OMRON

Environment-resistant Series

Oil-resistant Components

Let Us Help You

Eliminate Production Line Stoppages

No Cutting Oil Ingress by Any Path

Unexpected Component Failures:

Approx. 30% Are Caused by Cutting Oil.

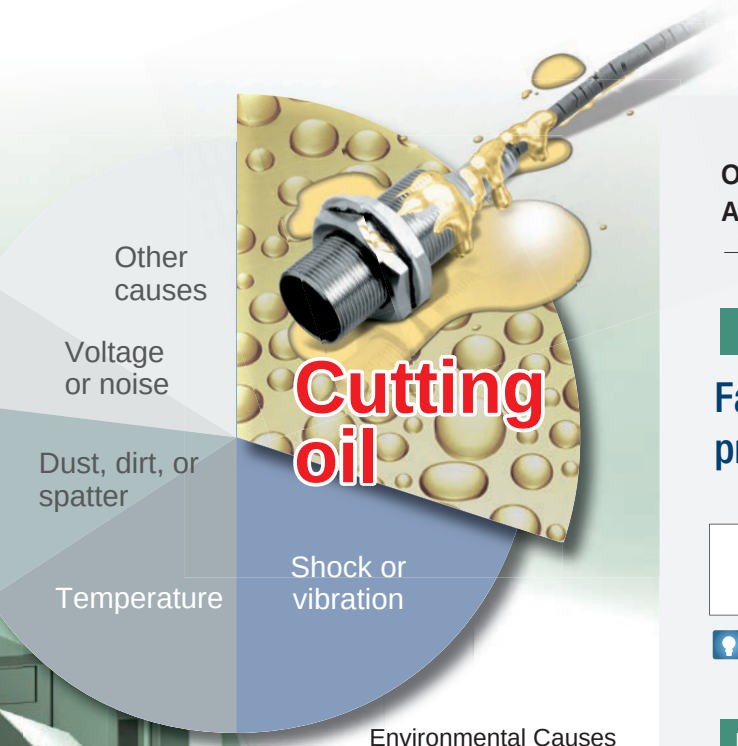
OMRON's Oil-resistant Components Resist Oil for 4 Years

*Refer to page 12 for details on oil resistance performance.

Five products, more than 140 models are available.

Let OMRON help you greatly reduce unexpected production line stoppages by using the Components that shut out cutting oil for four years and thereby increase operation rates.

Oil-resistant Fiber Units



Environmental Causes of Component Failures

*Based on June 2016 OMRON investigation.

OMRON's Oil-resistant Components Solve Problems at All Phases of Production

Management

Factories must be capable of stable production of scheduled quantities.

Eliminate lost opportunity resulting from unexpected production line stoppages.

POINT The opportunity to invest in new projects is increased.

Maintenance

Reducing unscheduled maintenance through stable operation is important.

Unscheduled maintenance visits and replacement frequencies are greatly reduced.

POINT Time can be used effectively for improvement activities.

Production

New facilities must start stable operation without delay.

The risk of faults in newly commissioned facilities is reduced.

POINT A smooth transition can be made to the next production facility commissioning.

Facility Design

Overseas facilities must provide stable operation.

The risk of faults in newly commissioned overseas facilities is reduced. Maintenance cost for unscheduled visits overseas is reduced.

POINT Resources can be centered on designing new facilities.

No Cutting Oil Ingress by Any Path

The Strongest Material

Cables with Fluororesin Sheaths

Fluororesin Blocks Ingress from Cables

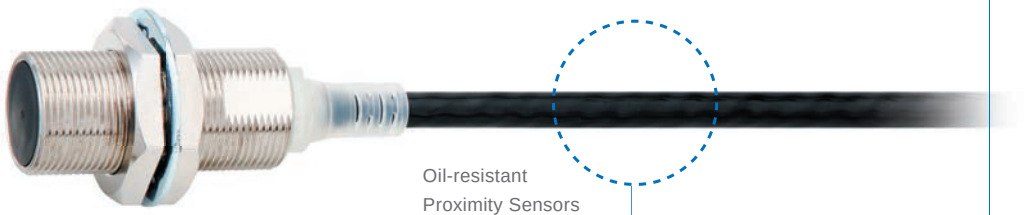
Oil-resistant Connectors
XS5□R

Patent Pending

Fluororesin Outer Cable Sheath

Fluororesin Sheath

Fluororesin, which provides superior resistance to corrosion, is used for the outer cable sheath to suppress cable swelling and deterioration and prevent the ingress of cutting oil into the PCB inside the Sensor.

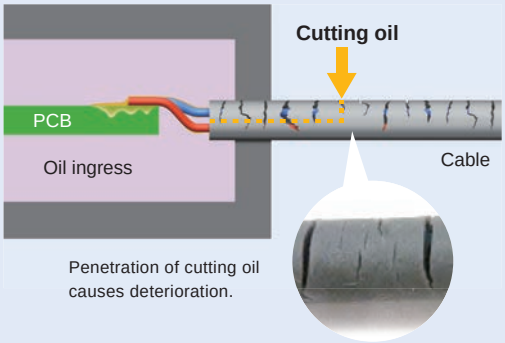


Oil-resistant Proximity Sensors
E2ER/E2ERZ

Proximity Sensors and Photoelectric Sensors, Limit Switches, Connectors

Previous Models Cable Sheath: PVC or PUR

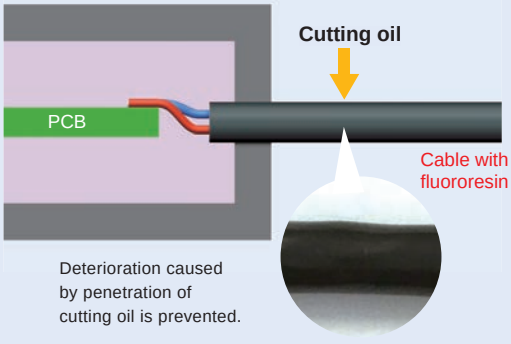
Water-insoluble cutting oils deteriorate PVC and water-soluble cutting oils deteriorate PUR, so the correct cable must be used. Application in an oily environment that causes deterioration makes the cable harden and break, resulting in ingress of cutting oil to the conductor insulation surface. The oil follows this surface to enter the PCB and destroy the circuit.



Penetration of cutting oil causes deterioration.

NEW Cable Sheath: Fluororesin

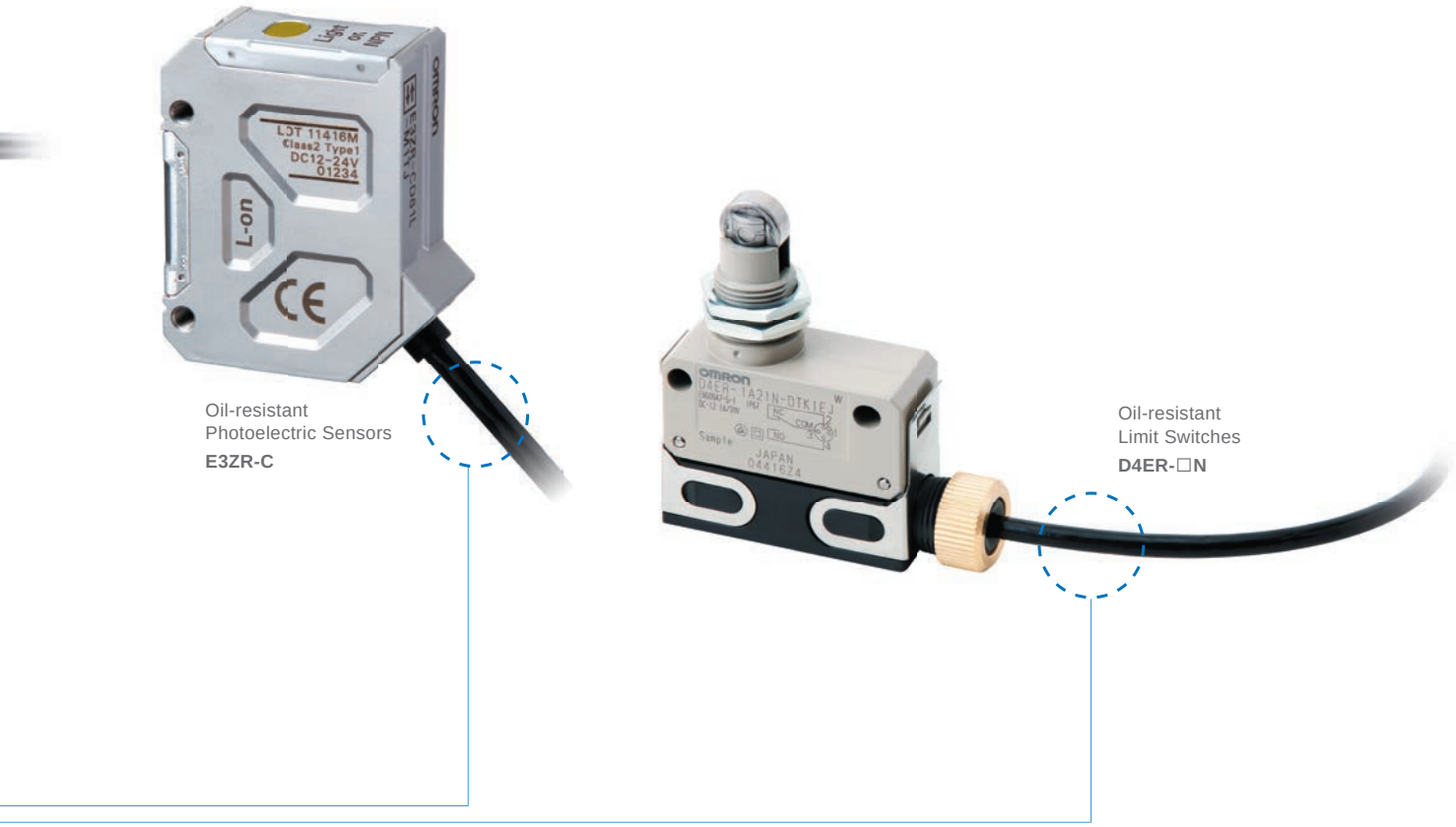
Fluororesin, which is less likely to be deteriorated by either water-insoluble or water-soluble cutting oils, is used for the cable sheath. This prevents penetration of cutting oils into the cable.



