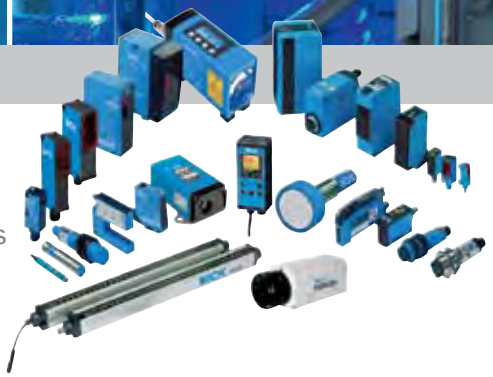
SICK Sensor Selection Tool



SICK has a wide range of photoelectric, electromagnetic and ultrasonic sensors available to solve demanding industrial applications. SICK also offers a complete line of rotary and linear encoders. This selection guide is used with the Industrial Sensors Catalog (part number: 7028071). These tools will enable users to select the appropriate sensor technology, and then narrow the search to a specific model number.

Key sensing technologies from SICK:

Photoelectric

- Standard photoelectric sensors are ideal for applications such as counting, ensuring parts presence, sorting, automatic routing and positioning.
- High-performance sensors measure from up to 1.1 km distance micron level thickness and identify registration marks without needing to use different contrast sensors for registration mark color changes. Moreover, SICK offers application-specific sensors such as vision, measuring light grids, luminescence and color sensors.

Electromagnetic

- Inductive sensors detect metals, enabling die protection on presses, counting, and positioning of a robot arm.
- Capacitive sensors detect non-metal objects. Applications include controlling the level of granules or verifying product reserve.
- Magnetic sensors detect magnetic objects. Eg: object detection through non-ferrous material such as plastic containers/pipes.
- Magnetic cylinder sensors detect piston position in pneumatic cylinders.

Ultrasonic

- Ultrasonic sensors can be used in applications such as fill level detection of silos/tanks, sag control and counting.

Angular, Positional, and Length Measurement

- Encoders provide angular, position and length feedback for servo drives and controls such as material handling (conveying and warehousing technology, stage construction, navigation), and in manufacturing (packaging machinery, machine tools, robots). The HIPERDRIVE® is an integrated drive system with absolute positioning suitable for all kinds of format adjustment in machines and installations.

Selecting a specific sensor is a 3-step process:

- Use the selection charts on pages 2-4 of this guide to determine the best sensing technology for a particular application.
- Refer to the recommended Selection Tables in the Industrial Sensors Catalog (part number: 7028071), found throughout the catalog on the pages listed*.
- Use the table to determine the best sensor type (or model), then refer to the corresponding catalog page to choose the exact sensor needed.

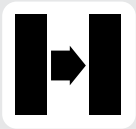
* You can also search and select sensor products from SICK at www.sickusa.com

SICK
Sensor Intelligence.

Photoelectric Sensor Selection Chart

Photoelectric sensors are used for a wide range of applications, including presence detection, positioning, sorting, routing, counting, etc. The function of a photoelectric sensor is detection through the transmission of light. This chart will help users select the best photoelectric sensor technology for an application.

PHOTOELECTRIC THROUGH-BEAM SENSOR
(sender+receiver)



Can you mount both the sender and receiver of the photoelectric sensor? ✓

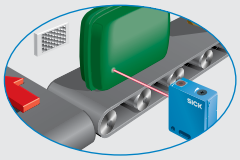
Is there dust, water vapor in the area that requires a strong stability in the environment? ✓

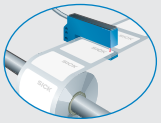
A photoelectric through-beam sensor consists of two devices: a light sender and light receiver. The sensor switches when an object blocks the light beam. The primary advantage of the through-beam is its long sensing range. Through-beam sensors are ideal for harsh application environments.

Trying to sense a label?

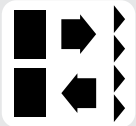
NO → Go to pages 324 and 325 of the SICK Industrial Sensors Catalog to select a through-beam sensor type for your application.

YES → Go to page 933 of the SICK Industrial Sensors Catalog to select a fork sensor for your application.



