

# PROXIMITY SWITCH

## Description

The sensors provide excellent results even with difficult-to-detect objects, e.g. small or thin parts, wires or bright metals.

A variety of types cover a wide range of individual requirements and installation situations. Thus, devices are available with N.C. or N.O. functions, with NPN or PNP switching outputs, and cable or plug connection.

The enclosure rating is IP66.

## Features

- Easy-to-use and tough
- Wide range of models
- Wide operating voltage range
- Short circuit protected
- Ideal for a variety of applications
- With a metal connector that can be tightened securely and a cord protector
- Enclosure rating of IP66, water-proof and oil-drip proof
- Fast response



## Specification

| Item   | Standard   |
|--|--|
| Differential travel                              | 10% max. of sensing distance   |
| Target   | Ferrous metal (The sensing distance decreases with non-ferrous metal.)   |
| Power supply voltage (operating voltage range)   | 12 ~ 24 VDC. Ripple (p-p): 10% max. (10 ~ 30 VDC)  |
| Current consumption (DC 3-wire)                  | 10 mA max.   |
| Output type                                      | See Product selection  |
| Control output                                   | Load current (See note 1.) 200 mA max. (32 VDC max.)<br>Residual voltage 1 V max. (under load current of 200 mA with cable length of 2 m)                          |
| Operation mode (with sensing object approaching) | See Product selection  |
| Protection circuit                               | Output reverse polarity protection, Power source circuit reverse polarity protection, Surge suppressor, Short-circuit protection                                   |
| Ambient air temperature                          | Operating: -40°C to 70°C, Storage: -40°C to 85°C (with no icing or condensation)   |
| Temperature influence (See note 1.)              | ±10% max. of sensing distance at 23°C within temperature range of -25°C to 70°C<br>±15% max. of sensing distance at 23°C within temperature range of -40°C to 70°C |
| Ambient humidity                                 | Operating: 35% to 95%, Storage: 35% to 95%   |
| Voltage influence                                | ±1% max. of sensing distance in rated voltage range ±15%   |
| Insulation resistance                            | 50 MΩ min. (at 500 VDC) between current carry parts and case   |
| Dielectric strength                              | 1,000 VAC at 50/60 Hz for 1 min between current carry parts and case   |
| Vibration resistance                             | 10 to 55 Hz, 1.5mm double amplitude for 2 hours each in X, Y and Z directions  |
| Shock resistance                                 | 1,000 m/s <sup>2</sup> , 10 times each in x, Y and Z directions  |
| Standards and listings                           | IEC60529: IP66, Degree of protection<br>EN60947-5-2: EMC   |

Note : When using any model at an ambient temperature between -40°C and -25°C and a power voltage between 30 and 32 VDC, use a load current of 100 mA max.,

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# PROXIMITY SWITCH

## Product selection

$\frac{TS}{1}$     $\square$  -  $\square$   $\square$  -  $\square$   
 1   2   3   4   5

### 1. Housing outline

TS: Inductive thread round  
 S : Inductive square  
 CS: Inductive thread round connector

### 2. Dimension of sensing face

#### TS CS type series

12: diameter 12mm  
 18: diameter 18mm  
 30: diameter 30mm

#### S type series

17: square 17mm x 17mm  
 18: square 18mm x 18mm  
 18L: square 18mm x 18mm  
 25: square 25mm x 25mm  
 30: square 30mm x 30mm  
 40: square 40mm x 40mm

### 3. Sensing distance

Numeral: Sensing distance:  
 E.g. 02=2 mm, 16=16mm

### 4. Output stage

N: NPN open collector DC mode  
 P: PNP open collector DC mode

### 5. Output function

1: N.O. normally open  
 2: N.C. normally close

**Example:** Inductive thread round housing, M12, Sn=5mm, NPN-DC, normally open,  
**TS12-05N-1** Inductive square 18x18 mm, Sn=5mm, NPN-DC, normally open.  
**S18-05N-1**