Deterioration caused by penetration of cutting oil is prevented.

*The Strongest Material: Based on June 2016 OMRON investigation.

The results of a thorough analysis of the ingress paths of cutting oil show that the deterioration of cable sheaths is a large factor. The cable sheaths of OMRON's Oil-resistant Components are made from fluororesin materials to provide maximum protection against the deterioration with a unique new concept. The result is an oil resistance impregnable to even highly aggressive cutting oils.



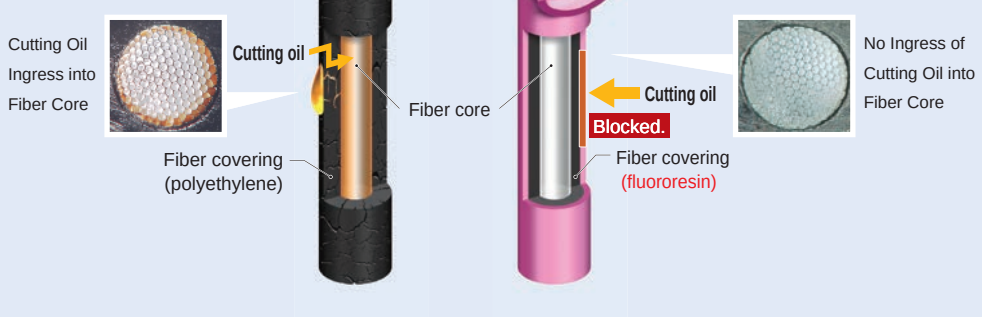
Fiber Units

Previous Models Cable Sheath (Fiber Covering): Polyethylene

Using these cables for extended periods of time in oily environments causes the cable sheath (fiber covering) to harden and crack, resulting in the ingress of cutting oil into the fiber core. This reduces the light level.

NEW Cable Sheath (Fiber Covering): Fluororesin

The fluororesin that covers the entire surface of the cable sheath (fiber covering) prevents the penetration of cutting oil.



Oil-resistant
Fiber Units
E32-T11NF

No Cutting Oil Ingress by Any Path

The Strongest Material

New Rubber Material Combining HNBR and Fluororubber

OMRON-developed Rubber Blocks Ingress through Joints and Moving Sections

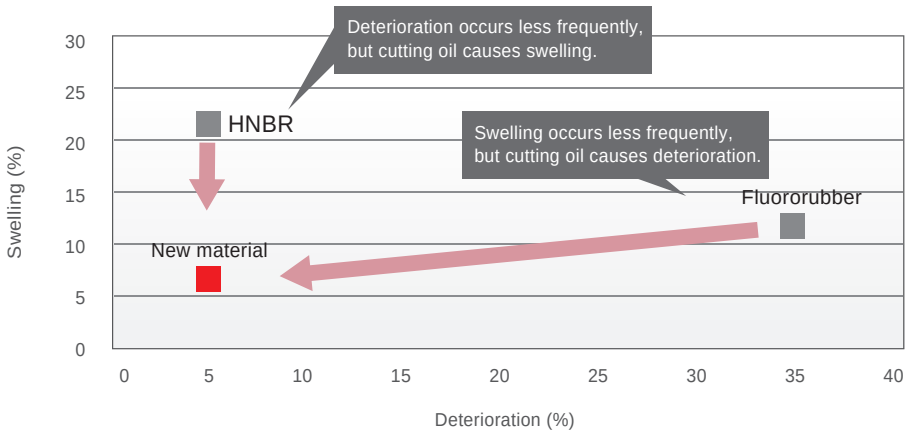
Patented

New Rubber Material Combining HNBR and Fluororubber

New Rubber Material

Hydrogenated nitrile butadiene rubber (HNBR), which provides superior resistance to oil, was blended with fluororubber in a unique OMRON compound to develop a new rubber that provides superior resistance to both swelling and deterioration due to cutting oil.
It is used in seals for joints and moving sections that prevent ingress to prevent deterioration and destruction of the seal due to cutting oil, resulting in increased oil resistance performance.

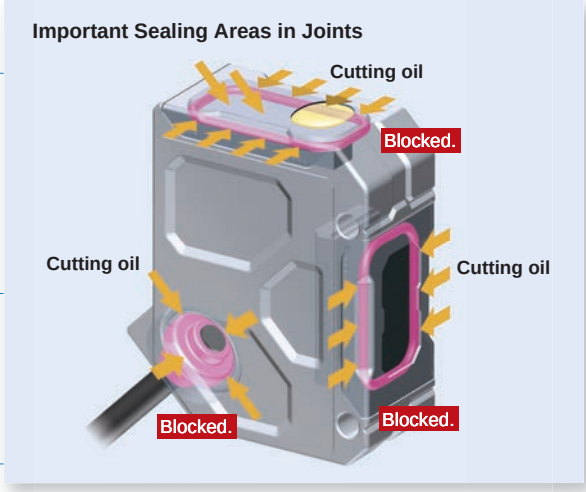
This new material combines the benefits of HNBR and fluororubber



Photoelectric Sensors

Oil-resistant
Photoelectric Sensors
E3ZR-C

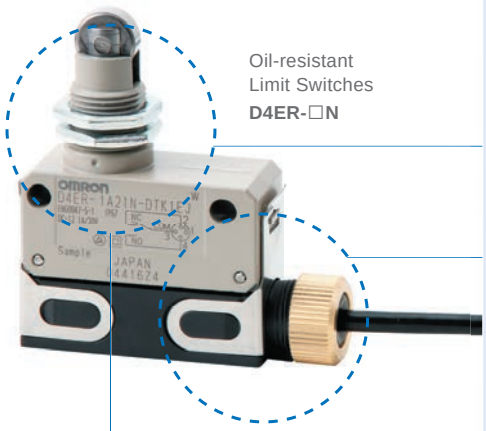
Important Sealing Areas in Joints



*The Strongest Material: Based on June 2016 OMRON investigation.