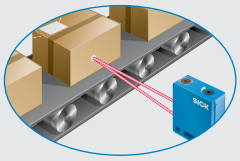


PHOTOELECTRIC REFLEX SENSOR
(sender+reflector)



Can you mount reflector? ✓

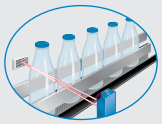
Reflex sensors or retro-reflective sensors contain both the sender and receiver in a single housing. However, you have to mount a reflector to return the light. The sensor only needs to be wired on one side, making the solution more cost effective. Reflex sensors feature a long sensing range although not as long as through-beam. Range is dependent on the type of reflector used in the system.



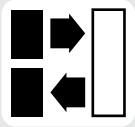
Is the target a clear material?

NO → Go to pages 322 and 323 of the SICK Industrial Sensors Catalog to select a standard reflex photoelectric sensor for your application.

YES → Go to pages 324 and 325 of the SICK Industrial Sensors Catalog to select a clear material sensor for your application.



PHOTOELECTRIC PROXIMITY SENSOR



Do you need direct detection of an object? ✓

Photoelectric proximity (diffuse mode) sensors contain both the sender and receiver in a single housing. The emitted light is reflected by the target object. Range is usually less than through-beam or reflex types.

Is there a background near the target?

NO → Go to pages 318 and 319 of the SICK Industrial Sensors Catalog to select an energetic proximity sensor for your application.

YES → Is the background material similar to your target?

YES → Go to pages 316 and 317 of the SICK Industrial Sensors Catalog to select a background suppression proximity sensor for your application.

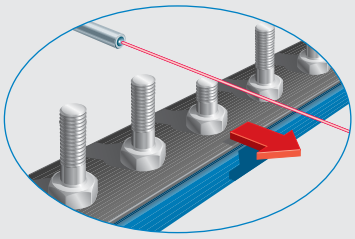
NO → Are you trying to detect a shiny object or a target with an irregular surface?

NO → Go to the High-Performance Sensor selection chart in this document

YES → Do you have consistent background?

NO → Go to the High-Performance Sensor selection chart in this document

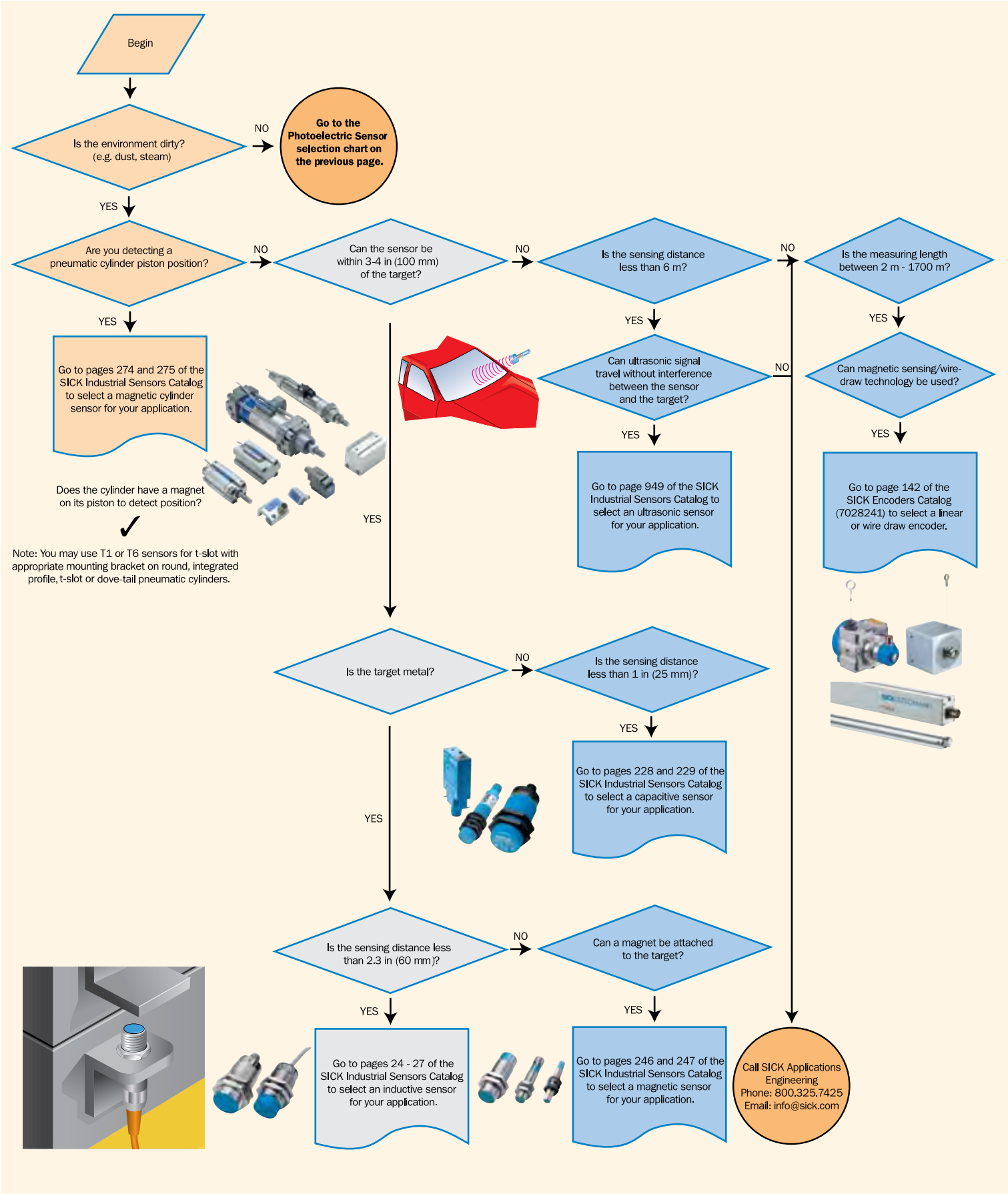
YES → Go to pages 320 and 321 of the SICK Industrial Sensors Catalog to select a foreground suppression proximity sensor for your application.



