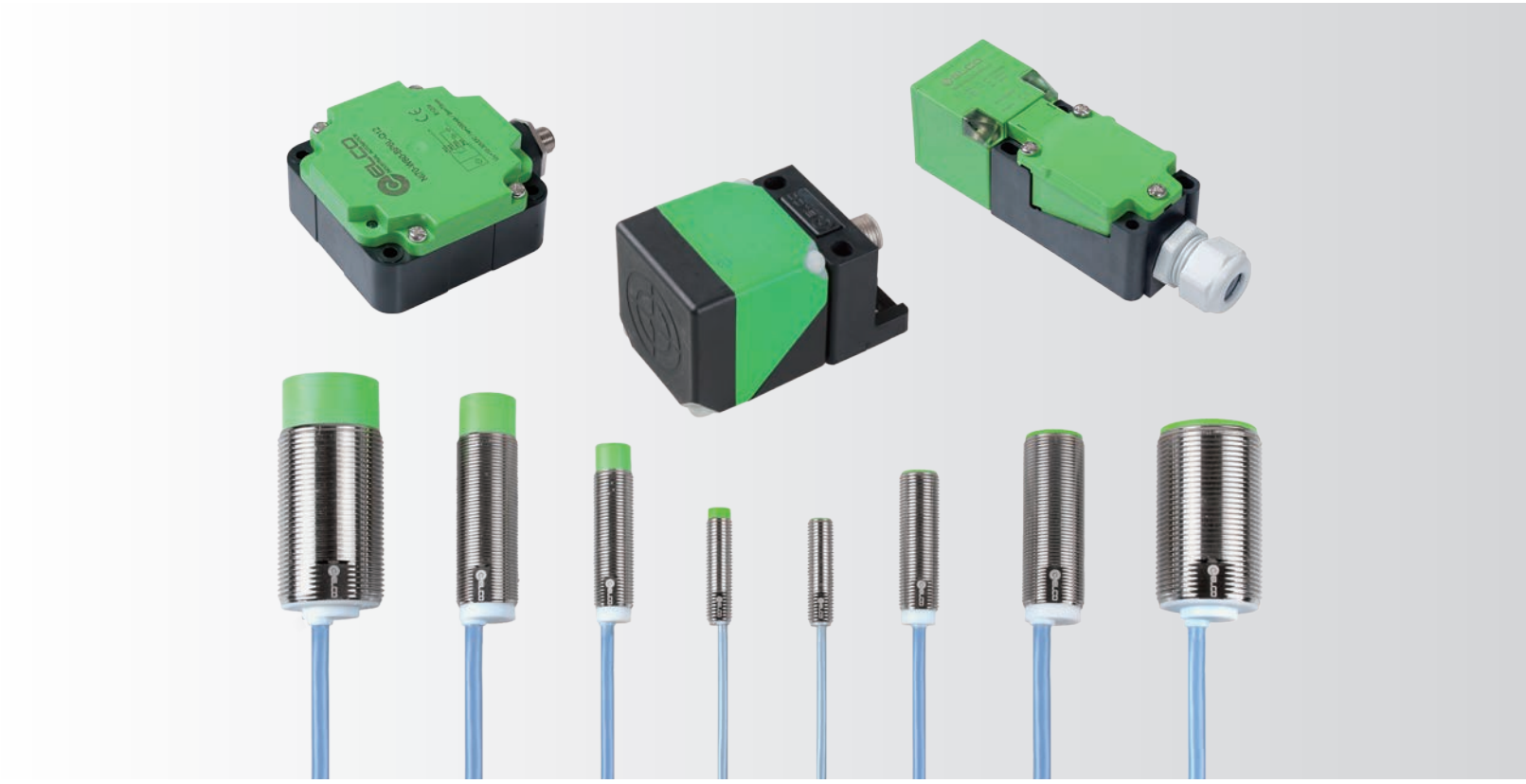
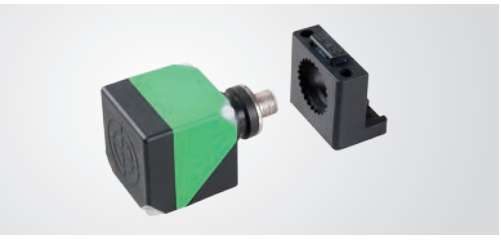
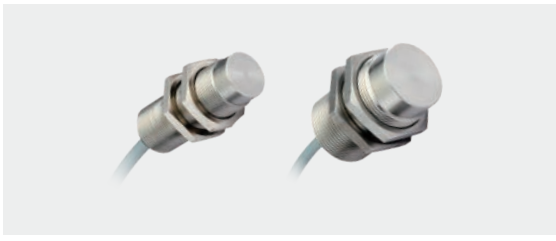
Inductive Sensors Introduction







V1.0

Inductive sensor

When the metal conductive objects close to the magnetic field and reach the induction area, high-frequency alternating magnetic field generated by a LC oscillation circuit, which is composed of a coil wound on a ferrite, through the eddy current effect generated by internal of metal objects to achieve non-contact detection.