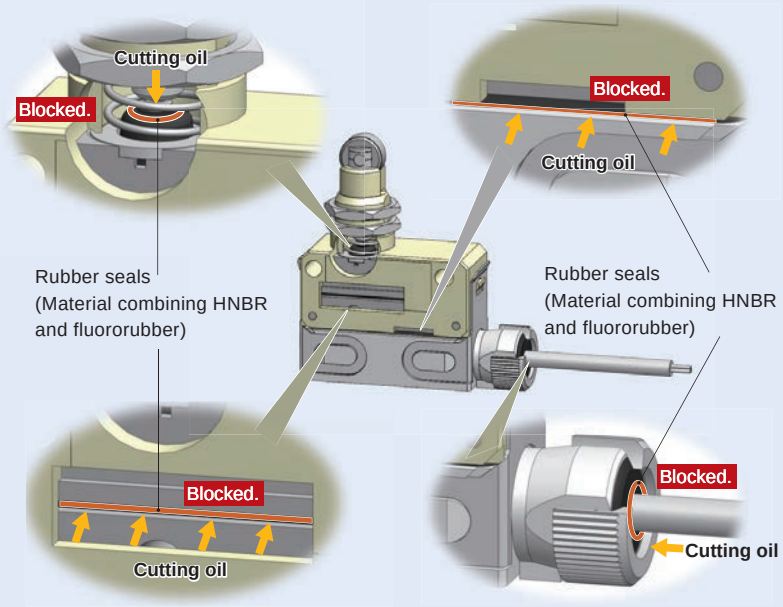
In addition to deterioration of cable sheaths, deterioration of the rubber used at joints and moving sections is also a major cause of ingress of cutting oil. In order to prevent rubber deterioration, OMRON's Oil-resistant Components use a new fluorinated rubber at joints and moving sections. Combined with fluororesin cables, this double use of the strongest materials forms an impregnable wall of oil resistance.

Limit Switches



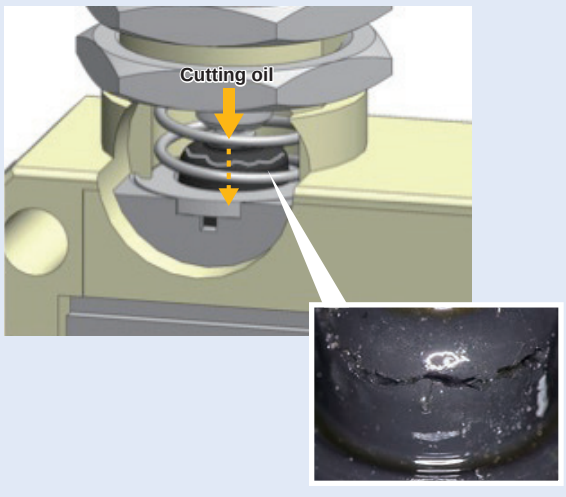
Oil-resistant
Limit Switches
D4ER-□N

Important Sealing Areas in Moveing Sections



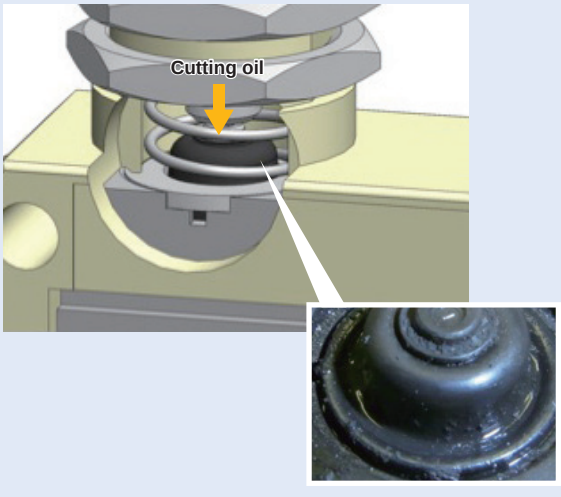
Previous Models Rubber Seal: NBR

Long-term use in an oily environment leads to the hardening and splitting of the rubber seals that block the ingress of cutting oil from moving sections. Cutting oil gets inside and destroys the built-in switches.



NEW Rubber Seal: Material Combining HNBR and Fluororubber

The moving sections are shielded with a new rubber material that has superior resistance to swelling and deterioration caused by cutting oil. This blocks the ingress of cutting oil.



No Cutting Oil Ingress by Any Path

Advanced Sealing Method

Ingress through Cable Joints Is Blocked with a State-of-the-art Sealing Method

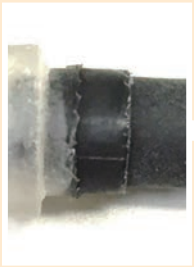
Oil-resistant
Proximity Sensors
E2ER/E2ERZ

Patent Pending

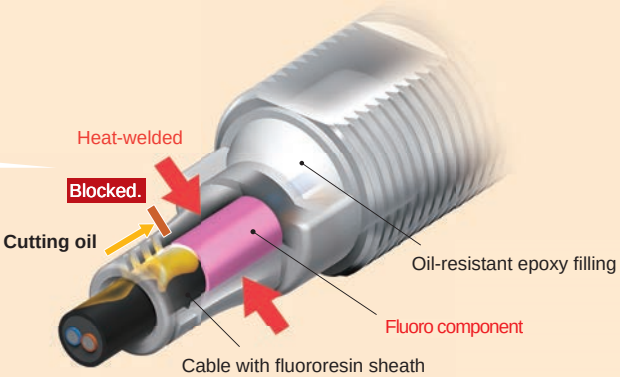
Heat-Sealing Method

Heat-welding Sealing

A fluororesin cable is heat-welded with a fluoro component which has a high bondability and a melting point close to that of the cable. This blocks the ingress of cutting oil from the joined surfaces.



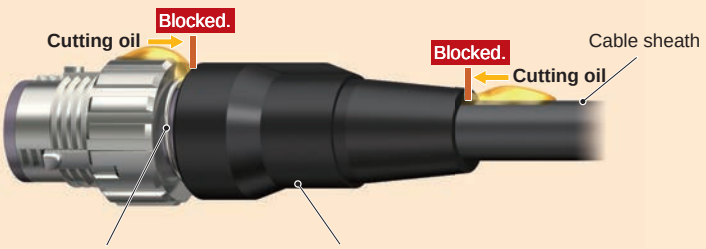
Heat-welded Joint

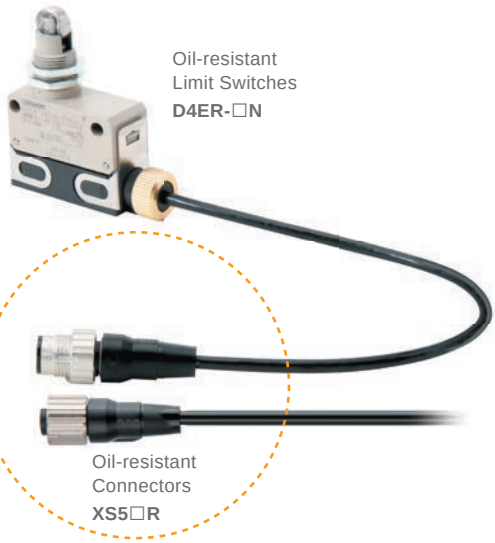


Forming and Sealing Method + Surface Bonding Technique

Forming/ Sealing+ Surface Bonding

OMRON's unique over-molding method that combines forming and sealing methods with surface bonding techniques blocks the ingress of cutting oil through the joined surfaces into the connector.



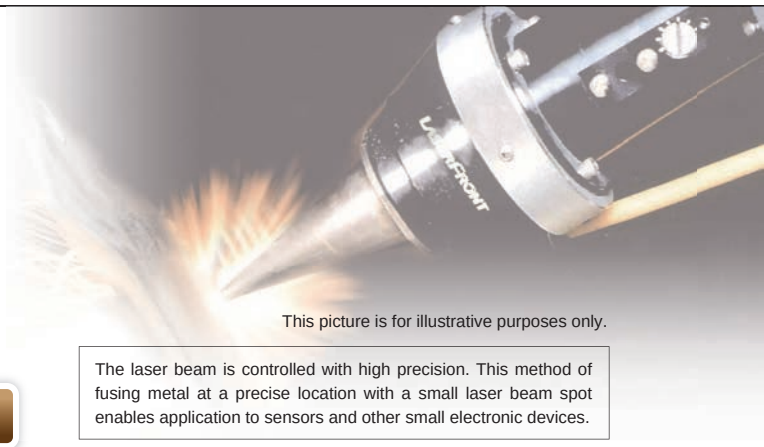


Oil-resistant
Limit Switches
D4ER-□N

Oil-resistant
Connectors
XS5□R

In addition to cable sheaths, joints, and moving sections, cutting oil enters most easily in gaps between different materials. OMRON's Oil-resistant Components completely block the ingress of cutting oil with a state-of-the-art sealing method that does not allow the creation of gaps.

Completely Sealed with Laser Welding



This picture is for illustrative purposes only.