SICK also offers a wide range of fiber-optic sensors for proximity and through-beam applications.
Go to page 846 of the SICK Industrial Sensors Catalog for Selection Table.

Electromagnetic and Ultrasonic Sensor Technology Selection Chart

Electromagnetic sensors are used for sensing at shorter distances, when the environment is dirty.
Ultrasonic sensors are also used in dirty environments, but for longer ranges.
For distance measurement in dirty environments, linear/wire draw encoders can be used.



High Performance Sensor Technology Selection Chart

High performance sensors provide a diverse set of functions for many applications.
Use the descriptions below to identify the best SICK high performance sensor technology for your needs.

Distance measurement → Do you need distance measurement from x meters to y meters? →

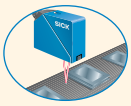
SICK's distance measurement sensors provide up to 1.1 km distance at +/- 10 mm resolution measurement. Distance measurement sensors provide accurate non-contact position information for numerous applications. Some of these applications include: ASRS, rail car positioning, roll diameter measurement, product displacement.

→ Go to page 1063 of the SICK Industrial Sensors Catalog to select a distance measurement sensor for your application.

Optical Displacement sensors → Do you need to measure minute variations, recesses or unevenness with high accuracy? →

The OD displacement sensors are a sensing and measuring system in one easy-to-use, easy-to-install, compact package. The intelligent micro-controller technology makes it possible to integrate both sensing and measuring functions into a single device. It can measure with ultra precision and reliably detect the presence of objects such as those found in the automotive, electronics, packaging, and robotics industries. OD sensors can detect a variety of distances with up to 1 micron meter accuracy.

→ Go to page 1043 of the SICK Industrial Sensors Catalog to select a displacement sensor for your application.



Conveyor Sensor → Do you need to control product flow on a conveyor? →

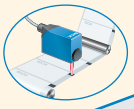
ZoneControl™ is the SICK offering of ZPA (zero pressure accumulation) control solutions. ***ZoneControl*** consists of integrated ZPA systems designed for accumulation conveyors and all the necessary peripherals and accessories to support the system. The ***ZoneControl*** family of products offers multiple ZPA solutions, all of which are similar in their function, but accommodate different types of conveyors by using a variety of mounting configurations. Often used for retrofit of mechanical limit switches that connect to existing pneumatics.