Standards

All ELCO's inductive proximity sensors conform to IEC 60947-5-2.

Housing material

The housing material of sensor including nickel plated copper, also stainless steel and plastic with resistance of compression and temperature rapid change. Most of square sensor is plastic housing. Plastic can also be used to produce square sensors with adjustable sensing surface or compact (small square) sensors. Such sensors can be used in the occasions of limited installation space or required large detection range.

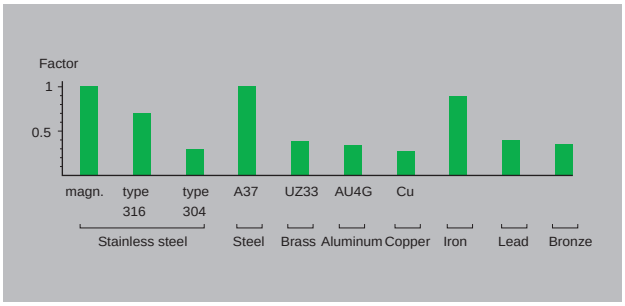
Application

Inductive proximity switch is a low cost method for non-contact detection of metal objects, which is widely used in the following sectors, such as:

- Automotive Industry
- Metallurgical sector
- Machine tool sector
- Robot industry
- Conveyor system
- Paper and printing industry
- Mechanical Engineering

Attenuation coefficient

When detect different materials with inductive sensors, there will be different detection distance even using the same product, please refer to following Figure.



Special inductive sensor

ELCO can provide special sensor for special environment to adapt to the field environment, avoid malfunction occurred and extend the service life.

General parameters

Shock resistance 30G, 11 ms

Anti-vibration 55 Hz, 1 mm

Voltage drop

- 2-wire non-polarity DC transistor output proximity switch ＜5V
- 2-wire polarity DC transistor output proximity switch ＜5V
- 2-wire AC / DC proximity switch ＜6V
- 3-wire DC transistor output proximity switch ＜1.8 V
- 4-wire DC transistor output proximity switch ＜1.8 V

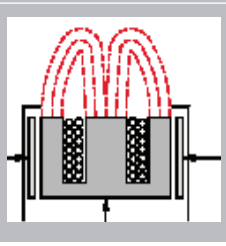
Fastening nut	M8	M12	M18	M30
Fastening torque Nm	Brass 2	Brass 10	Brass 20	Brass 40
		Plastic 1	Plastic 3	Plastic 5
	Stainless steel 5	Stainless steel 25	Stainless steel 50	Stainless steel 100

Flush mounting and non-flush mounting

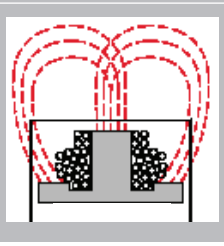
Flush mounting, the sensing surface and the base surface are flushed to protect the detection surface of sensor.

Non-flush mounting, the sensing surface is higher than the base surface. Generally, the non-flushing sensor has larger detection range.

Flush mounting



Non-flush mounting

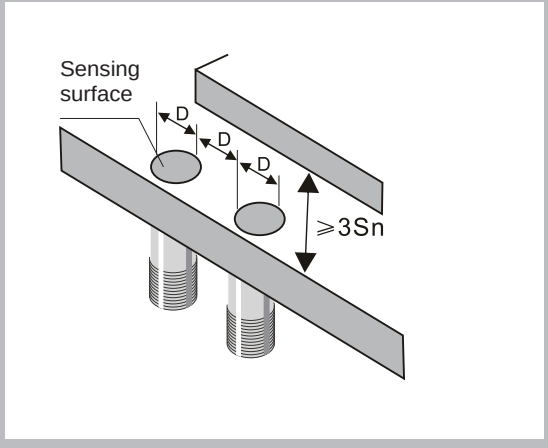


Installation space requirements

To avoid the interference of the surrounding metal objects or other sensors during installation, there shall have the minimum installation space.