Patent Pending

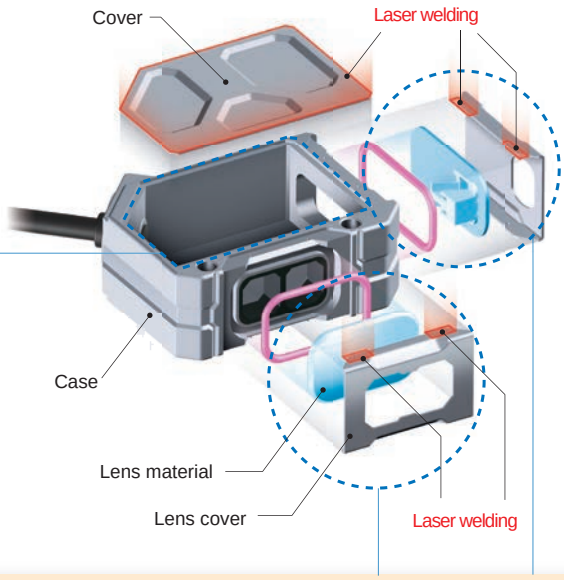
The laser beam is controlled with high precision. This method of fusing metal at a precise location with a small laser beam spot enables application to sensors and other small electronic devices.

Method for Complete Sealing without Adhesive

Laser Welding

The gaps at joints between metal parts are sealed by fusing the metal parts together with the laser beam.
At other joints, O-rings of the new material are used and the circumference is fastened with laser welding to prevent ingress of cutting oil without any adhesive which can cause swelling and deterioration.

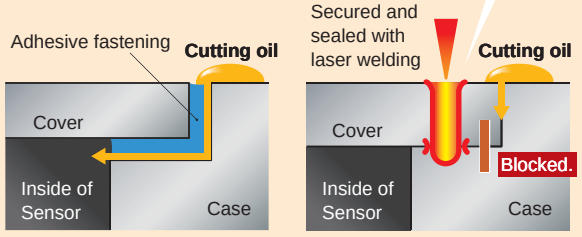
Oil-resistant
Photoelectric Sensors
E3ZR-C



Joints between Metal Parts

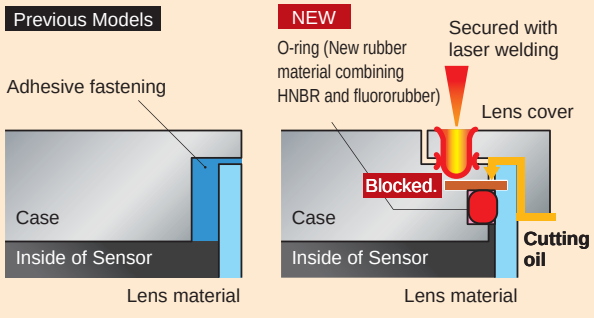
Gaps are sealed by fusing the metal case and cover with a laser beam.

Illustration of Laser Welding



Joints between Metal and Non-metal Parts

Securing the metal case and lens cover with laser welding makes the compressed O-ring seal the gap.



No Cutting Oil Ingress by Any Path

Unique Structure

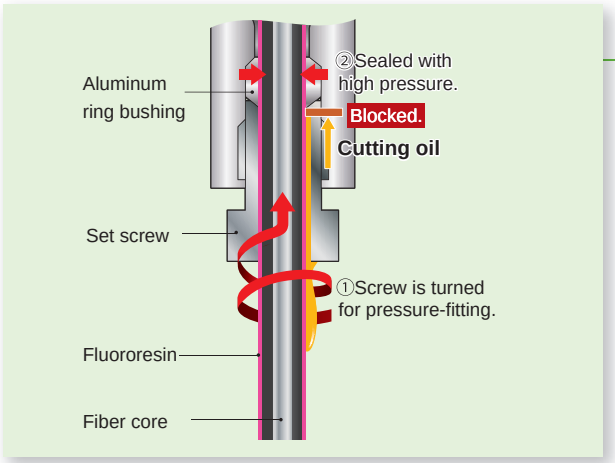
OMRON's Unique Structure without Gaps Blocks Oil Ingress

Mechanical Seal Structure

Mechanical Seal

Fiber Units

An aluminum ring bushing is compressed and deformed by a set screw to seal the structure by pressing against the fluororesin part of the fiber core. This prevents the ingress of cutting oil from the joined surfaces.

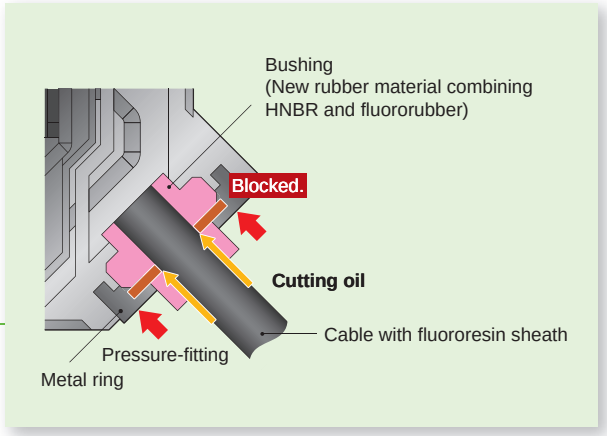


Oil-resistant Fiber Units
E32-T11NF

Photoelectric Sensors

A bushing made from the new material is compressed and deformed by pressing a metal ring against it to tighten and seal the fluororesin cable.
This prevents the ingress of cutting oil through the cable lead section.

Oil-resistant Photoelectric Sensors
E3ZR-C



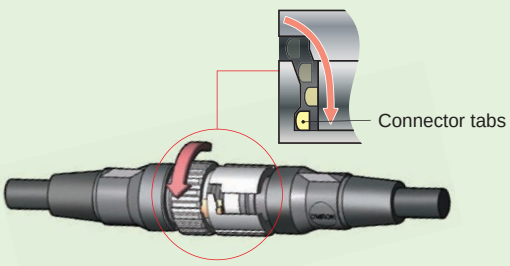
In addition to cable sheaths, joints, and moving sections, cutting oil enters most easily in gaps between different materials. OMRON's Oil-resistant Components completely block the ingress of cutting oil with a unique structure that does not allow the creation of gaps.

Smartclick Patented Smartclick Structure + O-ring

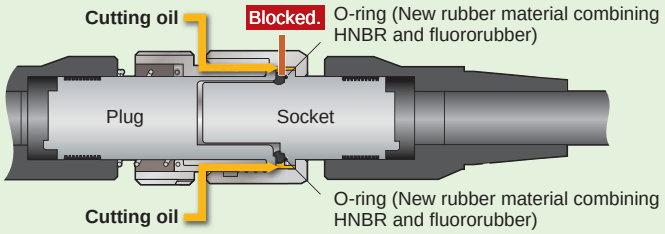
With traditional screw-tightened structures, differences in tightening torque made achieving oil resistance difficult. The Smartclick structure, however, locks in a single operation. The built-in O-ring at the lock position is dependably compressed to block the ingress of cutting oil. This structure eliminates the needs to manage screw tightening torque and prevents screw loosening due to vibration, which were issues in environments requiring oil resistance.

Oil-resistant Connectors **XS5□R**

Unique Smartclick Structure



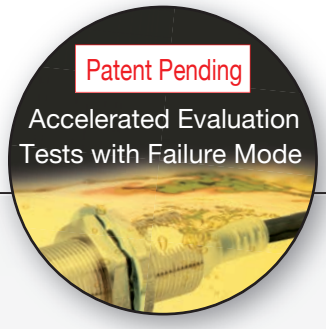
O-ring Seal



Verification of Four-year*1 Oil Resistance

*1. Applicable oil types: specified in JIS K 2241:2000

OMRON's Unique Evaluation Technology



Verification of 4-Year Oil Resistance Based on IP67G*2 and OMRON's Oil-resistant Component Evaluation Standards

OMRON's Environment-resistant Series Oil-resistant Components have been evaluated according to IP67G of JIS C 0920*2 as well as according to the strict evaluation standards for OMRON's oil-resistant components.

