Cylindrical Inductive Full-Metal General / Spatter-Resistant Proximity Sensors

PRF / PRFA Series (DC 2-wire)

For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.
The specifications, dimensions, etc. are subject to change without notice for product improvement. Some models may be discontinued without notice.

Features

- High resistance to impact and wear caused by contact with workpieces or wire brushes (sensor head/housing : stainless steel)
- Reduced risk of malfunction caused by aluminum chips
- Spatter-resistant type
  : PTFE coating prevents malfunctions caused by welding spatter
- Excellent noise immunity with specialized sensor IC
- Built-in surge protection circuit, output short over current protection circuit, reverse polarity protection
- 360° ring type operation indicator (red LED) (except Ø 8 mm model)
- Oil resistant cable
- IP67 protection structure (IEC standards)

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.
- 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 of the product is rubbed with a hard object, PTFE coating can be worn out.
- This unit may be used in the following environments.
  - Indoors (UL Type 1 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 3.5 mm cable with a tensile strength of 25 N, 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 22 cable or over within 200 m.

Ordering Information

This is only for reference.
For selecting the specific model, follow the Autonics web site.

PRF ❶ ❷ T ❸ - ❹ D O - ❺

❶ Characteristic
No-mark: General type
A: Spatter-resistant type

❷ Connection
No-mark: Cable type
W: Cable connector type

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

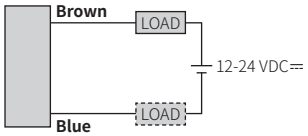
❹ Sensing distance
Number: Sensing distance (unit: mm)

❺ Cable
V: Oil resistant cable type
IV: Oil resistant cable type (IEC standards)

Connections

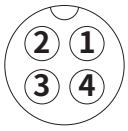
- LOAD can be wired to any direction.
- Connect LOAD before suppling the power.

■ Cable type



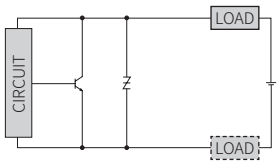
■ Cable connector type

- 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	Normally open	
	Color	Func.
①	Brown	+V
②	-	-
③	-	-
④	Blue	0 V

■ Inner circuit



Operation Timing Chart

	Normally open	
Sensing target	Presence Nothing	
Load	Operation Return	
Operation indicator (red)	ON OFF	

Sold Separately

- Connector cable, Connector connection cable
- Transmission coupler
- Spatter protection cover
- Fixing bracket

Specifications

Installation	Flush type			
General	PRF□T08-1.5DO-□	PRF□T12-2DO-□	PRF□T18-5DO-□	PRF□T30-10DO-□
Spatter-resistant	PRFA□T08-1.5DO-□	PRFA□T12-2DO-□	PRFA□T18-5DO-□	PRFA□T30-10DO-□
DIA. of sensing side	Ø 8 mm	Ø 12 mm	Ø 18 mm	Ø 30 mm
Sensing distance 01)	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	≤ 15 % of sensing distance			
Standard sensing target: iron	8 × 8 × 1 mm	12 × 12 × 1 mm	30 × 30 × 1 mm	54 × 54 × 1 mm
Response frequency 02)	200 Hz	100 Hz	80 Hz	50 Hz
Affection by temperature	≤ ± 20 % for sensing distance at ambient temperature 20 °C			
Indicator	Operating indicator (red)			
Approval	CE cULus EAC	CE cULus EAC	CE cULus EAC	CE cULus EAC
Unit weight (package)	≈ 55 g (≈ 80 g)	≈ 83 g (≈ 110 g)	≈ 97 g (≈ 132 g)	≈ 170 g (≈ 225 g)

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.