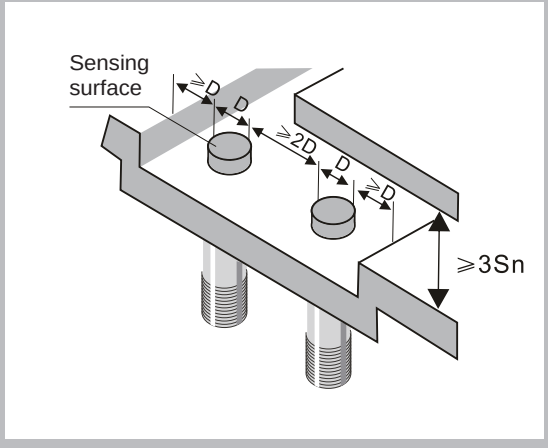
Flush

The sensing surface is flushed with the metal surface during installation. The distance from the sensing surface to detected metal object should be ≥3Sn. The distance between two adjacent switches must be ≥D.



Non-flush

Since there is no metal housing in the sensing surface, the mounting type can be identified through the sensor head. The distance from sensing surface to the metal mounting medium must be ≥2Sn. The distance from the sensing surface to detected metal object must be ≥3Sn. The distance between the two adjacent proximity switches must be ≥ 2D.



Resistance to electromagnetic interference

When the inductive load is disconnected, the output voltage rises to a very high value (without a protective element), at which point the output transistor will be destroyed. Therefore, the proximity switch is equipped with a Zener diode at the output, which can limit the disconnect voltage to a safe value (3-wire proximity switch).
When connecting inductive loads with current >100mA and switching voltage >10Hz, it is recommended to connect a continuous current diode directly between the loads (due to power loss in the built-in Zener diode).

Rf interference protection

The high frequency sensitivity is sufficiently reduced to comply with IEC 61000-4-3 Level 3 (test level 10 V/m).

Antistatic discharge

The structure of the device is such that electrostatic discharge according to IEC 61000-4-3 Level 3 (8kV) can damage the device.

Application Electromagnetic Compatibility (EMC)

All inductive proximity switches comply with EMC guidelines protection requirements of No.89/334/ECC. This can be confirmed by EN 60947-5-2 standard.
Individual tests apply the following EMC standards:
- EN 61000-6-2
- EN 61000-6-4
- EN 61000-3-2
- EN 61000-3-3

Protection level

Sensor housing protection against solids and liquids, IP
The INTERNATIONAL PROTECTION Class standard IEC 60529 is compiled by the IEC (INTERNATIONALELE CTR-Technical) COMMISSION) in order to classify electrical appliances and other equipment according to their dustproof and waterproof characteristics. IP protection level is composed of two numbers, the first mark number indicates the electrical dust, to prevent the level of foreign object intrusion, the second mark number indicates the degree of anti-electrical moisture and water intrusion. The greater the number indicates the higher the level of protection. (The foreign objects referred to here include tools, human fingers, etc., should not touch the live part of the electrical appliance to avoid electric shock).

IP65 Full contact protection under upright part pressure. Anti-dust and drench.
IP67 Full contact protection under pressure in the upright part.
IP68 Includes IP67 content
- 24 hours at +70℃
- 24 hours at -25℃
- 7 days under 1 meter of water, no seepage
- +70℃ to -25℃, every 10℃ for 1 hour

Reverse polarity protection

Short-circuit protection is applied to the sensor when the polarity reversal results in a short circuit (only relative to the sensor without reverse polarity protection).

Short circuit protection

Built-in standard short-circuit protection circuit to protect the temporary access current greater than the rated load current.

Power-on delay

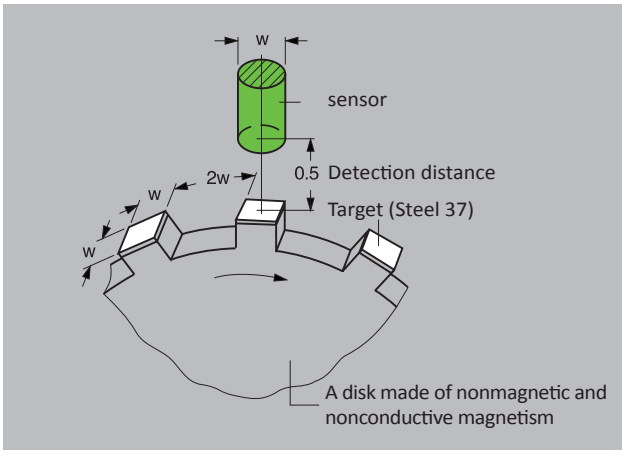
All have power-on delay function, so that the sensor can be switched on the instant circuit protection.

