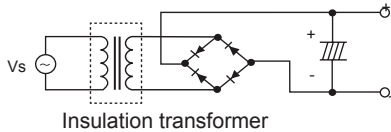# Proper Usage

▣ Proper Usage

To using proximity sensors, please refer to the below instructions.

◎ Power supply

● DC type proximity sensor

Power of DC type proximity sensor should be used the rectified power by insulation transformer and ripple should be within 10%.

Insulation transformer

● AC type proximity sensor

Supply power should be sine wave. Square wave of AC power may cause return error, etc.

◎ Load

When wiring proximity sensor, be sure that the load should not be short by wrong connection of power, wrong wiring.

- DC 2-wire has polarity and be sure that the power polarity is properly connected.
  Load connection can be connected to any direction.
  Do not supply the power without loads, or inner element is damaged.
- DC 3-wire has built-in load short protection circuit but this protection circuit operates only for normal operation.
  Be sure that shorted output line with + power line or unproper polarity.
- AC 2-wire power is AC and there is no polarity.
  Load connection method is same as DC 2-wire method.
  Do not supply the power without loads, or inner element is damaged.

◎ Wiring

Do not use the same conduit with cord of proximity sensor and electric power line or power line. Also avoid the same conduction, or it may cause malfunction.
It is possible to extend cable with over 0.3mm^2 and max. 200m.
If fast response is required and using extended cable, it may cause distortion phenomenon of output wave and it does not operate properly.
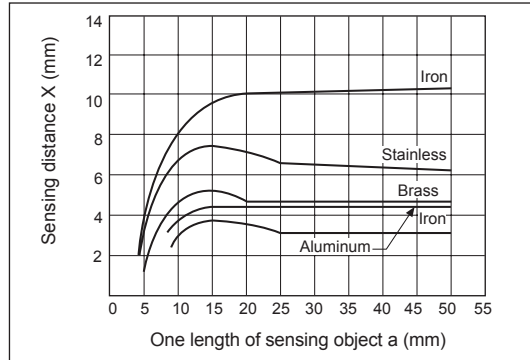
◎ Sensing distance by material of sensing object

Material of the standard sensing object is magnetic metal (iron). Be sure that sensing distance of nonmagnetic metal (aluminum, etc) for a sensing object is shorten extremely.

Material	Sensing distance
Iron	100%
Stainless	Approx. 65%
Brass	Approx. 40%
Aluminum	Approx. 30%
Copper	Approx. 28%

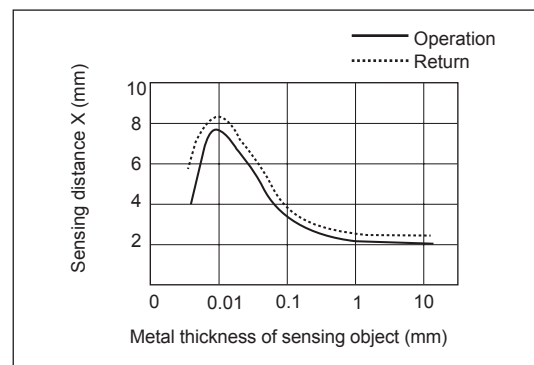### ◎ Sensing distance by size of sensing object

If a sensing object is smaller than the standard sensing object, the sensing distance is shorten. If a sensing object is bigger than the standard sensing object, the sensing distance is constant. The below figure is characteristics data by changing one side of sensing distance per a (mm) based on 1mm thickness of square metal plate as a sensing object.
E.g.) For PR30-10DN

◎ Sensing distance of thickness of sensing object

Thickness of standard sensing object is 1mm. If the thickness is over 1mm and sensing distance does not have any variation.
Even though material of a sensing object is nonmagnetic metal (aluminum, copper, etc) and the thickness is around 0.01mm, the sensing object has the same sensing distance as magnetic metal's. If a sensing object which is ultra thin by film, etc or has no conductive cannot be detected.
E.g.) Proximity sensor: PR18-8DN, Sensing object: Aluminum

Autonics

◎ **Sensing distance by plate of sensing object**

Refer to the below table for changing sensing distance by the plate of sensing objects.

● Effect by plate (examples of standards)   (unit: %)

Thickness of plated type \ Applied metal	Iron	Brass
Not plated	100	100
Zn 5 to 15μm	90 to 120	95 to 105
Cd5 to 15μm	100 to 110	95 to 100
Ag 5 to 15μm	60 to 90	85 to 100
Cu 10 to 20μm	70 to 95	95 to 105
Cu 5 to 15μm	—	95 to 105
Cu 5 to 10μm + Ni (10 to 20μm)	70 to 95	—
Cu (5 to 15μm) + Ni (10μ)+Cr (0.3μm)	75 to 95	—

※ Reference: % of not plated sensing object

◎ **The characteristic of spatter-resistance type**

The hot arc from arc welding machine is adhesive even with metals or plastics. Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with teflon against thermal resistance. Also, the protection cover sold optionally has the same function.