## Output stage diagram

|            | NO   | NC   |
|------------|--|--|
| <b>PNP</b> | <p>M12 connector Pin Arrangement</p> <p>Terminal 2 of the M12 connector is not used.</p> | <p>M12 connector Pin Arrangement</p> <p>Terminal 4 of the M12 connector is not used.</p> |
| <b>NPN</b> | <p>M12 connector Pin Arrangement</p> <p>Terminal 2 of the M12 connector is not used.</p> | <p>M12 connector Pin Arrangement</p> <p>Terminal 4 of the M12 connector is not used.</p> |

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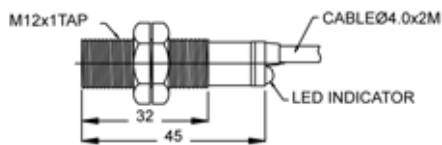
## Ordering information

Inductive thread Round metal body type

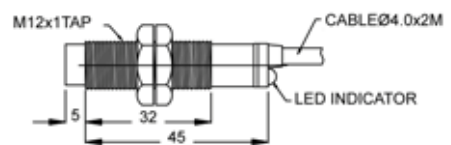
|  |               |  |                |   |                |
|--|---------------|--|----------------|---|----------------|
| Appearance                                       |               |  |                |  |                |
| Item   |               | Shield   |                | Non-Shield  |                |
|  |               | Cable type   | Connector type | Cable type  | Connector type |
| Output Function<br>Output Stage                  | NPN NO-output | TS12-02N-1   | CS12-02N-1     | TS12-05N-1  | CS12-05N-1     |
|  | NPN NC-output | TS12-02N-2   | CS12-02N-2     | TS12-05N-2  | CS12-05N-2     |
|  | PNP NO-output | TS12-02P-1   | CS-12-02P-1    | TS12-05P-1  | CS12-05P-1     |
|  | PNP NO-output | TS12-02P-2   | CS12-02P-2     | TS12-05P-2  | CS12-05P-2     |
| Sensing Distance                                 |               | 2 mm ± 10%   |                | 5 mm ± 10%  |                |
| Setting distance                                 |               | 0 to 1.6 mm  |                | 0 to 4.0mm  |                |
| Response frequency                               |               | 1.5KHz   |                |   |                |
| Standard target                                  |               | 12x12x1mm  |                |   |                |
| Body Material                                    |               | Brass Nickel plated  |                |   |                |
| Circuit Protection                               |               | Yes  |                |   |                |
| Reverse polarity protection<br>of supply voltage |               | Yes  |                |   |                |
| Cable length                                     |               | 2 m  |                |   |                |
| Enclosure Protection                             |               | IP 67  |                |   |                |