Power supply	12-24 VDC⎓ (ripple P-P: ≤ 10 %), operating voltage: 10-30 VDC⎓
Leakage current	≤ 0.8 mA
Control output	3 to 100 mA
Residual voltage	≤ 3.5 V
Protection circuit	Surge protection circuit, output short over current protection circuit, reverse polarity protection
Insulation resistance	≥ 50 MΩ (500 VDC⎓ megger)
Dielectric strength	1,000 VAC~ 50/60Hz for 1 minute (between all terminals and case)
Vibration	1.5 mm amplitude at frequency 10 to 55 Hz in each X, Y, Z direction for 2 hours
Shock	1,000 m/s² (≈ 100 G) in each X, Y, Z direction for 10 times (DIA. of sensing side Ø 8 mm : 500 m/s² (≈ 50 G) in each X, Y, Z direction for 10 times)
Ambient temp. 01)	-25 to 70 °C, storage: -25 to 70 °C (non-freezing or non-condensation)
Ambient humi.	35 to 95 %RH, storage: 35 to 95 %RH (non-freezing or non-condensation)
Protection	IP67 (IEC standards)
Connection	Cable type / Cable connector type model
Cable spec. 02)	DIA. of sensing side Ø 8 mm: Ø 4 mm, 2-wire DIA. of sensing side Ø 12 mm, Ø 18 mm, Ø 30 mm: Ø 5 mm, 2-wire
Wire spec.	AWG 22 (0.08 mm, 60-wire), insulator diameter: Ø 1.25 mm
Connector	M12 connector
Material	Oil resistant cable (dark gray): oil resistant polyvinyl chloride (PVC)
General	Case/Nut: SUS303, washer: SUS304, sensing side 03): SUS303
Spatter-resistant	Case/Nut: SUS303 (PTFE coated), washer: SUS304, sensing side 03): SUS303 (PTFE coated)

01) UL approved surrounding air temperature 40 °C
02) Cable type: 2 m (option: 5 m), cable connector type: 300 mm
03) Thickness: 0.8 mm (DIA. of sensing side Ø 8 mm: 0.4 mm)

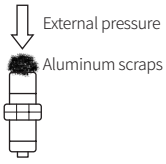
Effect of Aluminum Scraps

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)

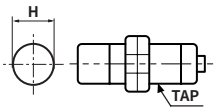
Sensing side \ Size	D (mm)
Ø 8 mm	6
Ø 12 mm	10
Ø 18 mm	16
Ø 30 mm	28

- When aluminum scraps are attached on the sensing side by external pressure

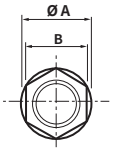


Cut-out Dimensions

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



	Ø 8 mm	Ø 12 mm	Ø 18 mm	Ø 30 mm
Mounting hole (H)	Ø 8.5 $^{+0.5}_{0}$	Ø 12.5 $^{+0.5}_{0}$	Ø 18.5 $^{+0.5}_{0}$	Ø 30.5 $^{+0.5}_{0}$
TAP	M8×1	M12×1	M18×1	M30×1.5

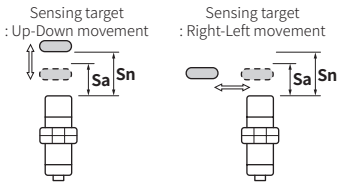


	Ø 8 mm	Ø 12 mm	Ø 18 mm	Ø 30 mm
Ø A	15	21	29	42
B	13	17	24	36

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%

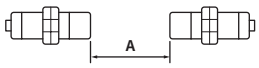


Mutual-interference & Influence by Surrounding Metals

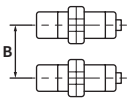
■ Mutual-interference

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.

[Face to Face]

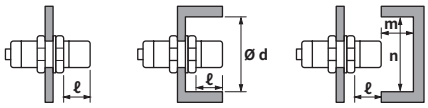


[Parallel]



■ 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.

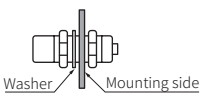


(unit: mm)

Item \ Sensing side	Ø 8 mm	Ø 12 mm	Ø 18 mm	Ø 30 mm
A	35	40	65	110
B	30	35	60	100
ℓ	0	0	0	0
Ø d	8	12	18	30
m	4.5	8	20	40
n	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.



