

# Cylindrical Inductive Full-Metal Long-Distance Proximity Sensors

## PRFD Series (DC 3-wire)

### INSTRUCTION MANUAL

TCD220040AB

**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.

**03. Do not supply power without load.**  
Failure to follow this instruction may result in fire or product damage.

#### Cautions during Use

- Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
- 10-30 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 (UL Type I Enclosure)
  - Altitude max. 2,000 m
  - Pollution degree 3
  - 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 Ø 4 mm cable with a tensile strength of 30 N or over and the Ø 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 23 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.

PRFD ① ② ③ - ④ ⑤ ⑥ - ⑦

- ① Characteristic**  
No-mark: General type  
A: Spatter-resistant type
- ② Connection**  
No-mark: Cable type  
W: Cable connector type  
CM: Connector type
- ③ DIA. of sensing side**  
Number: DIA. of sensing side (unit: mm)
- ④ Sensing distance**  
Number: Sensing distance (unit: mm)
- ⑤ Power supply**  
D: 10 - 30 VDC
- ⑥ Control output**  
N: NPN Normally Open  
P: PNP Normally Open
- ⑦ Cable**  
V: Oil resistant cable type

#### Product Components

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

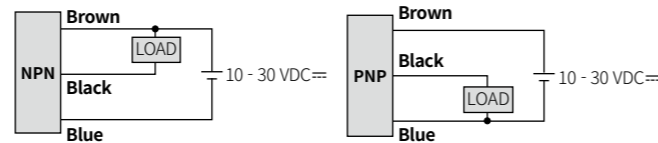
#### Sold Separately

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

#### Connections

##### ■ Cable type

- The white wire of DIA. of sensing side Ø 8 mm is not used.

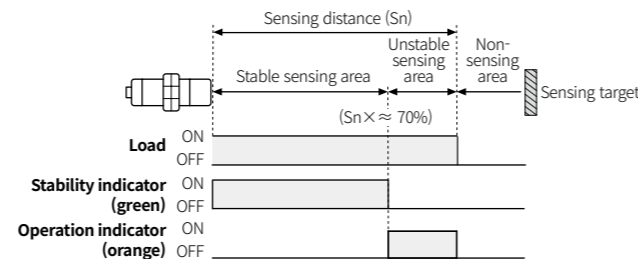


##### ■ Cable connector / Connector type

- For wire and 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	VCC
②	-	-
③	Blue	0 V
④	Black	OUT

#### Operation Timing Chart



#### Specifications

Installation	Flush type			
<b>General</b>	PRFD□08-2D□-□	PRFD□12-3D□-□	PRFD□18-7D□-□	PRFD□30-12D□-□
<b>Spatter-resistant</b>	PRFDA□08-2D□-□	PRFDA□12-3D□-□	PRFDA□18-7D□-□	PRFDA□30-12D□-□
<b>DIA. of sensing side</b>	Ø 8 mm	Ø 12 mm	Ø 18 mm	Ø 30 mm
<b>Sensing distance<sup>01)</sup></b>	2 mm	3 mm	7 mm	12 mm
<b>Setting distance</b>	0 to 1.4 mm	0 to 2.1 mm	0 to 4.9 mm	0 to 8.4 mm
<b>Hysteresis</b>	≤ 15 % of sensing distance			
<b>Standard sensing target: iron</b>	12 × 12 × 1 mm	12 × 12 × 1 mm	30 × 30 × 1 mm	54 × 54 × 1 mm
<b>Response frequency<sup>02)</sup></b>	150 Hz	80 Hz	80 Hz	50 Hz
<b>Affection by temperature</b>	≤ ± 20 % for sensing distance at ambient temperature 20 °C			
<b>Indicator</b>	Operation indicator (orange), stable indicator (green), Abnormal detect indicator (cross-flashing green, orange)			
<b>Certification</b>	CE, RoHS, REACH			

01) Use accessories (nut, washer) made of SUS. Or, sensing distance cannot be guaranteed.

02) 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)	Ø 8 mm	Ø 12 mm	Ø 18 mm	Ø 30 mm
<b>Cable type</b>	≈ 60 g (≈ 85 g)	≈ 80 g (≈ 110 g)	≈ 100 g (≈ 135 g)	≈ 165 g (≈ 220 g)
<b>Cable connector type</b>	≈ 25 g (≈ 50 g)	≈ 35 g (≈ 60 g)	≈ 55 g (≈ 90 g)	≈ 120 g (≈ 180 g)
<b>Connector type</b>	≈ 10 g (≈ 35 g)	≈ 15 g (≈ 40 g)	≈ 32 g (≈ 67 g)	≈ 85 g (≈ 140 g)

