GET MORE THAN YOU PAY FOR...
What is a Proximity Sensor?

Proximity Sensors Typical Sensing Distances (mm)

Selection Criteria

Sensing Distance

Proximity sensors come in three basic sensing distances: standard, extended, and triple distance, but the size/shape, switching frequency, ingress rating, shielded vs unshielded, housing material, and connection type.

Size and Shape

Proximity sensors are available in a vast assortment of shapes and sizes, from tiny 3 or 4mm bar-rels to 30mm cylindrical and its numerous miniaturized variants. Capacitive and magnetic sensors are single piece designs while some ultrasonic探子 are two-piece "man and woman" designs.

Switching frequency

The internal quality of a proximity sensor always has a switching frequency, this can loosely be interpreted to mean how often the sensor is checking to detect moving objects at any high speed, you may have to pay attention to the switching frequency – most sensors are fast enough for routine operations.

Output type

The type of output required must be determined (i.e., NPN, PNP, or analog). Most PLC products will accept either NPN or PNP output. If connecting to a solid state relay, a PNP output is needed. The need for analog output is determined by the application. Sensors with analog outputs produce an output signal approximately proportional to the target distance.

Do you need 2, 3, or 4-wire discrete outputs? This may be dictated by the device to which the sensor will be connected, or it may be a personal preference. Some simple guidelines to use are:

- 2-wire: widely used in sensing and sourcing devices
- Only 2 wires to terminate
- Higher noise
- May work with sinking or sourcing devices
- Most popular variety – familiar to most users

- 3-wire: may have both NPN and PNP outputs
- May be used with DC or AC inputs
- More expensive
- Higher noise
- May work with sinking or sourcing devices

- 4-wire: allows configurability in one device
- May have both NPN or PNP output
- 4-wire is传奇游戏
- Allows the user to stock one part for all applications

Shielded vs unshielded

Shielded and unshielded sensors are also referred to as noshielded and non-embeddable. Unshielded sensors allow longer sensing distances but the sensor face must protrude from the mounting substrate. Shielded sensors can be flush-mounted.

Environmental ratings

All proximity sensors provide excellent protection from environmental factors such as moisture and debris. Ingress Protection (IP) ratings are all fixed by electrical devices and there end users. It is similar to the NEMA rating system. IP65 (or higher) is very common for proximity sensors. Many bulk models are also available and can have ratings as high as IP69K. IP69K is often required in the food and beverage industry where the sensors must withstand "washdown" cleaning procedures, often with harsh chemicals.

Axial cables

Axial cables typically use flat 24m and are molded into the body of the sensor at the attachment point, exiting axially (inline with the sensor body). They are typically the less expensive option. The cable can be cut to length, but may not be long enough to reach all the way to the machine controller. Field junction boxes may be required, and numerous sensor signals are often connected into multi-conductor cables at such junction points. Lastly, an axial cable exiting from the end of the sensor body may not fit (physically) in all applications.
Quick-disconnects (Q/D)

Cables with quick-disconnects on both ends (patch cables) can be used with multi-port junction blocks to multiplex sensor signals and simplify wiring. These quick-disconnects offer axial or 90-degree connections at the sensor. Field-wirable quick-disconnect connectors are also available for constructing custom cables. Extremely small sensors may have a short axial cable with the quick-disconnect a few inches from the sensor body. Quick-disconnects (Q/D) cables in PVC and PUR jackets meet the environmental requirements of most applications. Axial cables typically come with a PVC jacket. PVC is a general purpose insulation while PUR provides excellent oxidation, oil and ozone resistance. PUR is used for multi-port junction blocks to multiplex sensor signals and simplify wiring.

Multipurpose junction blocks

Multiport junction blocks

Types of proximity sensors

Inductive

Inductive proximity sensors detect the presence of metallic objects at close range (up to about 1.5 inches typically). Ferrous metals allow the greatest distances to the sensor; other metals may reduce detection range. Low-cost, reliable sensors are available in an array of shapes and sizes for a wide range of applications. Magnetic proximity sensors are used for non-contact object detection beyond the normal limits of inductive sensors. Used with a separation damping magnet, they offer very long sensing ranges in a small package beyond the normal limits of inductive sensors. Used with a separation damping magnet, they offer very long sensing ranges in a small package.

Capacitive

Capacitive sensors detect both metal and non-metal objects and can sense through insulating materials such as wood or plastic. They are often used to detect fill levels of liquids, pellets, and powders through container walls. Capacitive sensors are available in cylindrical or rectangular shapes, with sensing distances typically up to 40mm.

Magnetic

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Ultrasonic

The principle of ultrasonic sensors is based on the emission of a sound impulse and the measurement of the time elapsed of the return echo signal reflected by the detected object. The ultrasonic beam is well reflected by almost all material (metal, wood, plastic, glass, liquid, etc.) and is not affected by colored, transparent, or shiny objects. This al- lowed these sensors to be used for many materials without any extra setup or sensing concerns. Through-beam part sensors are the most often and the most accurate and reliable sensor configurations, but can also be more costly when compared to traditional diffuse or retro-reflection sensors. Magnetic proximity sensors are used for non-contact object detection beyond the normal limits of inductive sensors. Used with a separation damping magnet, they offer very long sensing ranges in a small package. Magnetic sensors are used for non-contact object detection beyond the normal limits of inductive sensors. Used with a separation damping magnet, they offer very long sensing ranges in a small package. Magnetic sensors are used for non-contact object detection beyond the normal limits of inductive sensors. Used with a separation damping magnet, they offer very long sensing ranges in a small package.
Beyond Proximity Sensors: Use Light, Touch, or Laser for Reliable and Accurate Position Sensing

Limit switches, photoelectric switches and laser sensors all provide position sensing, but there are many options and technologies to consider when specifying the use of these presence sensors in automated machines. There is much overlap in functionality of these sensors, and there are also some selection considerations as each device has its advantages and disadvantages.

