical signal that, properly elaborated, acti-

vates a final amplifying stage that is capable of driving an external load. In order to produce correct operation up to 2.000 LUX of ambient light and to obtain high operating distances with low energy consumption, the transmitted light beam used is a modulated infrared type.

The photoelectric sensors can be divided into the following types:

- Diffused sensors

Diffused sensors use the reflected light of the object for detection leading it to the receiver. Transmitter and receiver are housed in the same case together with the electronic control circuits.

- Reflex sensors

Reflex sensors (Fig. 4) base their operating principle on the fact that the target stops the light beam emitted from the transmitter which is then reflected, by a reflector, to the receiver. Transmitter and receiver are housed in the same case together with the electronic control circuits.

- Thru-beam sensors

As the reflex type, thru-beam sensors use the interruption, caused by the target of the beam emitted from the transmitter and normally directed to the receiver by an optical system. The thru-beam sensors use components in separate housings.

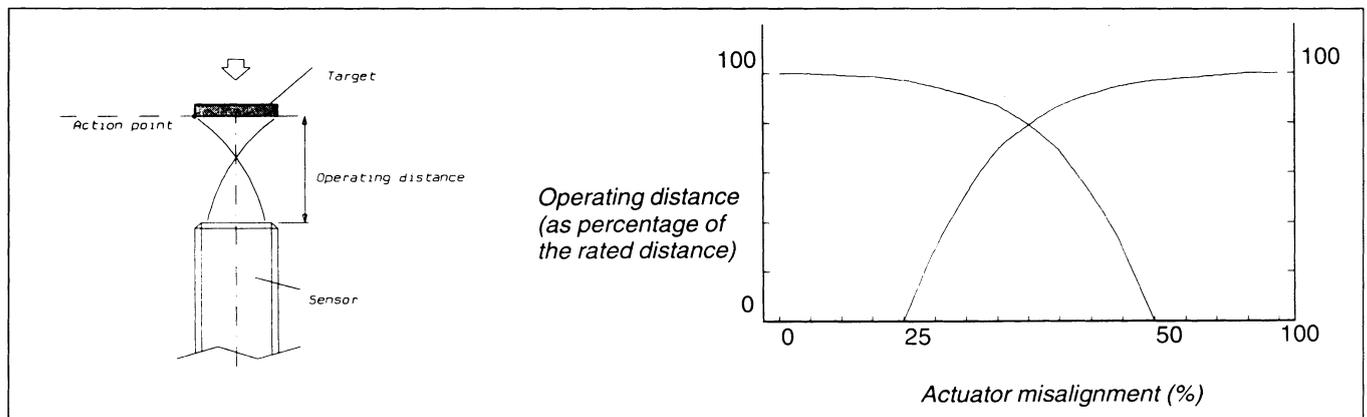


Fig. 6 - 8mm diameter "short series" inductive sensor: misalignment actuation curves

MAGNETIC EFFECT ELECTRONIC PROXIMITY SENSORS

The magnetic effect electronic sensors uses a physical property called Hall effect. When a thin sheet of a semiconductor material (Hall element) is placed in a magnetic field and a perpendicular current is passed through it, a voltage is generated between the opposite borders of the semiconductor sheet.

The sensor is housed in a three branch slot case. The Hall element with all the electronics is in one branch and a magnet is in another branch. The third slot contains a ferromagnetic vane (actuator) that blocks the influence of the magnetic field of the Hall element, determining an output change of the state.

The case for the magnetic effect electronic sensor is made of plastic and strengthened with glass fibers.

OPERATING FREQUENCY FOR INDUCTIVE & CAPACITIVE

According to CENELEC EN 50010, this parameter is measured by the dynamic method shown in fig. 7 with the sensor in position (a) and (b). S is the nominal operating distance. The frequency is given by the formula:

$$f = \frac{1}{t_1 + t_2} \quad (\text{see Fig. 10})$$

The maximum frequency is reached when t_1 or t_2 is 50 μsec long.

WORKING FREQUENCY FOR PHOTOELECTRIC SENSORS

The working frequency indicates the sensor switching frequency in time. The above parameter can be measured by using a wheel with alternating black and white sectors as a target (Fig. 9).

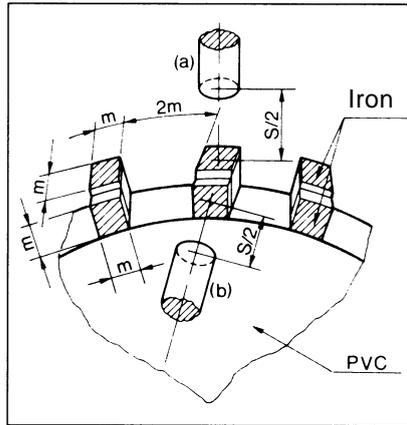


Fig. 7 - Measuring the operating frequency.