Test Conditions

Oil-drop Test

(Illustration)

Test Conditions

Oil Immersion

(Illustration)

Oil Resistance: **4 years**

3 years

2 years

1 year

IP67G*2	
Oil type	N3 (water-insoluble cutting oil)
Evaluation time	48 hours
Evaluation temperature	Room temperature
Dilution concentration	-
Criteria	Appearance and performance

OMRON's Oil-resistant Component Evaluation Standards	
Oil type	A1 (water-soluble cutting oil)
Evaluation time	2,000 hours of machining*3 800 hours of conveyance*4
Evaluation temperature	55°C
Dilution concentration	Undiluted
Criteria	Appearance, performance, and no label text loss

*2. The IP67G is the degree of protection which is defined according to the JIS (Japanese Industrial Standards).
The IP67 indicates the same level of protection as defined by the IEC, and the G indicates that a device has resistance to oil.
*3. This is the evaluation time for products for machining processes where the amount of splashing cutting oil is large. Target products: Oil-resistant Proximity Sensor E2ER/E2ERZ, Oil-resistant Limit Switch D4ER-□N, Oil-resistant Connector XS5□R, Oil-resistant Fiber Unit E32-T11NF
*4. This is the evaluation time for products for conveyance processes where the amount of splashing cutting oil is small. Target products: Oil-resistant Photoelectric Sensor E3ZR-C

Patent Pending

OMRON's Unique Accelerated Evaluation Tests with Failure Mode

To verify a four-year oil resistance, the most aggressive of the water-soluble cutting oils (A1) was used without dilution. (Normally, it is diluted 20 to 30 times with water.)
In addition, an environmental temperature*5 of 55°C, a temperature that is eight times as severe as room temperature, was used in a unique OMRON evaluation method that enables the verification of four-year oil resistance in a short period of time by analyzing failure caused by cutting oils and deriving the time until occurrence of the failure in the field and time until reproduction in accelerated testing linked with the failure state. (Because conveyance processes have less splashing of cutting oil than manufacturing processes, conveyance processes were evaluated for approximately 1/3 the time.)
Also, the criterion, no labeling text loss, was added so that laser-marked lot numbers can be accurately confirmed over the life of the product for reliable usage for four years.

Test oil	A1 (water-soluble cutting oil)
Evaluation time	2,000 hours
Evaluation temperature	55°C
Dilution concentration	Undiluted

Note: The photograph shows an E2ER Proximity Sensor.

*5. Deterioration proceeds twice as quickly for every 10°C increase in the ambient operating temperature (Arrhenius law). Therefore, a 30°C increase over room temperature (25°C) to an evaluation temperature of 55°C would make the evaluation eight times stricter.

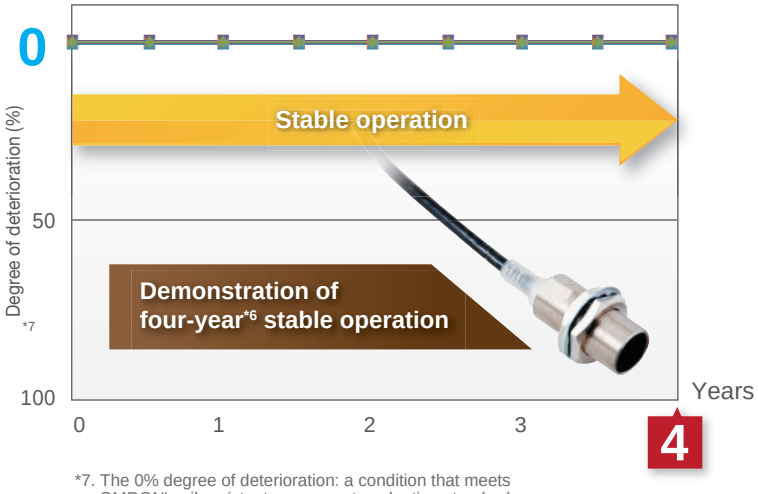
Four-year*6 Stable Operation Verified in Oil Resistance Testing with Representative Cutting Oils

Based on OMRON's oil-resistant component evaluation standards, we performed oil resistance testing with eight representative cutting oils that are used in manufacturing sites (see Table 1). In the results, the four-year*6 stable operation of the "Oil-resistant Components" was demonstrated, and the evaluation of oil resistance for four years was proven.

*6. Years in actual usage environment in OMRON's unique accelerated evaluation tests.

We offer the reassurance of no failure for four years on all these products.

Representative example: Oil-resistant Proximity Sensors **E2ER/E2ERZ**



*7. The 0% degree of deterioration: a condition that meets OMRON's oil-resistant component evaluation standards

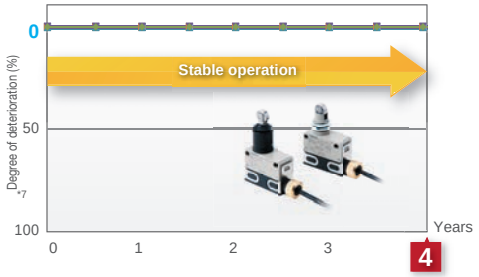
(Table 1)

Sample number	Test oil type	Oil	JIS classification	Kinetic viscosity (mm²/s, 40°C)	pH*8
1	Water-soluble cutting oil	Yushiroken EC50T-3	A1	–	10.2
2		Yushiroken FGE2002	A1	–	8.9
3		Yushiroken FGE366	A1	–	9.3
4		Yushiroken FX90	A1	–	9.6
5		Yushiroken GC	A1	–	9.6
6		Yushiroken FGM427	A2	–	10.2
7		Yushiroken FGM520	A2	–	9.3
8		Yushiroken FGS700	A2	–	9.9
9		Yushiroken FGS795	A2	–	9.6
10		Yushiroken CN-100	A3	–	9.7
11		Yushiroken FGC826	A3	–	9.5
12		Yushiroken FGC950PR	A3	–	10.1
13	Water-insoluble cutting oil	Yushiron Oil CA26	N1	15	–
14		Yushiron Oil CL	N1	2	–
15		Yushiron Cut Abas BZ135	N3	2	–
16		Yushiron Cut Abas BZ224K	N3	10	–
17		Yushiron Cut Abas KZ440	N4	19	–
18		Yushiron Cut Abas SF33	N4	3	–

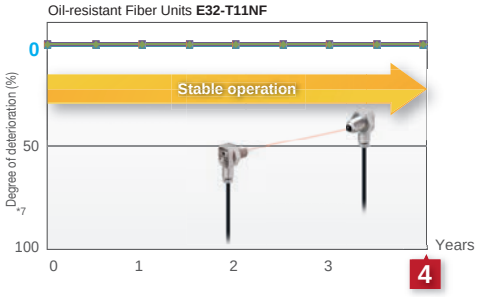
Note. Cutting oil givein in (table 1) are all manufactured by YUSHIRO CHEMICAL INDUSTRY CO., LTD.

*8. pH values recommended by the cutting oil manufacturer are listed. These values are reference values only. For more information, refer to the YUSHIRO CHEMICAL INDUSTRY CO., LTD. website.

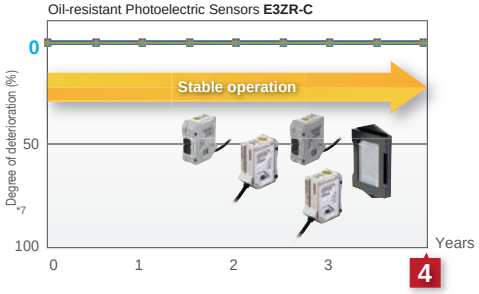
Oil-resistant Limit Switches **D4ER-□N**

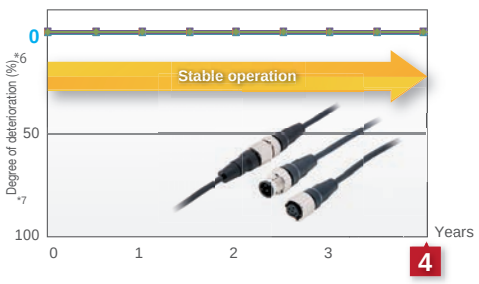


Oil-resistant Fiber Units **E32-T11NF**



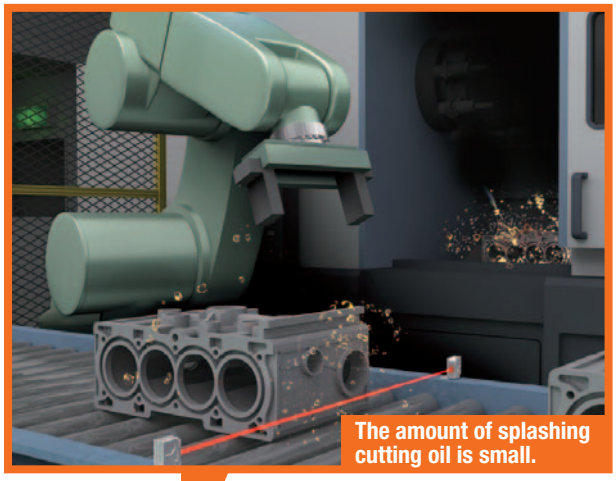
Oil-resistant Photoelectric Sensors **E3ZR-C**





Select a product that suits your application

Product Lineup



Product name / model	Applicable processes		Sensing distance	For details
	Machining process	Conveyance process		
Oil-resistant Limit Switches **D4ER-☐N** 	Yes	Yes	0 mm	P. 27
Oil-resistant Proximity Sensors **E2ER/E2ERZ** 	Yes	Yes	2 mm (M8) 3 mm (M12) 7 mm (M18) 10 mm (M30) *E2ER	P. 15
Oil-resistant Fiber Units **E32-T11NF** 	Yes	Yes	4 m	P. 39
Oil-resistant Photoelectric Sensors **E3ZR-C** 	—	Yes	0.5 m (Diffuse-reflective Models) 2.5 m (Retro-reflective Models) 30 m (Through-beam Models)	P. 41
Oil-resistant Connectors **XS5☐R** 	Yes	Yes	—	P. 53

Proximity Sensors That Withstand Cutting Oil to Reduce Failures Caused by Ingress of Cutting Oil

- Fluororesin cable that withstands cutting oil.
- A sealing method that eliminates gaps at cable joints and the resin filling work together to block ingress of cutting oil.
- IP67G * degree of protection (JIS C 0920 Annex 1).