Standard test substance

Material: 37 steel
Thickness: 1mm
Dimensions: 3 times the rated working distance, and the diameter of the sensing surface, take the bigger value.

Switching frequency

The maximum number of switch changes per second measured by a standard dial



Operating voltage

The operating voltage specification shall include 10% ripple voltage.

Rated working distance Sn

The rated working distance is a general variable used to define the working distance. Scattering of the object under test and changes caused by external influences such as voltage or temperature (IEC) are not taken into account. The working distance is applicable when a standard target is used and measured according to IEC 60947-5-2. If the size of the material and/or target is different from the standard target, the reduction factor must be taken into account.

Actual working distance Sr

The operating distance of a proximity switch at a given temperature, voltage, and installation condition. This is the working distance of the proximity switch measured according to IEC60947-5-2.

Manufacturing tolerance is 10%:

0.9 Sn < Sr < 1.1 Sn

Usable working distance Su

The working distance (IEC) of a proximity switch measured under certain conditions. This includes additional expected deviations due to variations in temperature and operating voltage within specified ranges. The usable working distance is between 90% and 110% of the actual working distance. For a reliable design proximity switch:

0.81 Sn < Su < 1.21 Sn

Assured working distance (execution distance) Sa

The distance (IEC) from an effective surface to which proximity to the switch execution action is guaranteed under certain conditions. Ensure that the working distance is between zero and the lowest value of the available working distance: 0 < Sa < 0.81 Sn

Rated operating current Ie (Output current)

Proximity switches are designed to have a specific maximum output current. If this current is exceeded (even for a short time), the built-in overload protection function is activated. Bulb capacitors and other strong capacitive loads (such as long wires) have a similar effect to overload.

Hysteresis H

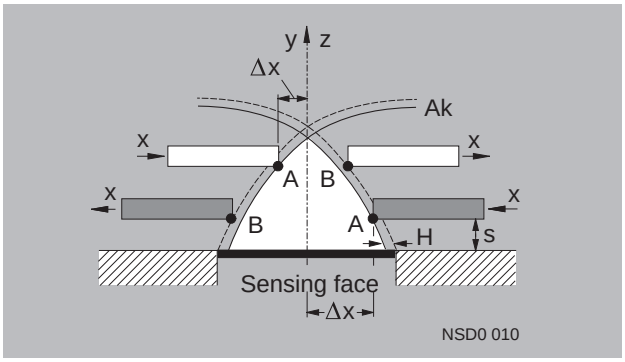
The hysteresis H is the distance between the standard metal target approaching the start point of the sensor and leaving the end point of the sensor.

Repetition accuracy R

Repetition accuracy refers to the change in the true working distance Sr (IEC) under certain conditions. The repetition accuracy was measured within 8 hours at 23 °C (±5 °C), within a specified range relative humidity and at a determined supply voltage. The difference between any two measured values should not exceed 10% of the actual working distance. Sr repetition accuracy is usually much better in cases where measurements are made one after the other.

Response curve

Curves for all response points A. The curve is determined using standard targets. The correlation characteristics of proximity switch can be obtained from this curve. The Z-axis of the switch is coincided with to the Y-axis.



Ak	Response characteristic	x	Direction of motion
A	Response point	△x	Trigger distance
B	Release point	y	Distance from proximity switch
H	Differential travel	Z	Reference axis
s	Working distance		

No-load current

Refers to the current required by the sensor itself, that is, when there is no load.

Operating current (continuous current)

Refers to the maximum load current in continuous operation.

Instantaneous current

It refers to the current that is allowed for a short period of time when the switch is closed without damaging the sensor.

Residual current

Refers to the current flowing through the load when the sensor is disconnected.

Voltage drop U

It refers to the voltage measured at the two ends of the sensor or the output end when the sensor is switched on.

Ripple voltage

Refers to the AC voltage superimposed on the operating voltage (peak-peak) is usually expressed as a percentage of the arithmetic mean.

Switching frequency

The maximum number of transformations from a attenuation state to an non-attenuation state, measured in Hertz (Hz).

Permissive interference voltage

A voltage spike acting on a power supply for a short period of time that can damage an unprotected sensor.
Turn-on delay refers to the time required when the power supply voltage of the proximity switch is connected until the proximity switch starts working.

False pulse suppression

When the operating voltage is added, the output of the error signal can be suppressed in the time stage of TV.

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