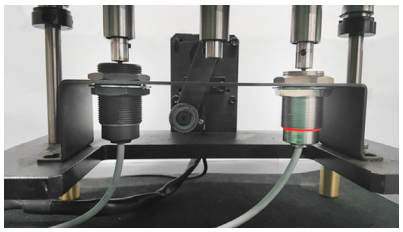
Strength \ Sensing side	Ø 8 mm	Ø 12 mm	Ø 18 mm	Ø 30 mm
Tightening torque	3.5 N m	25 N m	70 N m	180 N m

Durability Test

High resistance to the impact of removing Welding sludge attached to the sensing face

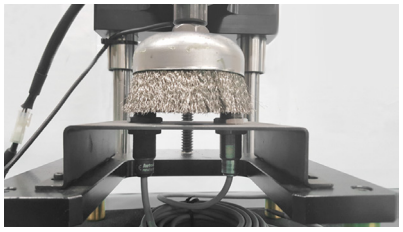
■ Continuous hitting test

• Test model: PRF18, hitting object: 1.3 kg of weight, hitting speed: 48 times per 1 min, The number of hitting times: 300 thousand times

Test conditions	Result
	

■ Metallic brush test

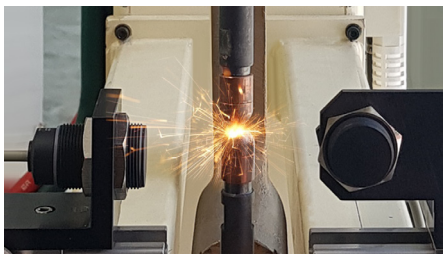
• Test model: PRF18, testing object: stainless cup brush, rotation speed: 80 RPM, testing time: 3 hours

Test conditions	Result
	

Electromagnetic Resistance Test

Large current from welding generates magnetic field which can affect the proximity sensor to malfunction due to noise. This product, however, can be used near strong noise without malfunctioning, thanks to excellent electromagnetic resistance.
This test is conducted in the environment of welding. Minimum sensing distance can be different by welding environment.

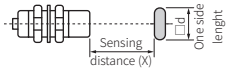
• Test model: all Series, welding current: 13,000 A, installation direction: front and side

Test conditions	Remarks
	Recommended to use spatter protection cover (sold separately) for general type.

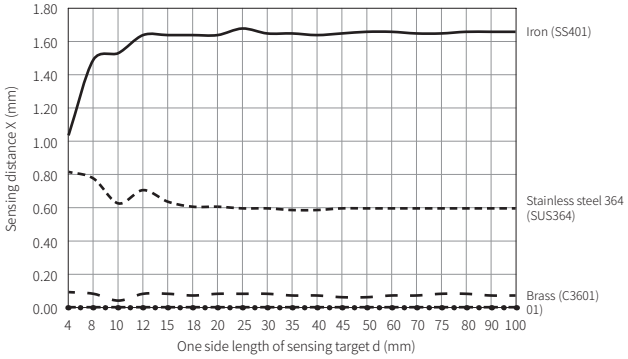
■ Minimum sensing distance between weld and sensor

Installation direction \ Sensing side	Ø 8 mm	Ø 12 mm	Ø 18 mm	Ø 30 mm
Front	60 mm	30 mm	10 mm	120 mm
Side	70 mm	60 mm	50 mm	120 mm