Refer to *Safety Precautions* on page 22.

* The IP67G is the degree of protection which is defined according to the JIS (Japanese Industrial Standards).
The IP67 indicates the same level of protection as defined by the IEC, and the G indicates that a device has resistance to oil.

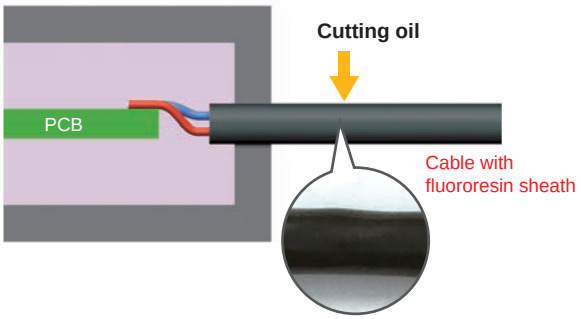
For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

Features

Fluororesin Outer Cable Sheath

Fluororesin Sheath

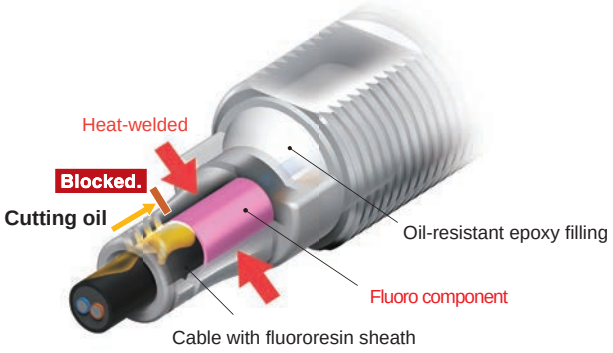
Fluororesin, which is less likely to be deteriorated by either water-insoluble or water-soluble cutting oils, is used for the cable sheath.
This prevents penetration of cutting oils into the cable.



Heat-Sealing Method

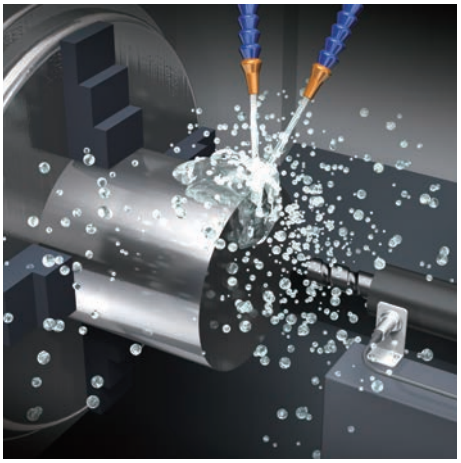
Heat-welding Sealing

A fluororesin cable is heat-welded with a fluoro component which has a high bondability and a melting point close to that of the cable. This blocks the ingress of cutting oil from the joined surfaces.



Applications

Detection of Cylinders



Detection of Cutting Workpieces

Ordering Information

Sensors

Standard Proximity Sensors [Refer to *Dimensions* on page 25.]

Appearance		Sensing distance	Connection method	Cable specifications	Model	
					Operation mode: NO	Operation mode: NC
Shielded 	M8	2 mm	Pre-wired Models (2 m)	Fluororesin	E2ER-X2D1 2M *	E2ER-X2D2 2M *
			M12 Pre-wired Smartclick Connector Models (0.3 m)		E2ER-X2D1-M1TGJ 0.3M	E2ER-X2D2-M1TGJ 0.3M
	M12	3 mm	Pre-wired Models (2 m)		E2ER-X3D1 2M *	E2ER-X3D2 2M *
			M12 Pre-wired Smartclick Connector Models (0.3 m)		E2ER-X3D1-M1TGJ 0.3M	E2ER-X3D2-M1TGJ 0.3M
	M18	7 mm	Pre-wired Models (2 m)		E2ER-X7D1 2M *	E2ER-X7D2 2M *
			M12 Pre-wired Smartclick Connector Models (0.3 m)		E2ER-X7D1-M1TGJ 0.3M	E2ER-X7D2-M1TGJ 0.3M
	M30	10 mm	Pre-wired Models (2 m)		E2ER-X10D1 2M *	E2ER-X10D2 2M *
			M12 Pre-wired Smartclick Connector Models (0.3 m)		E2ER-X10D1-M1TGJ 0.3M	E2ER-X10D2-M1TGJ 0.3M

* Models with 5-m cable length are also available with "5M" suffix. (Example: E2ER-X2D1 5M)

Chip-immune Proximity Sensors [Refer to *Dimensions* on page 25.]

Appearance		Sensing distance	Connection method	Cable specifications	Model	
					Operation mode: NO	Operation mode: NC
Shielded 	M12	2 mm	Pre-wired Models (2 m)	Fluororesin	E2ERZ-X2D1 2M *	E2ERZ-X2D2 2M *
			M12 Pre-wired Smartclick Connector Models (0.3 m)		E2ERZ-X2D1-M1TGJ 0.3M	E2ERZ-X2D2-M1TGJ 0.3M
	M18	4 mm	Pre-wired Models (2 m)		E2ERZ-X4D1 2M *	E2ERZ-X4D2 2M *
			M12 Pre-wired Smartclick Connector Models (0.3 m)		E2ERZ-X4D1-M1TGJ 0.3M	E2ERZ-X4D2-M1TGJ 0.3M
	M30	8 mm	Pre-wired Models (2 m)		E2ERZ-X8D1 2M *	E2ERZ-X8D2 2M *
			M12 Pre-wired Smartclick Connector Models (0.3 m)		E2ERZ-X8D1-M1TGJ 0.3M	E2ERZ-X8D2-M1TGJ 0.3M

* Models with 5-m cable length are also available with "5M" suffix. (Example: E2ERZ-X2D1 5M)

Accessories (Sold Separately)

Sensor I/O Connectors (M12, Sockets on One Cable End)

(Models for Pre-wired Connectors) A Sensor I/O Connector is not provided with the Sensor. It must be ordered separately as required.

Appearance	Cable diameter (mm)	Cable length	Sensor I/O Connector model number	Applicable Proximity Sensor model number
Straight, Smartclick Oil-resistant Connectors 	4 dia.	2 m	XS5FR-D423-D80-RB1	E2ER-X□D□-M1TGJ E2ERZ-X□D□-M1TGJ
		5 m	XS5FR-D423-G80-RB1	
		10 m	XS5FR-D423-J80-RB1	

Note: Refer to the XS5□R on page 53 for connector details and for information on cables with connectors on both ends.