### DIMENSIONS

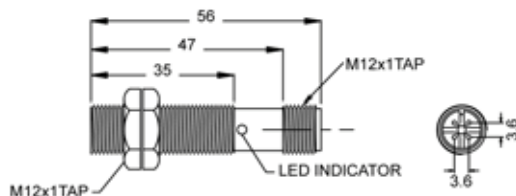
TS12 Shied



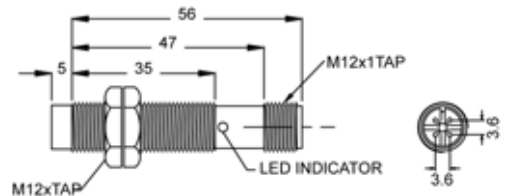
TS12 Non-Shied



CS12 Shied



CS12 Non-Shied



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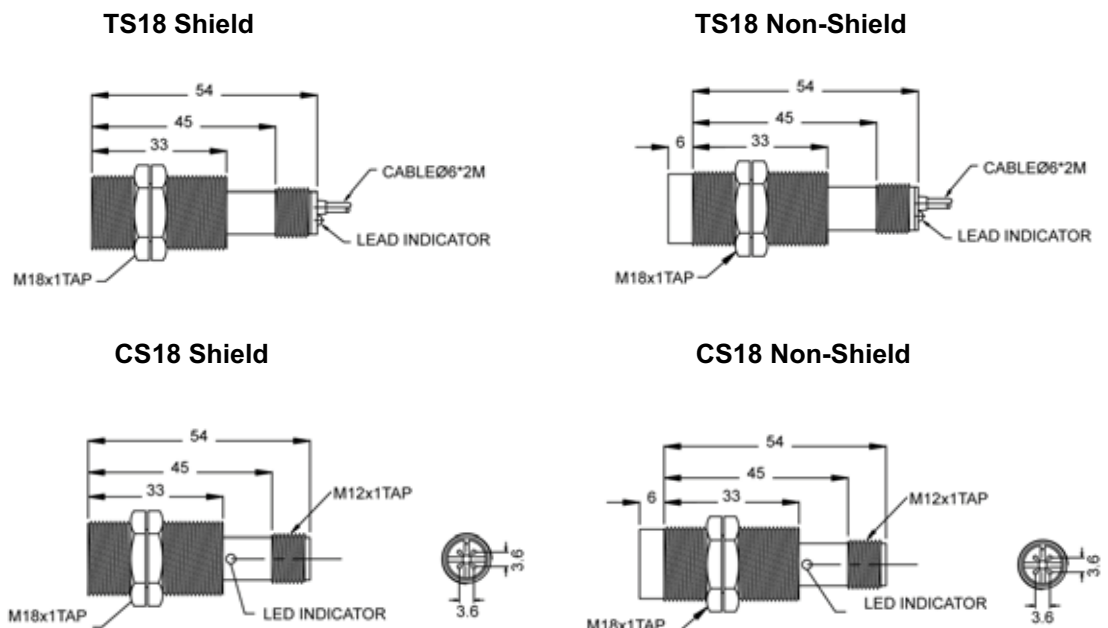
# PROXIMITY SWITCH

## Ordering information

Inductive thread Round metal body type

|   |               |                     |                |            |                |
|---|---------------|---------------------|----------------|------------|----------------|
| Appearance                                    |               |                     |                |            |                |
| Item  |               | Shield              |                | Non-Shield |                |
|   |               | Cable type          | Connector type | Cable type | Connector type |
| Output Function<br>Output Stage               | NPN NO-output | TS18-05N-1          | CS18-05N-1     | TS18-08N-1 | CS18-08N-1     |
|   | NPN NC-output | TS18-05N-2          | CS18-05N-2     | TS18-08N-2 | CS18-08N-2     |
|   | PNP NO-output | TS18-05P-1          | CS18-05P-1     | TS18-08P-1 | CS18-08P-1     |
|   | PNP NO-output | TS18-05P-2          | CS01-05P-2     | TS18-08P-2 | CS18-08P-2     |
| Sensing Distance                              |               | 5 mm ± 10%          |                | 8 mm ± 10% |                |
| Setting distance                              |               | 0 to 4.0 mm         |                | 0 to 6.4mm |                |
| Response frequency                            |               | 1.5KHz              |                |            |                |
| Standard target                               |               | 18x18x1mm           |                |            |                |
| Body Material                                 |               | Brass Nickel plated |                |            |                |
| Circuit Protection                            |               | Yes                 |                |            |                |
| Reverse polarity protection of supply voltage |               | Yes                 |                |            |                |
| Cable length                                  |               | 2 m                 |                |            |                |
| Enclosure Protection                          |               | IP 67               |                |            |                |