→ Go to page 904 of the SICK Industrial Sensors Catalog to select a roller conveyor sensor for your application.

Contrast sensor → Is there a contrast between the target and the background or are you trying to detect a registration mark? →

Contrast sensors can be used in a variety of applications, including positioning data processing forms, positioning labels, cans or tubes, and recognizing codes. The contrast sensor signals the machine control to cut, fold or fuse material, or to stop material feed. Contrast sensors detect registration marks by monitoring changes in the light reflected by the background and the mark. The mark is the symbol on the object that the contrast sensor must detect; the background is the area around the registration mark and must be in contrast to the mark. Web control is one application used in packaging machines. Fork sensors can be used for registration control as well.

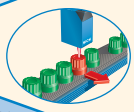
→ Go to page 970 of the SICK Industrial Sensors Catalog to select a contrast sensor for your application.



Color sensor → Do you need to verify the product is the correct color? →

The CSM1, CS81 and CS84 color sensors are compact and powerful for color detection of either opaque or transparent targets. Color sensors can be used for the automation of all industrial processes where color is a factor.

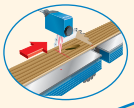
→ Go to page 971 of the SICK Industrial Sensors Catalog to select a color sensor for your application.



Luminescence sensor → Does the target or background have luminescence? Can you use flourecent additives as registration marks? →

If you are trying to sense an ultraviolet mark on an irregular background, such as grained wood, that can't be read reliably, then a luminescence sensor may help. The sensitivity of the device can be adjusted to the optimum setting for the fluorescent material. The background that the fluorescent material is applied to doesn't affect the level of detection reliability.

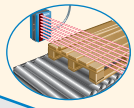
→ Go to page 971 of the SICK Industrial Sensors Catalog to select a luminescense sensor for your application.



Light grid → Do you need to detect presence or size of a wide variety of parts over a large window? →

The automation light grid sensors are specifically designed for use in parts ejection applications or any processes where product positioning variations occur. They can also be used to detect objects, determine the height or length of objects or detect irregularly shaped objects, or verify that manual operators have performed proper operations.

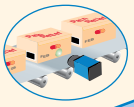
→ Go to page 1019 of the SICK Industrial Sensors Catalog to select an automation light grid sensor for your application.



Vision sensor → Do you need a vision sensor? →

The sensor compares the current image with the images it has been taught. When an image appears in the view finder, which coincides sufficiently with the taught information, the corresponding output is triggered. Some applications include: pattern matching, presence monitoring, shape verification, position and dimension verification, object detection, completeness verification, and date code detection.

→ Go to pages 1143-1145 of the SICK Industrial Sensors Catalog to select a vision sensor for your application.



Rotary encoders, linear encoders, and HIPERDRIVE® → Is this a motion control application? →

Displacement, position, angle - in industrial automation where positions have to be precisely determined, you can use an encoder. The same applies when determining speed and acceleration. Encoders can have a resolution of micrometers or few thousandths of a degree. Compared to incremental encoders, absolute encoders have one decisive advantage - they do not need an initializing reference. Generally, robotics and positioning applications require an absolute encoder and machine tool and packaging applications, such as speed control, require an incremental encoder. The HIPERDRIVE integrated positioning drive represents the optimum alternative to manual change-overs, particularly in those machines with several adjustment axes.

→ Choose an encoder from the SICK Encoder Catalog (7028241) or SICK web site: www.sickusa.com

Sensor Technology Definitions

Standard Photoelectric Sensor Technology Definitions

Background suppression is accomplished by means of light triangulation in which a focal distance is defined by mechanical or electronic adjustment of the sensor. Devices with background suppression suppress events occurring outside the active sensing range.

Background rejection is an ultra-precise form of background suppression. Background rejection sensors can detect the slightest difference from the object to the background.

Clear material sensors require only a small change in received light for the sensor to trigger. The design of the device has a stabilized and constant light output and a stabilized receiving and switching threshold element. In addition to clear objects, this type of device can be used to detect small objects, including objects smaller than the effective light beam.

