

Cylindrical Inductive Proximity Sensors

PR Series (DC 3-wire)

INSTRUCTION MANUAL

TCD210245AB

Autonics

Thank you for choosing our Autonics product.

Read and understand the instruction manual and manual thoroughly before using the product.

For your safety, read and follow the below safety considerations before using. For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.

Keep this instruction manual in a place where you can find easily.

The specifications, dimensions, etc. are subject to change without notice for product improvement. Some models may be discontinued without notice.

Follow Autonics website for the latest information.

Safety Considerations

- Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.
- ▲ symbol indicates caution due to special circumstances in which hazards may occur.

▲ Warning Failure to follow instructions may result in serious injury or death.

01. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.)

Failure to follow this instruction may result in personal injury, economic loss or fire.

02. Do not use the unit in the place where flammable/explosive/corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact, or salinity may be present.

Failure to follow this instruction may result in explosion or fire.

03. Do not disassemble or modify the unit.

Failure to follow this instruction may result in fire.

04. Do not connect, repair, or inspect the unit while connected to a power source.

Failure to follow this instruction may result in fire.

05. Check 'Connections' before wiring.

Failure to follow this instruction may result in fire.

▲ Caution Failure to follow instructions may result in injury or product damage.

01. Use the unit within the rated specifications.

Failure to follow this instruction may result in fire or product damage.

02. Use a dry cloth to clean the unit, and do not use water or organic solvent.

Failure to follow this instruction may result in fire.

Cautions during Use

- Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
- 12-24 VDC≐ power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Use the product, after 0.8 sec of supplying power.
- Wire as short as possible and keep away from high voltage lines or power lines, to prevent surge and inductive noise.
- Do not use near the equipment which generates strong magnetic force or high frequency noise (transceiver, etc.).
- In case installing the product near the equipment which generates strong surge (motor, welding machine, etc.), use diode or varistor to remove surge.
- If the surface is rubbed with a hard object, PTFE coating can be worn out. This unit may be used in the following environments.
 - Indoors (in the environment condition rated in 'Specifications')
 - Altitude max. 2,000 m
 - Pollution degree 2
 - Installation category II

Cautions for Installation

- Install the unit correctly with the usage environment, location, and the designated specifications.
- Do NOT impacts with a hard object or excessive bending of the wire lead-out. It may cause damage the water resistance.
- Do NOT pull the $\varnothing 3.5$ mm cable with a tensile strength of 25 N, the $\varnothing 4$ mm cable with a tensile strength of 30 N or over and the $\varnothing 5$ mm cable with a tensile strength of 50 N or over. It may result in fire due to the broken wire.
- When extending wire, use AWG 22 cable or over within 200 m.

Ordering Information

This is only for reference, the actual product does not support all combinations. For selecting the specified model, follow the Autonics website.

PR	①	②	③	④	-	⑤	⑥	⑦	-	⑧
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① Characteristic

No mark: General type
A: Spatter-resistant type

② Connection

No mark: Cable type
W: Cable connector type
CM: Connector type

③ Body length

No mark: Normal
S: Short
L: Long

④ DIA. of sensing side

Number: DIA. of sensing side (unit: mm)

⑤ Sensing distance

Number: Sensing distance (unit: mm)

⑥ Power supply

D: 12 - 24 VDC≐

⑦ Control output

N: NPN Normally open
N2: NPN Normally closed
P: PNP Normally open
P2: PNP Normally closed

⑧ Cable

No mark: Standard type
V: Oil resistant cable type

Product Components

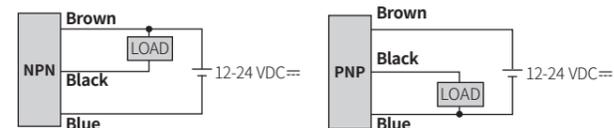
- Product × 1
- Instruction manual × 1
- Nut × 2
- Washer × 1

Sold Separately

- M12 Connector cable: C□D(H)3-□
- Fixing bracket: P90-R□
- Spatter protection cover: P90-M□

Connections

■ Cable type

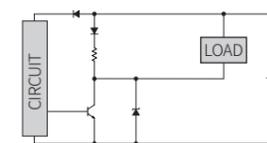


■ Cable connector type / Connector type

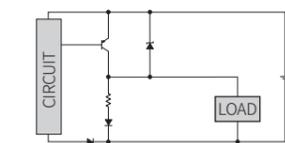
- For LOAD connection, follow the cable type connection.
- Fasten the connector not to shown the thread. (0.39 to 0.49 N m)
- Fasten the vibration part with PTFE tape.