### DIMENSIONS



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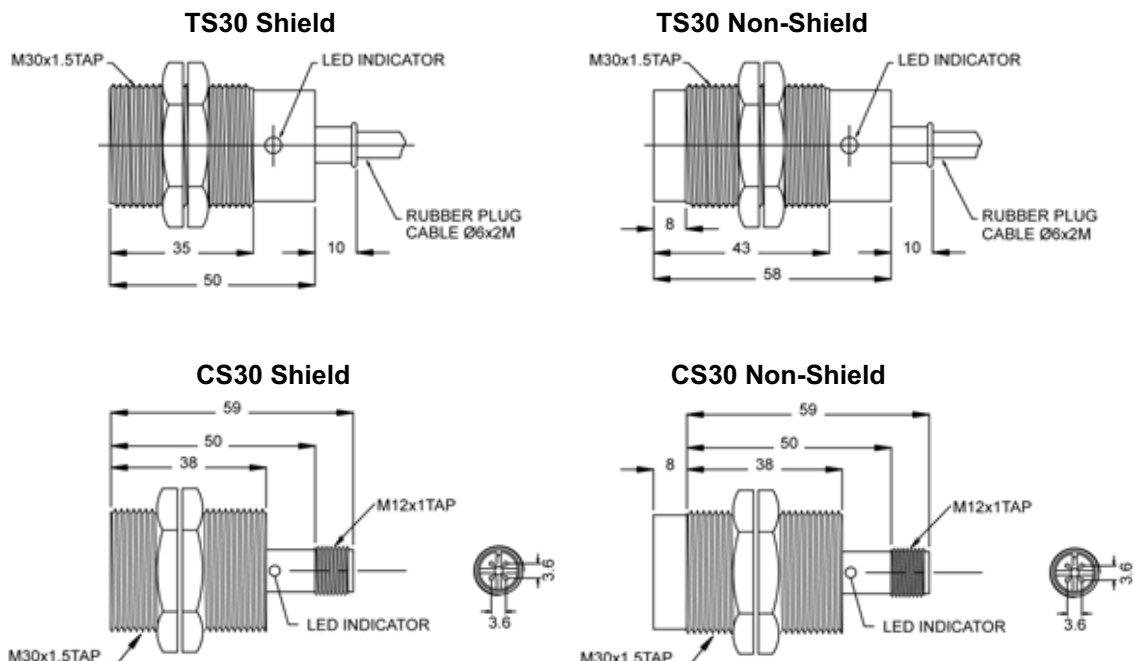
# PROXIMITY SWITCH

## Ordering information

Inductive thread Round metal body type

|  |               |  |                |             |                |
|--|---------------|--|----------------|-------------|----------------|
| Appearance                                       |               |  |                |             |                |
| Item   |               | Shield   |                | Non-Shield  |                |
|  |               | Cable type   | Connector type | Cable type  | Connector type |
| Output Function<br>Output Stage                  | NPN NO-output | TS30-10N-1   | CS30-10N-1     | TS30-15N-1  | CS30-15N-1     |
|  | NPN NC-output | TS30-10N-2   | CS30-10N-2     | TS30-15N-2  | CS30-15N-2     |
|  | PNP NO-output | TS30-10P-1   | CS30-10P-1     | TS30-15P-1  | CS30-15P-1     |
|  | PNP NO-output | TS30-10P-2   | CS30-10P-2     | TS30-15P-2  | CS30-15P-2     |
| Sensing Distance                                 |               | 10 mm ± 10%  |                | 15 mm ± 10% |                |
| Setting distance                                 |               | 0 to 8.0 mm  |                | 0 to 12.0mm |                |
| Response frequency                               |               | 1.5KHz   |                |             |                |
| Standard target                                  |               | 30x30x1mm  |                |             |                |
| Body Material                                    |               | Brass Nickel plated  |                |             |                |
| Circuit Protection                               |               | Yes  |                |             |                |
| Reverse polarity protection<br>of supply voltage |               | Yes  |                |             |                |
| Cable length                                     |               | 2 m  |                |             |                |
| Enclosure Protection                             |               | IP 67  |                |             |                |

## DIMENSIONS



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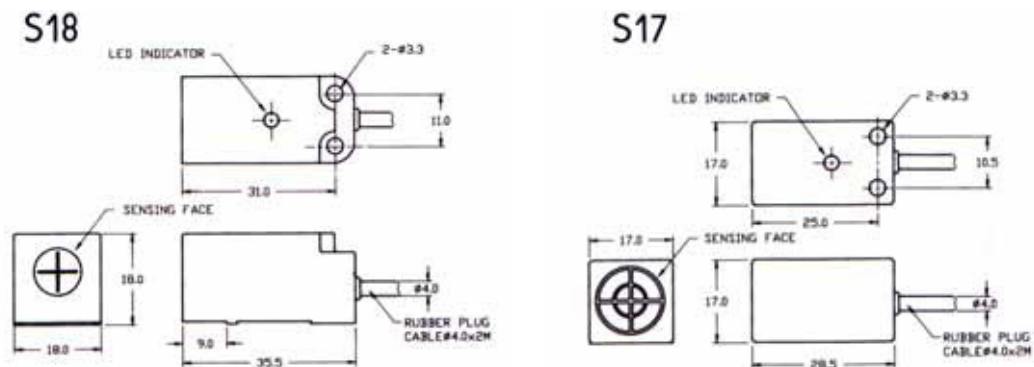
# PROXIMITY SWITCH