◎ **Protection cover**

If a proximity sensor is installed at the place where there are lots of arc when welding arc, use the protection cover to prevent a proximity sensor.
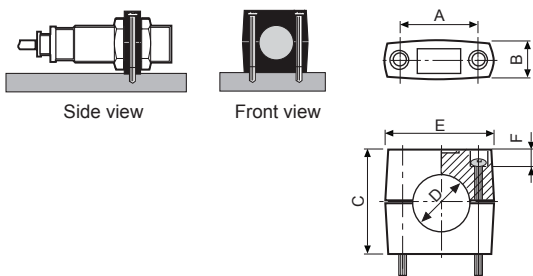
ø1

A B D C

Material: Silicone rubber
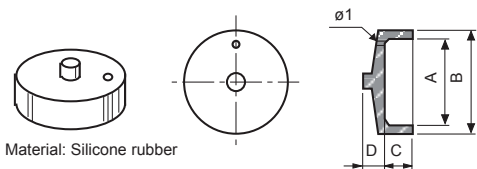
Item \ Model	P90-M12	P90-M18	P90-M30
A	ø11	ø17	ø28.5
B	ø14	ø21	ø33
C	5.0	6 0	8.0
D	1.0	3 0	6.0
Applied sensor	M12	M18	M30

※Only for Flush (shield) type

◎ **Fixing bracket for cylindrical proximity sensor**

If fixing holes are not made for cylindrical proximity sensor, use a cylindrical fixing bracket as below.

Side view   Front view

A B E F C D

Item \ Model	P90-R12	P90-R18	P90-R30
A	24±0.2	32±0.2	45±0.2
B	Max. 11.5	Max. 16	Max. 16
C	20	30	50
D	ø12	ø18	ø30
E	Max. 34.4	Max. 47	Max. 60
F	6.0	10	10
Fixing bolt	M4×20	M5×30	M5×50
Applied sensor	M12	M18	M30

※For Non-flush (non-shield) type, be sure effect by ambient material.

◎ **Other causes**

● When AC 2-wire proximity sensor is supplied to the power with noise, the inner circuit may be broken.

● **Surge protection (AC 2-wire)**

If there are machines (motor, welding, etc), which occurs big surge around this unit, please install Varistor or absorber to source of surge, even though there is built-in surge absorber in this unit.
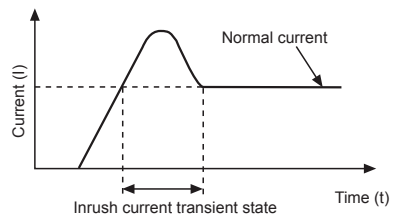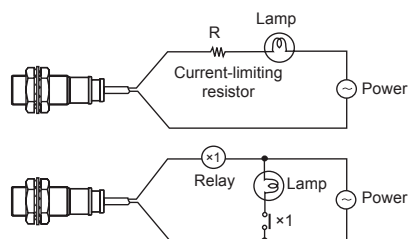
● **Effect by leakage current (residual voltage)**

DC 2-wire and AC 2-wire proximity sensor consumes a few of current to operate the circuit even thought the power is OFF. This is called as leakage current. It may cause return error of load because there is small voltage (load residual voltage) at load. Please check that this voltage is below the return voltage of load (leakage current is below than return current of load)

-Refer to "● When operating current of load is not enough" of page D-69.

● **Load with large inrush current (DC 2-wire, AC 2-wire)**

When using load with big inrush current (lamp, motor, etc.), large inrush current flows due to low initial resistance value and it returns to steady state current by high resistance value after certain time. In this case, too large current flows at initial power and it may cause damage to inner circuit of proximity sensor. Use additional relay or current-limit resistance (R) to protect proximity sensor.
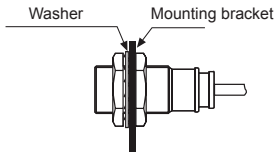
R   Lamp
Current-limiting resistor   ~ Power

Relay   Lamp   ~ Power
×1   ×1

Current (I)   Normal current
Inrush current transient state   Time (t)

Proper Usage

● Do not put overload to tighten nuts.
Please use the washer for tightening.

<Figure 1>

<Figure 2>
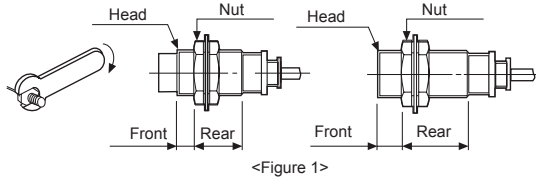
※Allowable tightening torque of nuts may be different by the distance from the head. For allowable tightening torque and the range of front and rear parts, refer to the below table. (front part is the range from head to size of the below table and rear part is including the nuts as the <Figure 1>. please apply the tightening torque of the front part when the nut on the front is located in the front part.)
※Allowable strength tightening (torque) denotes a torque value when using a provided washer as the <Figure 2>.