Pin	Color	Function
①	Brown	+V
②	-	-
③	Blue	0 V
④	Black	OUT

■ Inner circuit (NPN output)



■ Inner circuit (PNP output)



Operation Timing Chart

	Normally open	Normally closed
Sensing target	Presence: High pulse Nothing: Low	Presence: High pulse Nothing: Low
Load	Operation: High pulse Return: Low	Operation: High pulse Return: Low
Output voltage	NPN output	H: High pulse L: Low
	PNP output	H: High pulse L: Low
Operation indicator (red)	ON: High pulse OFF: Low	ON: High pulse OFF: Low

Specifications

Installation	Flush type			
	PR□08-1.5D □	PR□12-2D □	PR□18-5D □	PR□30-10D □
General	PR□08-1.5D □	PR□12-2D □	PR□18-5D □	PR□30-10D □
Spatter-resistant	-	PRA□12-2D □	PRA□18-5D □	PRA□30-10D □
DIA. of sensing side	$\varnothing 8$ mm	$\varnothing 12$ mm	$\varnothing 18$ mm	$\varnothing 30$ mm
Sensing distance	1.5 mm	2 mm	5 mm	10 mm
Setting distance	0 to 1.05 mm	0 to 1.4 mm	0 to 3.5 mm	0 to 7 mm
Hysteresis	≤ 10 % of sensing distance (DIA. of sensing side $\varnothing 8$ mm connector type: ≤ 15 %)			
Standard sensing target: iron	8 × 8 × 1 mm	12 × 12 × 1 mm	18 × 18 × 1 mm	30 × 30 × 1 mm
Response frequency ⁰¹⁾	1.5 kHz	1.5 kHz	500 Hz	400 Hz
Affection by temperature	≤ ± 10 % for sensing distance at ambient temperature 20 °C (DIA. of sensing side $\varnothing 8$ mm: ≤ ± 20 %)			
Indicator	Operation indicator (red)			
Approval	CE, RoHS, REACH			

Installation	Non-flush type			
	PR□08-2D □	PR□12-4D □	PR□18-8D □	PR□30-15D □
General	PR□08-2D □	PR□12-4D □	PR□18-8D □	PR□30-15D □
DIA. of sensing side	$\varnothing 8$ mm	$\varnothing 12$ mm	$\varnothing 18$ mm	$\varnothing 30$ mm
Sensing distance	2 mm	4 mm	8 mm	15 mm
Setting distance	0 to 1.4 mm	0 to 2.8 mm	0 to 5.6 mm	0 to 10.5 mm
Hysteresis	≤ 10 % of sensing distance (DIA. of sensing side $\varnothing 8$ mm connector type: ≤ 15 %)			
Standard sensing target: iron	8 × 8 × 1 mm	12 × 12 × 1 mm	25 × 25 × 1 mm	45 × 45 × 1 mm
Response frequency ⁰¹⁾	1.0 kHz	500 Hz	350 Hz	200 Hz
Affection by temperature	≤ ± 10 % for sensing distance at ambient temperature 20 °C (DIA. of sensing side $\varnothing 8$ mm: ≤ ± 20 %)			
Indicator	Operation indicator (red)			
Approval	CE, RoHS, REACH			

01) The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.

Unit weight (package)		$\varnothing 8$ mm	$\varnothing 12$ mm	$\varnothing 18$ mm	$\varnothing 30$ mm
		Normal	≈ 52 g (≈ 64 g)	≈ 72 g (≈ 84 g)	≈ 110 g (≈ 122 g)
Cable	Short	-	≈ 70 g (≈ 82 g)	-	-
	Long	≈ 54 g (≈ 66 g)	≈ 76 g (≈ 88 g)	≈ 130 g (≈ 142 g)	≈ 210 g (≈ 247 g)
	Normal	≈ 32 g (≈ 44 g)	≈ 42 g (≈ 54 g)	≈ 58 g (≈ 70 g)	≈ 122 g (≈ 134 g)
Cable connector	Long	≈ 34 g (≈ 46 g)	-	≈ 78 g (≈ 90 g)	≈ 158 g (≈ 195 g)
	Normal	≈ 10 g (≈ 32 g)	≈ 26 g (≈ 38 g)	≈ 49 g (≈ 61 g)	≈ 134 g (≈ 146 g)
Connector	Long	-	-	≈ 73 g (≈ 85 g)	≈ 169 g (≈ 181 g)

Power supply	12 - 24 VDC≐ (ripple P-P: ≤ 10 %), operating voltage: 10 - 30 VDC≐
Current consumption	≤ 10 mA
Control output	≤ 200 mA
Residual voltage	DIA. of sensing side $\varnothing 8$ mm: ≤ 2.0 V DIA. of sensing side $\varnothing 12$ mm, $\varnothing 18$ mm, $\varnothing 30$ mm: ≤ 1.5 V
Protection circuit	Surge protection circuit, output short over current protection circuit, reverse polarity protection
Insulation resistance	≥ 50 M Ω (500 VDC≐ megger)
Dielectric strength	Between the charging part and the case: 1,500 VAC~ 50 / 60Hz for 1 min
Vibration	1 mm double amplitude at frequency 10 to 55 Hz in each X, Y, Z direction for 2 hours
Shock	500 m/s ² (≈ 50 G) in each X, Y, Z direction for 3 times
Ambient temperature	-25 to 70 °C, storage: -30 to 80 °C (no freezing or condensation)
Ambient humidity	35 to 95 %RH, storage: 35 to 95 %RH (no freezing or condensation)
Protection structure	IP67 (IEC standards)
Connection	Cable type / Cable connector type ⁰¹⁾ / Connector type model
Cable spec. ⁰²⁾	DIA. of sensing side $\varnothing 8$ mm: $\varnothing 3.5$ mm, 3-wire DIA. of sensing side $\varnothing 12$ mm: $\varnothing 4$ mm, 3-wire DIA. of sensing side $\varnothing 18$ mm, $\varnothing 30$ mm: $\varnothing 5$ mm, 3-wire
Wire spec.	$\varnothing 3.5$ mm cable: AWG 24 (0.08 mm, 40-core), insulator DIA.: $\varnothing 1$ mm $\varnothing 4$ mm, $\varnothing 5$ mm cable: AWG 22 (0.08 mm, 60-core), insulator DIA.: $\varnothing 1.25$ mm
Connector spec.	M12 connector
Material	Standard type cable (black): polyvinyl chloride (PVC) Oil resistant cable (gray): polyvinyl chloride (oil resistant PVC)
General	Case/Nut: nickel plated brass (DIA. of sensing side $\varnothing 8$ mm connector type case: SUS303), washer: nickel plated iron, sensing side: PBT
Spatter-resistant	Case/Nut: PTFE coated brass, washer: PTFE coated iron, sensing side: PTFE