## Ordering information

Inductive Square Plastic body type

|   |               |  |   |
|---|---------------|--|---|
| Appearance                                    |               |  |  |
| Item  |               | <b>S17 series</b>  | <b>S18 series</b>   |
| Output Function<br>Output Stage               | NPN NO-output | S17-05N-1  | S18-05N-1   |
|   | NPN NC-output | S17-05N-2  | S18-05N-2   |
|   | PNP NO-output | S17-05P-1  | S18-05P-1   |
|   | PNP NO-output | S17-05P-2  | S18-05P-2   |
| Sensing Distance                              |               | 5 mm ± 10%   | 5 mm ± 10%  |
| Setting distance                              |               | 0 to 4.0 mm  | 0 to 4.0mm  |
| Response frequency                            |               | 1.5KHz   |   |
| Standard target                               |               | 17x17x1mm  | 18x18x1mm   |
| Body Material                                 |               | Plastic  |   |
| Circuit Protection                            |               | Yes  |   |
| Reverse polarity protection of supply voltage |               | Yes  |   |
| Cable length                                  |               | 2 m  |   |
| Enclosure Protection                          |               | IP 67  |   |

### DIMENSIONS





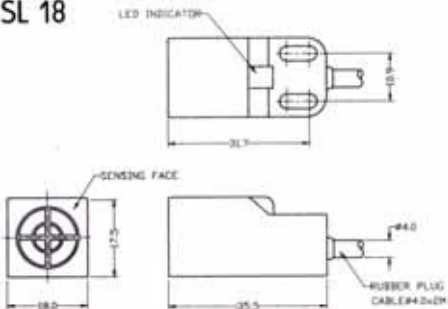
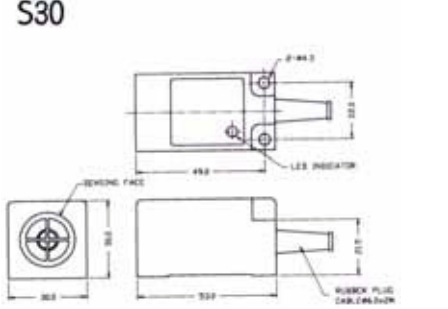
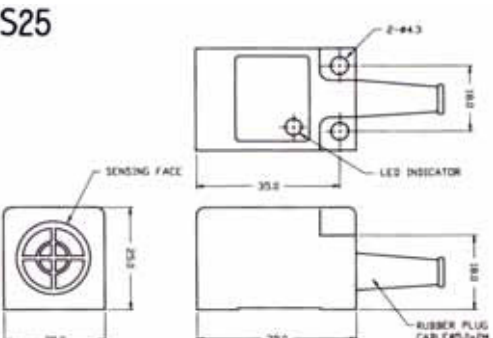
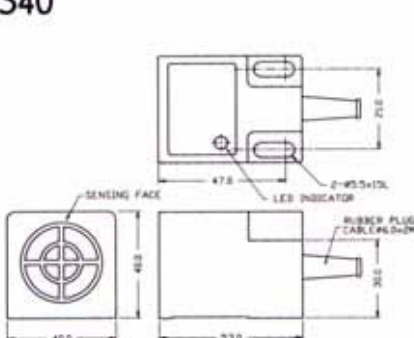