<b>Power supply</b>	10 - 30 VDC≒ (ripple P-P: ≤ 10 %)
<b>Current consumption</b>	≤ 20 mA
<b>Control output</b>	≤ 100 mA
<b>Residual voltage</b>	≤ 2.5 V
<b>Protection circuit</b>	Surge protection circuit, output short over current protection circuit, reverse polarity protection
<b>Insulation resistance</b>	≥ 50 MΩ (500 VDC≒ megger)
<b>Dielectric strength</b>	1,000 VAC~ 50 / 60Hz for 1 minute (between all terminals and case)
<b>Vibration</b>	1.5 mm double amplitude at frequency 10 to 55 Hz in each X, Y, Z direction for 2 hours
<b>Shock</b>	1,000 m/s <sup>2</sup> (≈ 100 G) in each X, Y, Z direction for 10 times (DIA. of sensing side Ø 8 mm : 500 m/s <sup>2</sup> (≈ 50 G) in each X, Y, Z direction for 10 times)
<b>Ambient temp.<sup>01)</sup></b>	-25 to 70 °C, storage: -25 to 70 °C (no freezing or condensation)
<b>Ambient humi.</b>	35 to 95 %RH, storage: 35 to 95 %RH (no freezing or condensation)
<b>Protection rating</b>	Cable type, cable connector type: IP66, IP67 (IEC standard) Connector type: IP66, IP67 (IEC standard), IP67G (JEM standard), IP68
<b>Connection</b>	Cable type / Cable connector type / Connector type model
<b>Cable spec.</b>	DIA. of sensing side Ø 8 mm: Ø 4 mm, 4-wire <sup>02)</sup> DIA. of sensing side Ø 12 mm, Ø 18 mm, Ø 30 mm: Ø 5 mm, 3-wire
<b>Wire spec.</b>	AWG 23 (0.08 mm, 60-core), insulator diameter: Ø 1.25 mm
<b>Connector</b>	M12 plug connector
<b>Material</b>	Oil resistant cable (dark gray): oil resistant polyvinyl chloride (PVC)
<b>General</b>	Case / Nut: stainless steel 303 (SUS303), washer: stainless steel 304 (SUS304), sensing side <sup>03)</sup> : stainless steel 303 (SUS303)
<b>Spatter-resistant</b>	Case / Nut: stainless steel 303 (SUS303, PTFE coated), washer: stainless steel 304 (SUS304), sensing side <sup>03)</sup> : stainless steel 303 (SUS303, PTFE coated)

01) UL approved surrounding air temperature 60 °C

02) The white wire of DIA. of sensing side Ø 8 mm is not used.

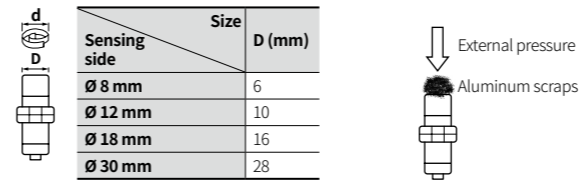
03) Thickness: DIA. of sensing side Ø 8 mm: 0.2 mm / DIA. of sensing side Ø 12 mm, Ø 18 mm: 0.4 mm / DIA. of sensing side Ø 30 mm: 0.5 mm

#### Effect of Aluminum Scraps

When aluminum scraps are attached or stacked at sensing side, the proximity sensor does not detect and sensing signal is OFF.

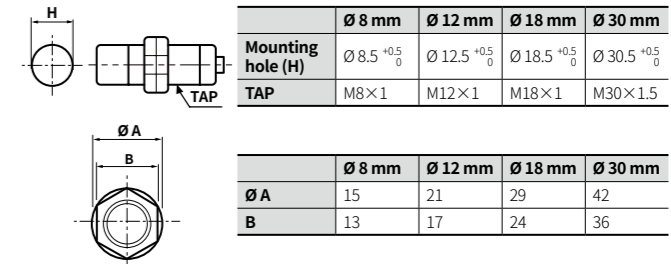
However, the below cases may occur to sensing signal. In this case, remove the scraps.

- When the size of aluminum scraps (d) is bigger than 2/3 of the sensing side size (D)
- When aluminum scraps are attached on the sensing side by external pressure



#### Cut-out Dimensions

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

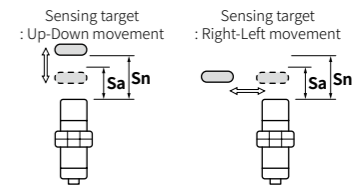


#### Setting Distance Formula

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

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

- When the sensing target is placed over approx. 70% of sensing distance (Sn), the operation indicator (orange) turns ON. When the target is placed within approx. 70 % of sensing distance (Sn), the stability indicator (green) turns ON. Use the sensor at the position where the stability indicator turns ON.

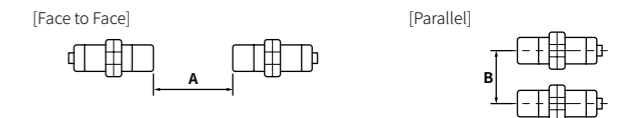


#### Mutual-interference & Influence by Surrounding Metals

##### ■ Mutual-interference

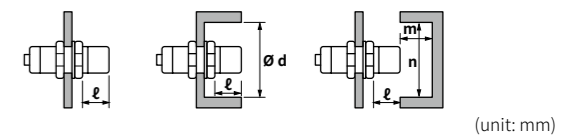
When plural proximity sensors are mounted in a close row, malfunction of sensor may be caused due to mutual interference.

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	Ø 8 mm	Ø 12 mm	Ø 18 mm	Ø 30 mm
<b>A</b>	35	40	65	110
<b>B</b>	30	35	60	100
<b>ℓ</b>	0	0	0	0
<b>Ø d</b>	8	12	18	30
<b>m</b>	4.5	8	20	40
<b>n</b>	30	40	60	100

#### Tightening Torque

Use the provided washer to tighten the nuts.

The allowable tightening torque table is for inserting the washer as below.

Sensing side	Ø 8 mm	Ø 12 mm	Ø 18 mm	Ø 30 mm
<b>Strength</b>				
<b>Tightening torque</b>	3.5 N m	25 N m	70 N m	180 N m