Sensing Distance Feature Data by Target Material and Size

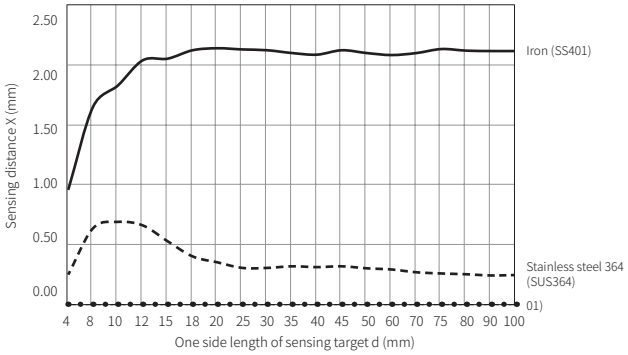


• Ø 8 mm



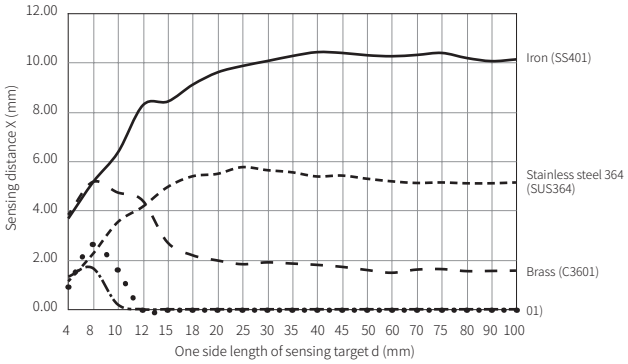
01) Aluminum (ALS052), Copper (C1100)

• Ø 12 mm



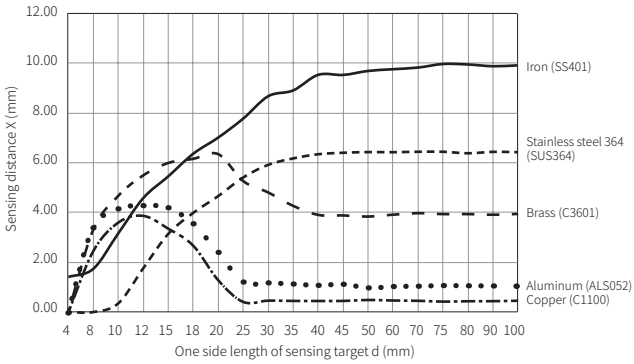
01) Brass (C3601), Aluminum (ALS052), Copper (C1100)

• Ø 18 mm

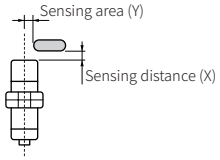


01) Aluminum (ALS052), Copper (C1100)

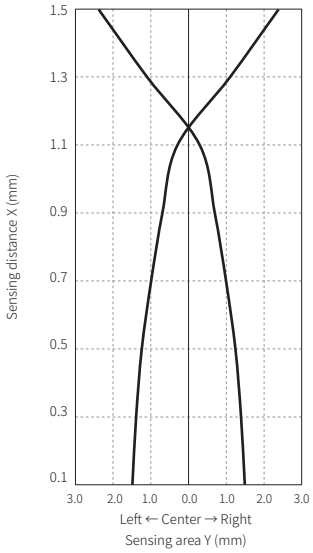
• Ø 30 mm



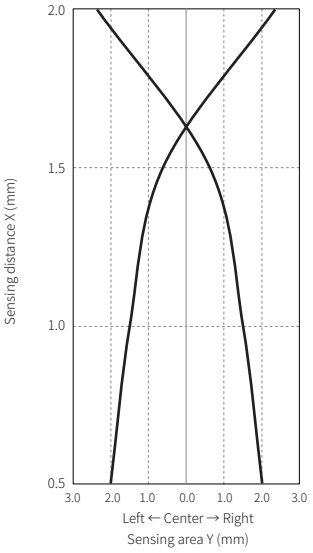
Sensing Distance Feature Data by Parallel (left/right) Movement



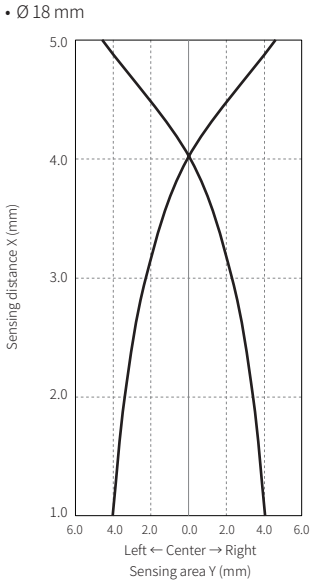
• Ø 8 mm



• Ø 12 mm



• Ø 18 mm



• Ø 30 mm