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# PROXIMITY SWITCH

|   |  |  |   |
|---|--|--|---|
|                        |                       |  |  |
| <b>SL18 series</b>  | <b>S25 series</b>  | <b>S30 series</b>  | <b>S40 series</b>   |
| SL18-05N-1  | S25-07N-1  | S30-10N-1  | S40-20N-1   |
| SL18-05N-2  | S25-07N-2  | S30-10N-2  | S40-20N-2   |
| SL18-05P-1  | S25-07P-1  | S30-10P-1  | S40-20P-1   |
| SL18-05P-2  | S25-07P-2  | S30-10P-2  | S40-20P-2   |
| 5 mm ± 10%  | 7 mm ± 10%   | 10 mm ± 10%  | 20 mm ± 10%   |
| 0 to 4.0 mm   | 0 to 5.6 mm  | 0 to 8.0mm   | 0 to 16.0mm   |
| 1.5KHz  |  |  |   |
| 18x18x1mm   | 25x25x1mm  | 30x30x1mm  | 40x40x1mm   |
| Plastic   |  |  |   |
| Yes   |  |  |   |
| Yes   |  |  |   |
| 2 m   |  |  |   |
| IP 67   |  |  |   |
| <p><b>SL 18</b></p>  | <p><b>S30</b></p>  |  |   |
| <p><b>S25</b></p>    | <p><b>S40</b></p>  |  |   |

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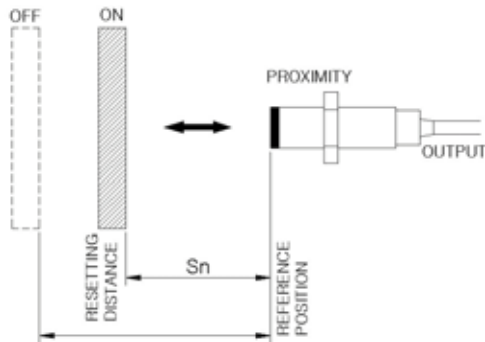
# PROXIMITY SWITCH

## Technical specifications

### Sensing distance: (Sn)

"Sensing distance" refers to the distance at which the proximity switch operates (or releases) as measured, from the reference position (or reference plane) by moving the target in the specified manner.

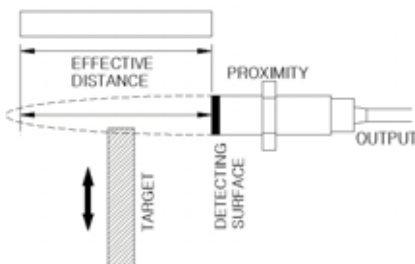
The item "sensing distance" under "specifications" indicates the value(s) when measured with the standard target.



### Effective distance:

"Effective distance" refers to the distance from the sensing surface to the passing position of the target which permits the proximity switch to operate without any malfunctions due to temperature or voltage fluctuation.

The item "effective distance" under "specifications" indicates the value(s) when measured with the standard target.



### Correction coefficient:

Taking an electrical proximity switch as an example, the sensing distance of the electrical inductance proximity switch is shorter for a non-metal target. In this case, please refer to the following chart for correction of pick-up distance. (But the correction factor has no an absolute value).

For example: Sensing distance of copper: S30-10N-1-P-V

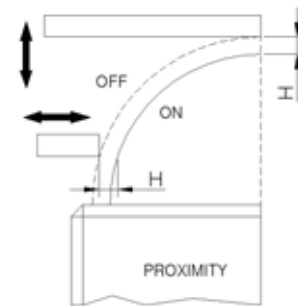
Standard sensing distance: (Sn) x 0.4

(Modulus of copper) = 10 x 0.4 = 4mm

| MATERIAL        | FACTOR APPROX |
|-----------------|---------------|
| MILD STEEL      | 1.0           |
| ALUMINIUM FOIL  | 0.95          |
| STAINLESS STEEL | 0.7           |
| BRASS           | 0.4           |
| ALUMINIUM       | 0.3           |
| COPPER          | 0.28          |

### Hysteresis: (H)

Proximity switch hysteresis is the max. difference between the switch-ON point (non detection→detection) and the switch-OFF point (detection→non detection) when the target approaches and recedes from the active face (or from its axis). It is quoted in % on switch-ON point. The difference between the two switching distance is intentionally introduced to avoid undesired switching of the proximity when the target is present just within the sensing range.



### Residual Voltage

Residual voltage refers to the saturated voltage in an output crystal when the proximity switch is "ON"

### Current consumption:

Current consumption refers to the maximum current when, under no load condition, it is measured between the power inlet terminal and the output terminal.