Mechanical limit switches are used in industrial automation systems to detect presence or position. Physical contact with the switch actuator, usually adjustable, activates these electromechanically-operated devices. Limit switches must touch an object to detect it, which limits sensing distance to the travel distance of the switch’s rotary lever arm or plunger-type actuator. However, this short sensing range provides reliable detection of an object regardless of its color, shape or size. Care must be taken to ensure the object touching and actuating the actuator roller or plunger does not damage it.

When looking at presence sensors’ repeatability or repeat accuracy, it is important to understand when it’s needed because many sensors don’t excel in this area for applications where a high degree of repeatability is needed. Precision touch limit switches are available with an accuracy of 5 microns or less.

Diffuse, Retroreflective and Through-Beam Photoelectric Sensors

The typical light source used in the emitter, or sender, of a photoelectric sensor is visible red or infrared. The light is reflected or interrupted by the target object, and then collected by a receiver where the intensity is measured. These emitter and receiver elements can be installed in the same housing or in different housings.

Diffuse and retroreflective configurations are available with the emitter and sensor integrated together. Diffuse sensing allows emitted light to directly see and detect objects at a meter or more. However, this short sensing range provides reliable detection of an object regardless of its color, shape or size. Care must be taken to ensure the object touching and actuating the actuator roller or plunger does not damage it.

A through-beam photoelectric sensor uses a configuration where the emitter and receiver are in different housings and detect presence when the beam is broken. Through-beam sensors provide the longest operating distances since the emitter shines light directly at the receiver.

The Tried and True Limit Switch

Limit switch actuators are available in many forms, including an adjustable arm or a plunger, mechanically linked to an electrical switch block inside the housing. Most limit switches use linkages and movement of the sensed object to operate the switch contacts. Heavy-duty contacts are common in limit switches, enabling switching of higher currents than other presence and position sensing devices.

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Laser Sensor Operating Principles
Laser sensors can highly focused laser light to detect objects or measure distance, and are immune to ambient light, object material, color or brightness. Laser sensors are available in diffuse, background suppression and retroreflective styles for object/position sensing, or with CMOS or time-of-flight technologies for accurate distance sensing.

The diffuse background suppression and retroreflective styles work similarly to their non-laser, photo-eye counterparts. The light source is reflected by or interrupted by the target object, and the built-in detector drives the output signal.

For distance measuring at short ranges, high-precision laser sensors measure down to 8 micrometers resolution using CMOS technology; long-range models use time-of-flight (measuring transit time of the reflected light) to measure distances up to 100 meters.

Applications for Touch, Light and Laser
There is much overlap in the application of limit switches, photoelectric sensors and laser sensors, so carefully check the device specifications; how it will fit into an application; and how it will be used. Limit switches are just one of the many solutions to use in automated applications, but they are a simple and rugged choice for presence sensing, providing reliable detection of many components or parts.

Both photoelectric and laser sensors have a sensing range from close to far. Adjustable light intensity and sensing thresholds help tune this range. This wide and adjustable detection makes the photo eye a popular choice for presence detection, and it has an excellent sensing range-to-size ratio. As the sensing distance increases on a more accurate or a smaller spot size is needed, laser becomes a popular choice.

Mechanical limit switches have moving parts that can wear out, so the speed of actuation must also be limited, making them unsuitable for high-speed applications. The electronics in both photonic and laser sensors enable fast switching operation. With operation speeds from 25 Hz on the low end to thousands of times per second, high-speed applications are possible, provided the number of actuations is not a concern.

Photo eyes are probably the best general-purpose position sensor. They have a longer sensing range than proximity sensors, and they are available in a wide variety of configurations and housing sizes to fit many applications. They also work well for small part detection, much better than other technologies.

Laser are best for precise measurement of distance, or object detection in dynamic lighting conditions. Close, far, dirty or clean—they work well in most environments. They also work well for small part detection, much better than other technologies.

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Danny in SAN ANTONIO, TX wrote:

"Excellent service, large selection of parts, and quick to get what I need. Been using you since you started out as PLC Direct. Quality is better on some items, but you have always taken care of me if there was an issue on anything. Please keep up what you are doing so well. Look forward to many more years doing business with you."

Bruce in LAFAYETTE, CA wrote:

"I recently bought 3 isolation transformers from Automation Direct. The specifications were equivalent to transformers from other industrial suppliers and the quality appears to also be equivalent. The pricing, as with other products from Automation Direct, is good and it is a pleasant experience. In my opinion, Automation Direct beats out competitors in value and service quality. Please keep up the good work."
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- Ball valves
- Needle valves
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- Tubing, hose and fittings
- Push-to-connect water fittings
- Hose clamps
- Hose
- Tubing
- Lead-free brass fittings
- Push-to-connect water fittings
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- Solenoid valves
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- Wire end connectors
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- 20 x 20 x 06" NEMA 4 wall mount
- 20 x 16 x 08" NEMA 12 wall mount
- 24 x 24 x 08" NEMA 1 wall mount
- 60 x 60 x 12" NEMA 12 free-standing mount
- 36 x 24 x 08" NEMA 4/12 wall mount
- 20 x 20 x 06" NEMA 4 wall mount
- 20 x 20 x 20" NEMA 6P wall mount

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- Flexible conduit and fittings
- Wiremold
- PVC conduit and fittings

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