<Allowable strength tightening for nut>

Model	Strength	Front part		Rear part
		Size	Torque	Torque
PR08 Series	Flush	7mm	40kgf·cm (3.92N·m)	90kgf·cm (8.82N·m)
	Non-flush	5mm		
PR12/ PRD12 Series	Flush	13mm	65kgf·cm (6.37N·m)	120kgf·cm (11.76N·m)
	Non-flush	7mm		
PR18 / PRD18 Series	Flush	—	150kgf·cm (14.7N·m)	
	Non-flush	—		
PR30 / PRD30 Series	Flush	26mm	500kgf·cm (49N·m)	800kgf·cm (78.4N·m)
	Non-flush	12mm		

※ (1kgf·cm = 0.098N·m)

● Wrong wiring damages inner circuit. Check the wiring connection before supplying the power.
● Check the voltage range due not over the rated specifications for power input.
● Do not operate proximity sensor when supplying the power after 60ms, muting time of proximity sensor, or it may cause malfunction.
● Do not connect capacitive load directly to the unit which does not built-in short protection circuit for output.
If it is over the rated load current, short protection circuit operates and if it is below the rated load current, it is cleared automatically.
● Turn OFF the power for wiring.
● Wire must be as short as possible in order to avoid noise.
● Be sure that for the plated sensing object, the sensing distance is varied by plating materials.
● If material dust sticks at the sensing part, it may cause malfunction.

● If the neck of wiring is move during operation, it may cause damage to wire.
Make big bending radius.
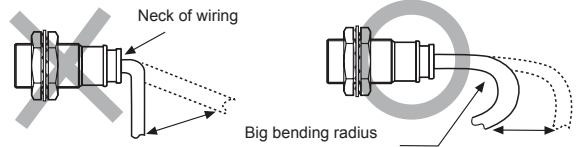
◎ Maintenance

For long-term using proximity sensor, check the below items.
● Installation environment for sensing target and proximity sensor, untightening of nut and distortion
● Untightening of wiring and connection, wrong connection, and disconnection
● Attached or accumulated metal dust at sensing part
● Setting distance
● Ambient environment and temperature

◎ Environment

To maintain stable operation, reliability and long life cycle, do not use this unit out of the rated temperature or outside. Proximity sensor has IP67 protection structure but use the cover not to touch water or cutting oil, etc. Do not use this unit at the place where there is chemicals such as acetic acid, strong alkaline, or chromate, etc.
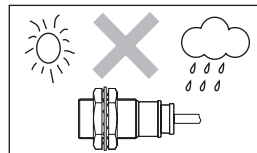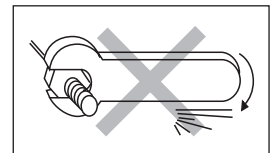

Do not use this unit outdoors.
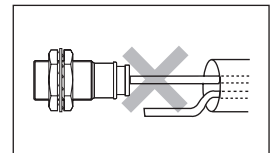
Do not use the same conduit with electric power line or power line, or it may cause malfunction.
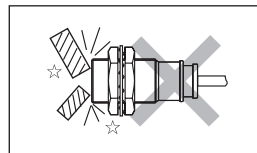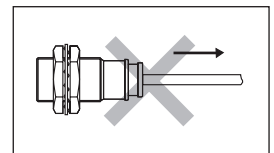

Sensing target should not hit the sensing side of proximity sensor.

Do not put overload to tighten a nut.

Be sure to the strong chemicals such as acid or alkaline.

Do not pull over the cable with excessive load.
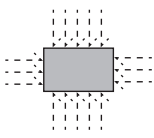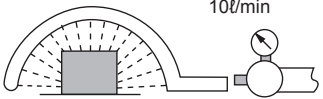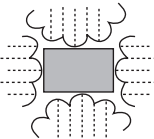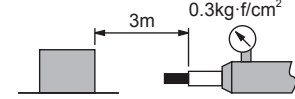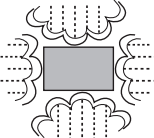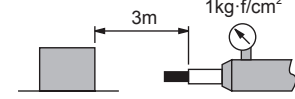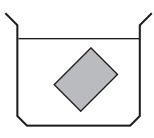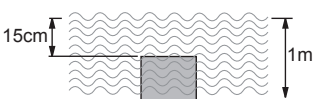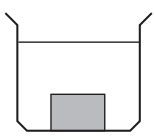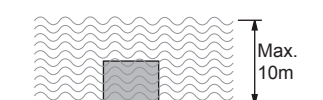
▣ Protection Structure

● IEC (International Electrotechnical Commission)

IP 6 ☐

IEC (International Electrotechnical Commission) Standard (IEC 60529)

■ Protection against ingress of water.

Code	Level of protection		Test method outline
4		No harmful effect of water spray from all direction	Splashing water from all direction for 10 min 10ℓ/min
5		No harmful effect of water splash from all direction	Splashing water from all direction for 3 min 3m 0.3kg·f/cm^2 Diameter of discharging nozzle: Ø6.3
6		No harmful effect of strong water jets from all direction	Splashing water from all direction for 3 min 3m 1kg·f/cm^2 Diameter of discharging nozzle: Ø12.5
7		No harmful effect of water dip in certain level of pressure and length of time	Dip into 1m depth water for 30 min 15cm 1m
8		No harmful effect against water sink	Dip into 10m depth water continually Max. 10m

■ Protection against solid object

Code	Level of protection	
6	Dust tight	No ingress of dust; complete protection against contact

International Protection