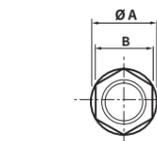
01) Except spatter-resistant type

02) Cable type: 2 m, cable connector type: 300 mm

Cut-out Dimensions

- Unit: mm, For the detailed drawings, follow the Autonics web site.

	$\varnothing 8$ mm	$\varnothing 12$ mm	$\varnothing 18$ mm	$\varnothing 30$ mm
Mounting hole (H)	$\varnothing 8.5^{+0.05}_0$	$\varnothing 12.5^{+0.05}_0$	$\varnothing 18.5^{+0.05}_0$	$\varnothing 30.5^{+0.05}_0$
TAP	M8×1	M12×1	M18×1	M30×1.5

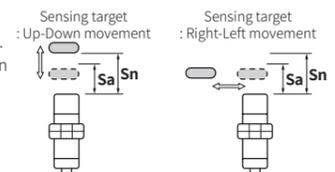


	$\varnothing 8$ mm	$\varnothing 12$ mm	$\varnothing 18$ mm	$\varnothing 30$ mm
$\varnothing A$	15	21	29	42
B	13	17	24	35

Setting Distance Formula

Detecting distance can be changed by the shape, size or material of the target. For stable sensing, install the unit within the 70 % of sensing distance.

Setting distance (Sa)
= Sensing distance (Sn) × 70 %

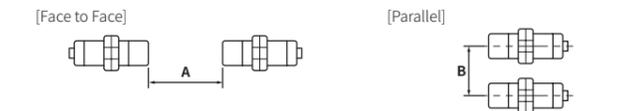


Mutual-interference & Influence by Surrounding Metals

■ Mutual-interference

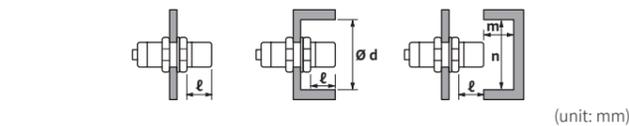
When plural proximity sensors are mounted in a close row, malfunction of sensor may be caused due to mutual interference.

Therefore, be sure to provide a minimum distance between the two sensors, as below table.



■ Influence by surrounding metals

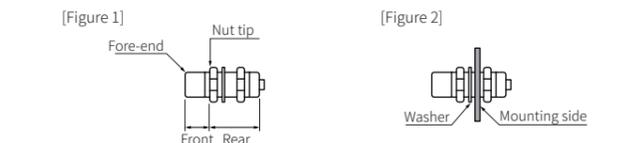
When sensors are mounted on metallic panel, it must be prevented sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart.



Sensing side / Item	$\varnothing 8$ mm		$\varnothing 12$ mm		$\varnothing 18$ mm		$\varnothing 30$ mm	
	Flush	Non-flush	Flush	Non-flush	Flush	Non-flush	Flush	Non-flush
A	9	12	12	24	30	48	60	90
B	16	24	24	36	36	54	60	90
l	0	8	0	11	0	14	0	15
$\varnothing d$	8	24	12	36	18	54	30	90
m	4.5	6	6	12	15	24	30	45
n	12	24	18	36	27	54	45	90

Tightening Torque

Use the provided washer to tighten the nuts. The tightening torque of the nut varies with the distance from the fore-end. [Figure 1] If the nut tip is located at the front of the product, apply the front tightening torque. the allowable tightening torque table is for inserting the washer as [Figure 2].



Sensing side / Strength	$\varnothing 8$ mm		$\varnothing 12$ mm		$\varnothing 18$ mm		$\varnothing 30$ mm	
	Flush	Non-flush	Flush	Non-flush	Flush	Non-flush	Flush	Non-flush
Front size	7 mm	5 mm	13 mm	7 mm	-	-	26 mm	12 mm
Front torque	3.92 N m		6.37 N m		14.7 N m		49 N m	
Rear torque	8.82 N m		11.76 N m		14.7 N m		78.4 N m	