Divergent proximity (diffuse) sensors send light out in a broad beam with a negative focal point. As a result, the light spot gets large very fast. Divergent sensors can see many objects in a broad area, but they have a very short range.

Energetic proximity (diffuse) sensors send light out in an infinite focus concentrated beam. Energetic type sensors typically have a longer range and a medium sized light spot. It has to be pointed directly at the target object. Sensing range/switching point can be set by adjusting the sensitivity. The sensors are ideal for detecting a light object in front of a dark background. All sensing distance specifications for diffused mode are based on a target with a 90% reflectivity such as white paper. If the reflectivity of the target is significantly less, then the sensing distance will be reduced.

Fiber-optic units are different in the way they handle light. The light exits the tip of the sender fiber cable, enters the tip of the receiver fiber and goes back into the sensor. Fiber-optics can fit into an extremely small area and detect small objects. Some are temperature tolerant up to 600° F. Glass or plastic fibers are available.

Fixed focus, triangulation type photoelectric devices have optics set for specific angles. Fixed focus is a type of limited background suppression. The area where detection of an object can take place is where the angle of acceptance and the angle of divergence cross.

Foreground suppression targets with shiny or irregular surfaces reflect light in many directions, causing false readings. Foreground suppression sensors solve this problem because they do not detect the object directly, but detect the presence of the object by the lack of light being reflected by the background. The background is used as a reflector by the sensor and anything that passes between the sensor and the background is detected.

Reflex sensors or retro-reflective sensors contain both the sender and receiver in a single housing. Light is returned by a reflector. Since only the sensor needs to be wired, this type of sensor is much more cost-effective than a through-beam sensor. Reflex sensors feature a long sensing range, which is dependent on the type of reflector used in the system.

Fork or slot sensors contain both the sender and receiver in a single housing. Slot sensors excel in applications in the printing and paper industries. Slot sensors are also ideal for label detection because they can sense labels on backing. Applications include: label detection, printing and paper industries.

A photoelectric through-beam sensor consists of two devices: a light sender and a light receiver. The sensor switches when an object passes through the light beam. The primary advantage of the through-beam sensor is its long sensing range and precise triggering. Because of their high resource power, through-beam sensors are ideal for harsh application environments.

V-Type proximity (convergent proximity, diffuse) optics produce a small light spot at a defined distance. This results in the ability to detect small objects with repeatable switch points, albeit at a shorter range than energetic types.

Advanced Photoelectric Sensor Technology Definitions

Color sensors are small, compact and powerful for color detection of either opaque or transparent targets. Consequently, they can be used for the automation of all industrial processes where color is a factor, such as sorting colored products.

Contrast sensors provide high speed, reliable registration in one sensor. Up to three LEDs select the best light source to detect the contrast. Contrast sensors recognize colors as grayscale values. At a constant sensing range, up to 30 gray tones on a scale ranging from black to white can be distinguished.

Roller conveyor sensors are specifically designed for accumulation and loading and unloading applications on roller conveyors. These sensors automatically function as accumulating conveyor systems without the need for additional control elements.

Luminescence sensors offer unique sensing solutions. They are able to handle more advanced applications than standard photoelectric proximity sensors. Luminescence sensors react to luminescent pigments, which are activated by the UV light source in the sensor.

Laser measurement sensors are an essential aid in the classification, positioning and material flow handling of products. They are excellent for measuring in both short and long distance applications.

Multi-dimensional sensors can position objects or sense the height of objects. The Dimensional Multifunctional Position Finder sensor (DMP) is the sensor of choice for automated storage and retrieval systems.

Automation light grid photoelectric sensors are a small, non-safety version of light curtains. They are ideal for recording and counting of objects and pick-to-light applications.

Industrial Proximity Sensors (Electromagnetic Sensors)

Inductive sensors detect metallic objects and are suitable for a wide variety of applications such as position polling, transport monitoring, counting pulse generation, speed monitoring and speed direction detection. Inductive sensors are available with various housing shapes and sizes.

Capacitive sensors can detect non-metallic objects and have enhanced sensing ranges for high operational reliability. Some applications include level detection and product availability in a sealed container.