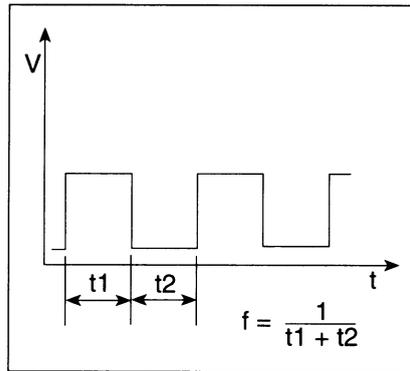


Fig. 8 - Sensor output signal.

MOUNTING

Totally shielded models can be embedded in metal for flush mounting. For side by side mounting, refer to Fig. 10a. Partially shielded models should be mounted as shown in Fig. 10b. For side by side mounting of partially shielded models, refer to Fig. 10c.

DEGREE OF PROTECTION

Enclosure degree of protection according to IEC (International Electrotechnical Commission) is as follows:

IP 65: Dust tight. Protection against water jets.

IP 67: Dust tight. Protection against the effects of immersion.

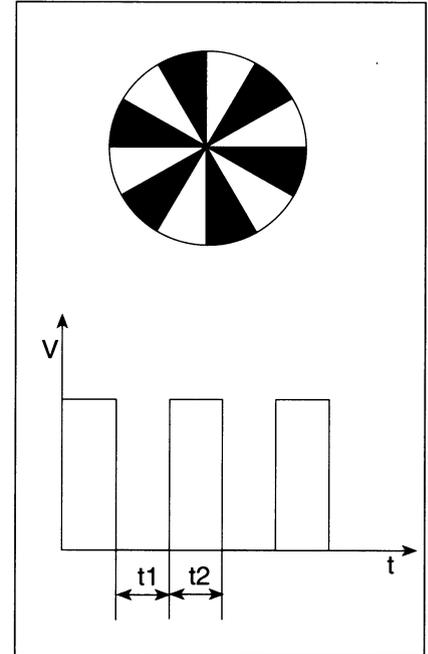


Fig. 9 - Operating frequency test.

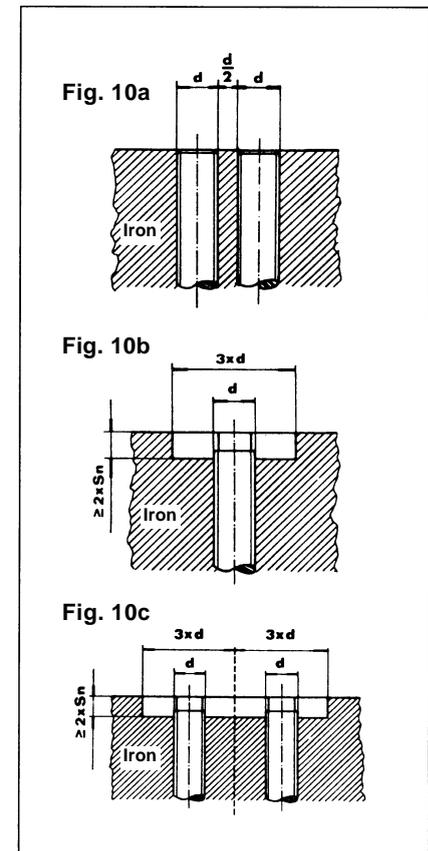


Fig. 10 - Mounting.

GENERAL SPECIFICATIONS				
Operating Features	Inductive	Capacitive	Photoelectric	Magnetic
Tolerance of operating distance	±10%	±15%	±10%	—
Hysteresis	≤10%	≤15%	—	—
Repeat Accuracy	≤10%	≤10%	±5%	—
Ripple(max)	10%	10%	10%	5%
Emitter average life	—	—	—	10 ⁵ hours

Hysteresis: The distance between the "switching on" point of the actuator approach and the "switching off" point of the actuator retreat. This distance reduces false triggering. Its value is given as a percent of the operating distance or a distance. See figure 11.

Repeat accuracy: The variation between any value of operating distance measured in an 8 hour period at a temperature between 15°C - 30°C and a supply voltage with a < 5% deviation.

Ripple (max.): This is the maximum ratio percentage between the residual AC voltage (ripple, peak to peak) on the DC supply voltage and the DC supply itself that the sensor will operate on.

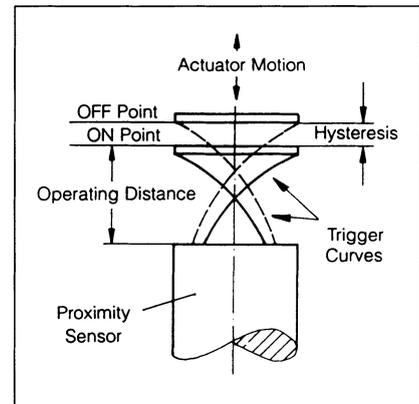


Fig. 11 - Examples of hysteresis.