Ratings and Specifications

Standard Proximity Sensors

Item	Size	M8	M12	M18	M30
	Shielded	Shielded			
	Model	E2ER-X2D□	E2ER-X3D□	E2ER-X7D□	E2ER-X10D□
Sensing distance		2 mm ±10%	3 mm ±10%	7 mm ±10%	10 mm ±10%
Set distance *1		0 to 1.6 mm	0 to 2.4 mm	0 to 5.6 mm	0 to 8 mm
Differential travel		15% max. of sensing distance	10% max. of sensing distance		
Detectable object		Ferrous metal (The sensing distance decreases with non-ferrous metal. Refer to *Engineering Data* on page 19.)			
Standard sensing object		Iron, 8 × 8 × 1 mm	Iron, 12 × 12 × 1 mm	Iron, 18 × 18 × 1 mm	Iron, 30 × 30 × 1 mm
Response frequency *2		1.5 kHz	1 kHz	0.5 kHz	0.4 kHz
Power supply voltage		10 to 30 VDC, (including 10% ripple (p-p))			
Leakage current		0.8 mA max.			
Control output	Load current	3 to 100 mA			
	Residual voltage	3 V max. (Load current: 100 mA, Cable length: 2 m)			
Indicators		D1 Models: Operation indicator (red), Setting indicator (green) D2 Models: Operation indicator (red)			
Operation mode (with sensing object approaching)		D1 Models: NO D2 Models: NC Refer to the timing charts under *I/O Circuit Diagrams* on page 21 for details.			
Protection circuits		Surge suppressor, Load short-circuit protection			
Ambient temperature range		Operating: –25 to 70°C, Storage: –40 to 85°C (with no icing or condensation)			
Ambient humidity range		Operating and Storage: 35% to 95% (with no condensation)			
Temperature influence		±15% max. of sensing distance at 23°C in the temperature range of –25 to 70°C	±10% max. of sensing distance at 23°C in the temperature range of –25 to 70°C		
Voltage influence		±1% max. of sensing distance at rated voltage in the rated voltage ±15% range			
Insulation resistance		50 MΩ min. (at 500 VDC) between current-carrying parts and case			
Dielectric strength		1,000 VAC, 50/60 Hz for 1 minute between current-carrying parts and case			
Vibration resistance (destruction)		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions			
Shock resistance (destruction)		500 m/s^2 10 times each in X, Y, and Z directions	1,000 m/s^2 10 times each in X, Y, and Z directions		
Degree of protection		IP67 (IEC 60529) and IP67G *3 (JIS C 0920 Annex 1) Passed OMRON's Oil-resistant Component Evaluation Standards *4 (Cutting oil type: specified in JIS K 2241:2000, Temperature: 35 °C max.)			
Connection method		Pre-wired Models (Standard cable length: 2 m) and Pre-wired Connector Models (Standard cable length: 300 mm)			
Weight (packed state)	Pre-wired Models	Approx. 65 g	Approx. 75 g	Approx. 145 g	Approx. 215 g
	Pre-wired Connector Models	Approx. 30 g	Approx. 40 g	Approx. 90 g	Approx. 155 g
Materials	Case	Stainless steel (SUS303)	Nickel-plated brass		
	Sensing surface	Polybutylene terephthalate (PBT)			
	Clamping nuts	Nickel-plated brass			
	Toothed washer	Zinc-plated iron			
Accessories		Instruction manual			

*1. Use the Sensor within the range in which the setting indicator (green LED) is ON (except D2 Models).
*2. The response frequency is an average value.
Measurement conditions are as follows: standard sensing object, a distance of twice the standard sensing object, and a set distance of half the sensing distance.
*3. The IP67G is the degree of protection which is defined according to the JIS (Japanese Industrial Standards).
The IP67 indicates the same level of protection as defined by the IEC, and the G indicates that a device has resistance to oil.
*4. The Oil-resistant Component Evaluation Standards are OMRON's own durability evaluation standards.
The Pre-wired Connector Model meets the degree of protection when it is correctly connected with an XS5□R Oil-resistant Connector.
The degree of protection is not satisfied with the part where there is no XS5FR Oil-resistant Connector connected and cable wires are uncovered.
And as for the Pre-wired Models, the degree of protection is not satisfied with the part where cable wires are uncovered.

Chip-immune Proximity Sensors

Item \ Size		M12	M18	M30
Shielded		Shielded		
Model		E2ERZ-X2D□	E2ERZ-X4D□	E2ERZ-X8D□
Sensing distance		2 mm ±10%	4 mm ±10%	8 mm ±10%
Set distance *1		0 to 1.6 mm	0 to 3.2 mm	0 to 6.4 mm
Differential travel		20% max. of sensing distance		
Detectable object		Ferrous metal (The sensing distance decreases with non-ferrous metal. Refer to *Engineering Data* on page 19.)		
Standard sensing object		Iron, 12 × 12 × 1 mm	Iron, 30 × 30 × 1 mm	Iron, 54 × 54 × 1 mm
Response frequency *2		200 Hz	100 Hz	30 Hz
Power supply voltage		10 to 30 VDC, (including 10% ripple (p-p))		
Leakage current		0.8 mA max.		
Control output	Load current	3 to 100 mA		
	Residual voltage	3 V max. (Load current: 100 mA, Cable length: 2 m)		
Indicators		D1 Models: Operation indicator (red), Setting indicator (green) D2 Models: Operation indicator (red)		
Operation mode (with sensing object approaching)		D1 Models: NO D2 Models: NC Refer to the timing charts under *I/O Circuit Diagrams* on page 21 for details.		
Protection circuits		Surge suppressor, Load short-circuit protection		
Ambient temperature range		Operating and Storage: 0 to 50°C (with no icing or condensation)		
Ambient humidity range		Operating and Storage: 35% to 95% (with no condensation)		
Temperature influence		±20% max. of sensing distance at 23°C in the temperature range of 0 to 50°C		
Voltage influence		±2.5% max. of sensing distance at rated voltage in the rated voltage ±10% range		
Insulation resistance		50 MΩ min. (at 500 VDC) between current-carrying parts and case		
Dielectric strength		1,000 VAC, 50/60 Hz for 1 minute between current-carrying parts and case		
Vibration resistance (destruction)		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions		
Shock resistance (destruction)		1,000 m/s^2 10 times each in X, Y, and Z directions		
Degree of protection		IP67 (IEC 60529) and IP67G *3 (JIS C 0920 Annex 1) Passed OMRON's Oil-resistant Component Evaluation Standards *4 (Cutting oil type: specified in JIS K 2241:2000, Temperature: 35 °C max.)		
Connection method		Pre-wired Models (Standard cable length: 2 m) and Pre-wired Connector Models (Standard cable length: 300 mm)		
Weight (packed state)	Pre-wired Models	Approx. 75 g	Approx. 145 g	Approx. 215 g
	Pre-wired Connector Models	Approx. 40 g	Approx. 90 g	Approx. 155 g
Materials	Case	Nickel-plated brass		
	Sensing surface	Polybutylene terephthalate (PBT)		
	Clamping nuts	Zinc-plated iron		
	Toothed washer	Zinc-plated iron		
Accessories		Instruction manual		

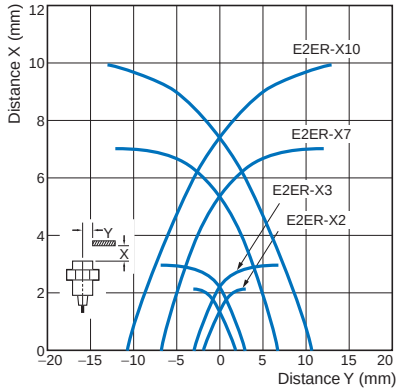
*1. Use the Sensor within the range in which the setting indicator (green LED) is ON (except D2 Models).
*2. The response frequency is an average value.
Measurement conditions are as follows: standard sensing object, a distance of twice the standard sensing object, and a set distance of half the sensing distance.
*3. The IP67G is the degree of protection which is defined according to the JIS (Japanese Industrial Standards).
The IP67 indicates the same level of protection as defined by the IEC, and the G indicates that a device has resistance to oil.
*4. The Oil-resistant Component Evaluation Standards are OMRON's own durability evaluation standards.
The Pre-wired Connector Model meets the degree of protection when it is correctly connected with an XS5□R Oil-resistant Connector.
The degree of protection is not satisfied with the part where there is no XS5FR Oil-resistant Connector connected and cable wires are uncovered.
And as for the Pre-wired Models, the degree of protection is not satisfied with the part where cable wires are uncovered.