### Leakage current:

"Leakage current" refers to the frequency of outputs from the proximity switch per second in response to the movement of each target when brought closer to the switch.

The item "switching frequency" under "specifications" indicates the value(s) when measured with the standard target.

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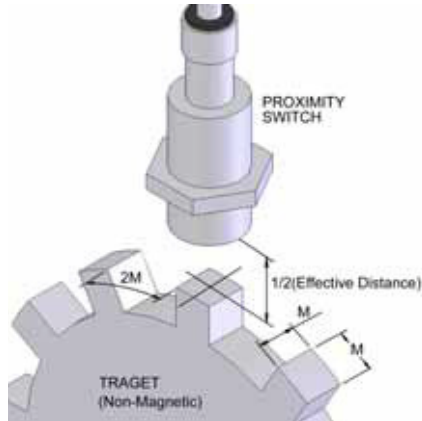
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# PROXIMITY SWITCH

## Switching frequency: (f)

"Response frequency" refers to the frequency of outputs from the proximity switch per second in response to the movement of each target when brought closer to the switch. The item "switching frequency" under "specifications" indicates the value(s) when measured with the standard target.



## Delay in readiness

The output state of the sensor requires 100ms to become ready after the power has been applied. During this time do not use the sensor output signal.

## Environment and temperature effect

It refers to the change of sensing distance of the proximity switch when the environmental temperature changes between (-) 20 to (+) 70 Celsius degrees. The amount of change taken at (+) 23 Celsius degrees shall be regarded as standard sensing distance  $S_n \times \pm 10\%$  (change effect distance).

## Environment and voltage effect:

It refers to the change of sensing distance of the proximity switch when the applied voltage changes from 10 to 30 VDC or from 24 to 240 VAC. The amount of changes is measured by the sensing distance taken at normal operating voltage  $S_n \times \pm 2.5\%$  (change effect distance).

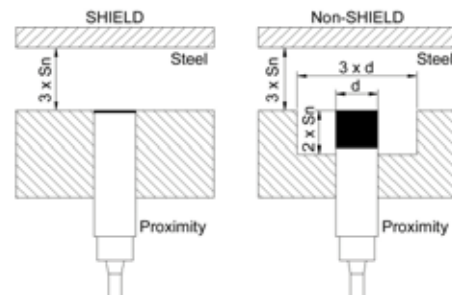
## MOUNTING CONDITION

### Shield type:

Since the sensing face of the proximity switch is a shield type, it can be buried in an iron or steel materials stockpile to prevent being effected by any surrounding metal objects.

### Non shield type:

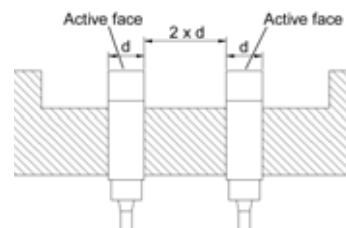
A space should be provided between the sensing face and the surrounding metals, or the sensing face should protrude to prevent surrounding interference.



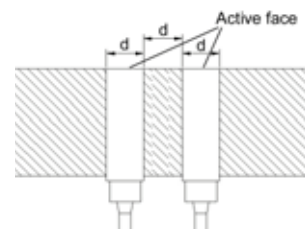
$d$  = Diameter of switch  
 $S_n$  = Sensing distance

### Mutual interference

A minimum distance must be observed when identical cylindrical rectangular sensors are mounted opposite each other or in parallel.



Non-shield mountable sensors mounted parallel.