Magnetic proximity sensors are characterized by their large sensing ranges. They detect magnetic objects (usually permanent objects). Applications include object detection through plastic containers/pipes, detection in aggressive media through protective Teflon® walls, detection in high temperature areas, and recognition of coding using magnets.

Magnetic cylinder sensors are used to detect the position of pistons in pneumatic cylinders. Magnets are attached to the piston and sensed through the housing wall by the cylinder sensors. The housing wall could be made of aluminum, brass, or stainless steel.

Ultrasonic Sensors

Ultrasonics sensors are color independent, an excellent solution for detection of liquids, foils and glass, and are stable in harsh environments. Ultrasonic sensors are low maintenance, easy to calibrate and offer long term reliability. The UM 18 double sheet detector is ideal for identifying two or more sheets of material on top of each other. These sensors can also be used for thicker materials such as plastic sheets, board stock, or sheet metal.

Angular, Positional, and Length Measurement Products

Incremental encoders are used when retention of absolute position upon power loss is not required. Examples include velocity control and simple point-to-point applications. **Absolute encoders** are used when position data must be retained after loss of power. Examples include robotics, lead/ball screws, overhead cranes, and rack and pinion applications.

Linear and wire draw encoders are used when users need linear position as an output with high resolution and repeatability.

HIPERDRIVES (Format Adjustment Drives) are used in product and format changes on machines. The Hiperdrives are usually on a fieldbus system and provide a high level of adjustment accuracy and reproducibility.

Common Questions:

Visible or infrared sensor?
- Visible red light provides easy alignment.
- Infrared can penetrate better through dust and dirty environments.

What is an alarm function?
- Early failure warning for misalignment or contamination.

What is a test input?
- With a test input users can remotely disable the sender LED (light source).

What time settings are available for SICK sensors?
- On-delay: Sensor waits before energizing the output. If the object clears before the sensor time is out, output does not energize.
- Off-delay: The sensor output will stay ON until the set time expires after the object clears the sensor.
- One shot: As soon as the sensor sees the object, the output will be a fixed pulse regardless of the duration for the target to clear.

Why use a laser sensor?
- Laser sensors provide a small light spot in order to precisely sense small targets. When selecting a sensor, please be aware of the light spot size versus the target size.
- Laser sensors have longer sensing ranges.

When is a fiber-optic cable used?
- In order to remove the sensor from an environment to avoid the effects of heat, dirt, and liquids.
- In order to have remote adjustability.
- In order to sense in tight spaces.

When is a NAMUR sensor used?
- NAMUR sensors are used in hazardous locations and are also referred to as intrinsically safe sensors. These sensors must be used with the EN 2 Ex power supply/controller.

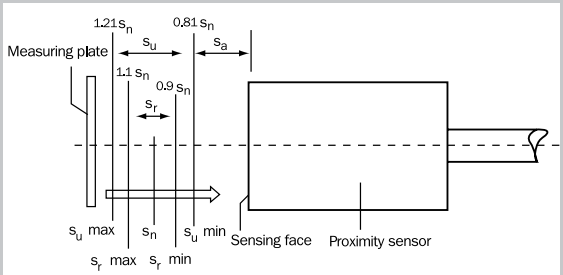
Specifying Inductive Proximity Sensors
- How close is the other metal, radially (to the side of the switching face) that you would not want the sensor to "see"? Rule of thumb: If the distance is less than 2x the published range, use a shielded (flush mount) switch. If it is equal to or greater than 2x the published range, use an unshielded (non-flush).

Calculating The Sensing Range For Inductive Sensors

Rated (nominal) sensing range Sn: Device characteristics
Real sensing range S_r: 0.9 Sn = S_r = 1.1 S_n
Useful sensing range S_u: 0.9 Sr =S_u = 1.1 S_r

Actuation distance S_a: The actuation distance is the distance at which a proximity sensor reacts under specified temperature and voltage conditions. It is between 0% and 81% of the rated sensing range. For inductive sensors you will need to correct the nominal sensing range with the correction factor based on the metal type that you are trying to detect.

St37 (Fe) = 1
Nickel chromium = 0.9
Stainless steel (V2A) = 0.8
Lead, brass (Pb, Ms) =0.5
Aluminum (solid) = 0.45
Copper (Cu) = 0.4



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