Actuator - Object that causes the sensor to operate when detected.

Analog Output - A continuously variable output quantity that represents an input.

Capacitive Proximity Sensor - A device that detects the presence of metal and non-metal objects (wood, plastic, liquids, etc.) without physical contact.

CENELEC - European Committee for Electromechanical Standardization. Complementary Output - A sensor with two outputs, one output that is NO (normally open) and one output that is NC (normally closed). Similar to a SPDT (single pole double throw) switch.

Diffused Sensor - A photoelectric sensor that contains the transmitter and receiver in the same housing. It uses the light reflected back from an object for detection. Used for short sensing ranges.

Flush Mounting - Sensors that may be flush mounted in metal without being affected by surrounding metal and other sensors. Also known as shielded sensors. Sensors that may not be flush mounted have a larger electromagnetic field giving them a greater sensing distance for the same diameter, while making them sensitive to surrounding metals and other sensors. Also known as unshielded sensors.

Hysteresis - The distance between the switching "on" point of the actuator approach and the switching "off" point of the actuator retreat. Its value is usually given as a percent of operating distance or a distance.

IEC - The International Electrotechnical Commission which prepares safety and performance standards for electrical components.

Inductive Proximity Sensor - A device that detects the presence of a metal object without physical contact.

IP Rating - A rating system that defines the degree of protection provided by electrical enclosures according to IEC publications 144 and 529.

LED - Light Emitting Diode used to indicate output.

Linear Output - An analog output that is proportional to the input over a range.

Load - A device that current flows through and has a voltage drop across it.

Magnetic Effect Electronic Proximity Sensor - Sensor that detects ferromagnetic actuators without contact.

Magnetic Sensor - A device that is actuated by a magnet.

NAMUR Sensor - A non-amplified sensor that supplies two different signal levels depending upon switch state. Consists essentially of an oscillator and is used to obtain low level signals which are able to drive a separate amplifier. Required in installation where special safety measures are necessary (locations with fire or explosion hazard).

NC (Normally Closed) - A switch output that is closed allowing current flow when an actuator is not present and open allowing no current flow when an actuator is present.

NO (Normally Open) - A switch output that is open allowing no current to flow when an actuator is not present and closed allowing current flow when an actuator is present.

NPN Output - Transistor output that switches the common or negative voltage to the load. The load is connected between the positive supply and the output. Current flows from the load through the output to ground when switch output is on. Also known as current sinking.

Open Collector - Refers to both NPN and PNP transistor devices with

no components connected to the collector. When a load is connected to an open collector sensor it acts as a SPST (single pole single throw) switch.

Operating Distance - The distance from the sensor that an actuator of Iron (Fe 37) of a specific size can be detected. Distance will decrease for other materials. Tests are carried out according to CENELEC EN 50010.

Operating Frequency - The maximum number of on/off cycles that the device is capable of in one second.

Photoelectric Proximity Sensor - A device that uses the properties of light sensitive elements to detect objects.

PNP Output - Transistor output that switches the positive voltage to the load. The load is connected between output and common. Current flows from the device's output, through the load to ground when the switch output is on. Also known as current sourcing.

Power Drain - The amount of current required to operate a sensor.

Power Supply - The supply voltage range that sensor will operate at.

Proximity Sensor - A device that detects the presence of an object without physical contact.

Reflex Sensor - A sensor that contains the transmitter and receiver in the same housing. Detection is made when an object interrupts the light beam between the sensor and the reflector. Used for medium sensing ranges. Also known as a retroreflective sensor.

Repeat Accuracy - The variation between any value of operating distance measures in an 8 hour period at a constant temperature and voltage.

Reverse Polarity Protection - Protection against damage to a sensor if connected to a power supply with incorrect polarity.

Ripple - The ratio in percent between the residual AC voltage (ripple, peak to peak) on the DC voltage supply and the DC supply itself, that the sensor will operate on.

Self-Amplified Sensor - Sensor whose output is amplified to a usable level.

Short Circuit Protection - Protection against damage to a sensor if the load becomes shorted.

Switching Current - The amount of current allowed to flow through the sensor without causing damage to the sensor. It is given as a maximum value.

Triac Output - Output designed to control heavy AC inductive loads with high inrush and working currents (i.e., contactors, solenoids, valves, lamps). A built-in Triac controls the load.

Thrubeam - A photoelectric sensor that requires two units, a transmitter and a receiver. Detection is made when an object interrupts the light beam between the transmitter and receiver. Used for long sensing ranges.