Shield mountable sensors mounted in parallel



Mounted opposite each other

$d$  = Diameter of switch  
 $S_n$  = Sensing distance

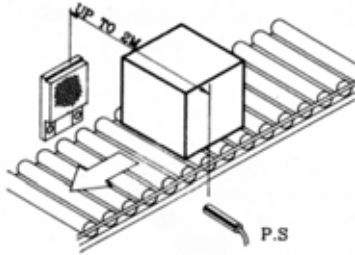
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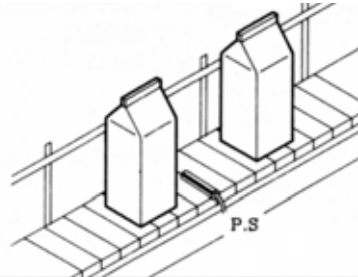
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# PROXIMITY SWITCH

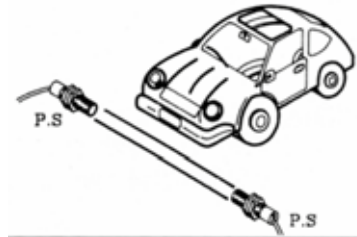
## Applications for sensor's switch



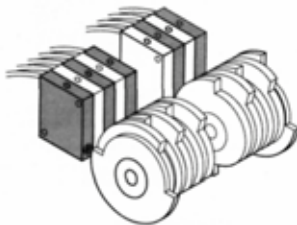
- Detection of luggage
- APPROPRIATE TYPE:  
Retro-Reflective Photoelectric Switch



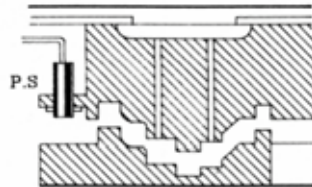
- Counting or detection of MILK Boxes
- APPROPRIATE TYPE:  
Diffuse Reflective Photoelectric Switch



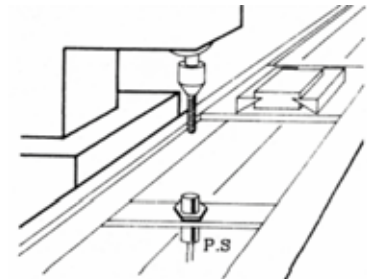
- Detection of presenting cars in parking lot
- APPROPRIATE TYPE:  
Thru-Beam Photoelectric Switch



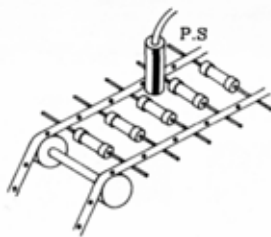
- Mechanical procedure control
- APPROPRIATE TYPE:  
Type PS12 Proximity Switch



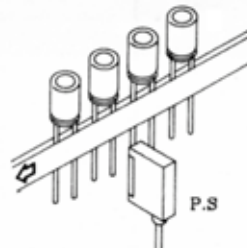
- Confirmation of tooling up-down position
- APPROPRIATE TYPE:  
Inductive Proximity Switch



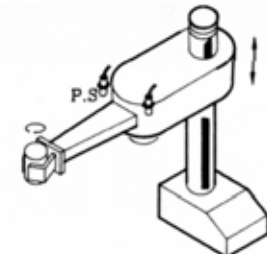
- Positioning of processing parts
- APPROPRIATE TYPE:  
Inductive Proximity Switch



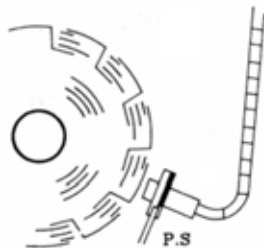
- Detection of resistor
- APPROPRIATE TYPE:  
Capacitive Proximity Switch



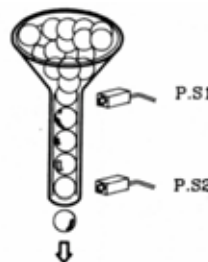
- Detection of electrolytic capacitor
- APPROPRIATE TYPE:  
Inductive Proximity Switch



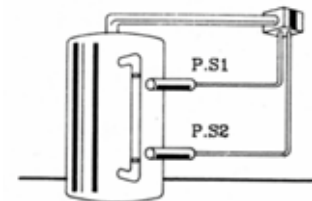
- Positioning of robot arm
- APPROPRIATE TYPE:  
Inductive Proximity Switch



- Detection of wave in high speed rotation
- APPROPRIATE TYPE:  
Inductive Proximity Switch



- Detection of steel ball
- APPROPRIATE TYPE:  
Inductive Proximity Switch



- Detection of powder/liquid position control
- APPROPRIATE TYPE:  
Capacitive Proximity Switch

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D10

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