Engineering Data (Reference Value)

Sensing Area

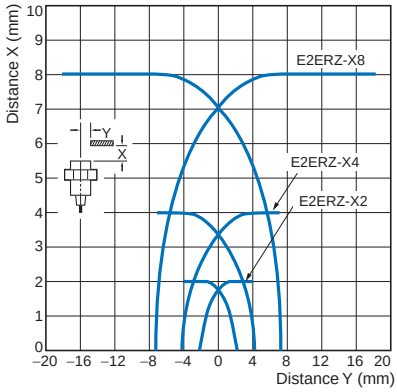
Standard Proximity Sensors

E2ER-X□D□



Chip-immune Proximity Sensors

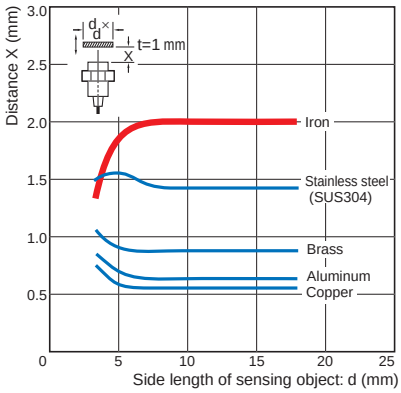
E2ERZ-X□D□



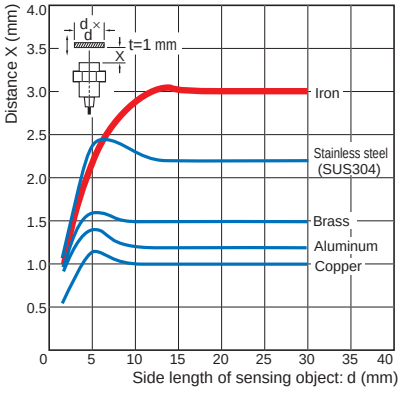
Influence of Sensing Object Size and Material

Standard Proximity Sensors

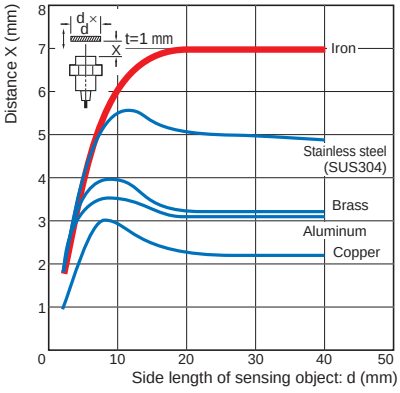
E2ER-X2



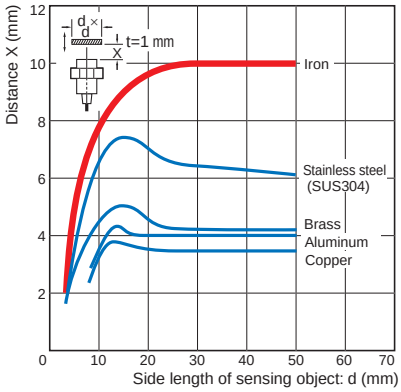
E2ER-X3



E2ER-X7

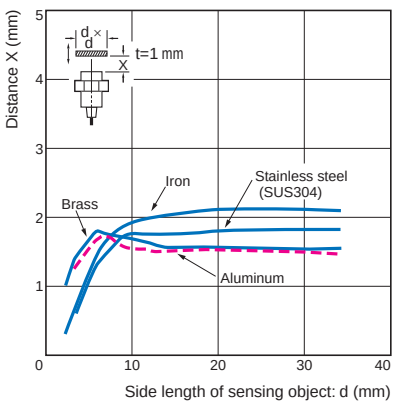


E2ER-X10

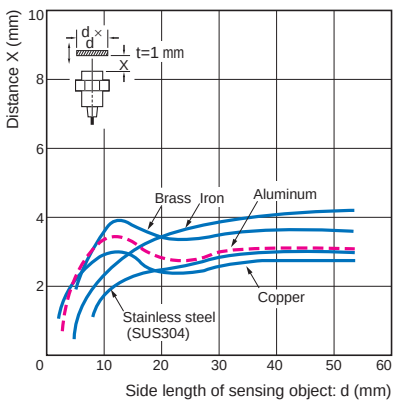


Chip-immune Proximity Sensors

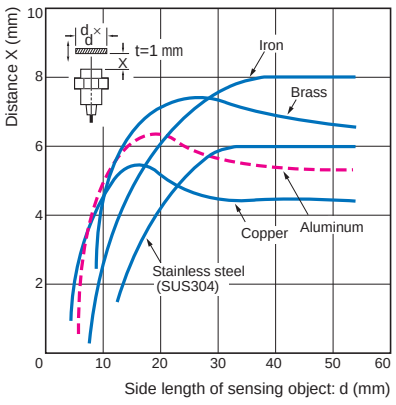
E2ERZ-X2



E2ERZ-X4

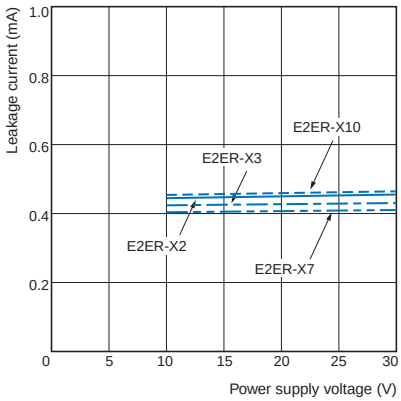


E2ERZ-X8

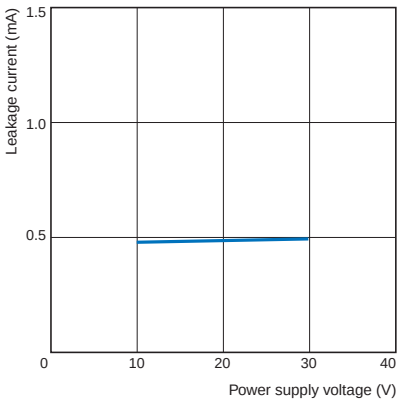


Leakage Current

Standard Proximity Sensors
E2ER-X□D□

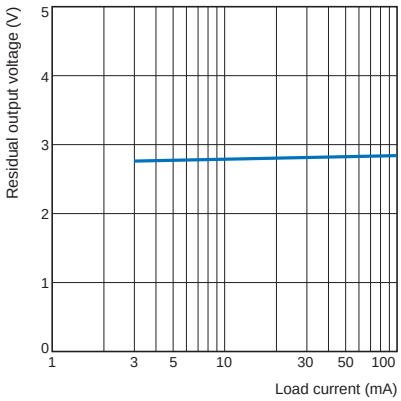


Chip-immune Proximity Sensors
E2ERZ-X□D□

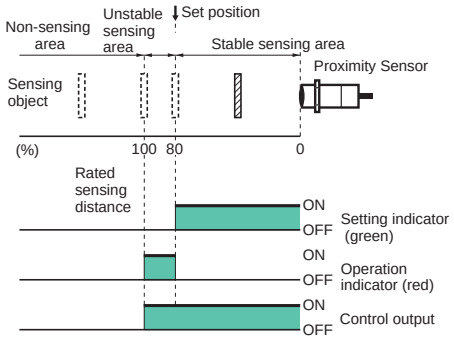
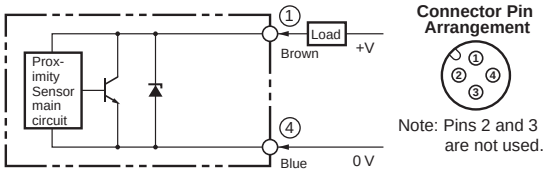
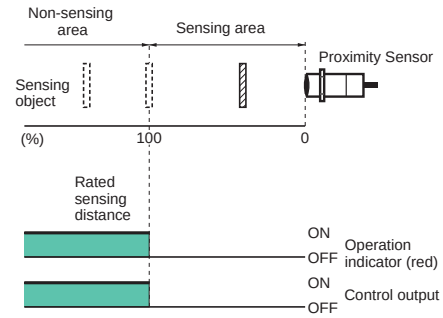
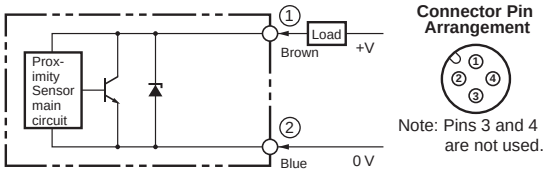


Residual Output Voltage

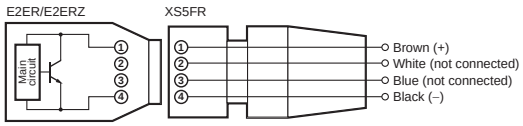
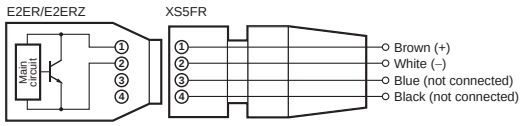
Standard Proximity Sensors / Chip-immune Proximity Sensors



I/O Circuit Diagrams

Operation mode	Model	Timing Chart	Output circuit
NO	E2ER-X□D1 E2ER-X□D1 -M1TGJ E2ERZ-X□D1 E2ERZ-X□D1 -M1TGJ		 Note: The load can be connected to either the +V or 0 V side.
NC	E2ER-X□D2 E2ER-X□D2 -M1TGJ E2ERZ-X□D2 E2ERZ-X□D2 -M1TGJ		 Note: The load can be connected to either the +V or 0 V side.

Connections to Sensor I/O Connectors

Proximity Sensor			Sensor I/O Connector model number	Connections
Type	Operation mode	Model		
DC 2-wire (Smartclick)	NO	E2ER-X□D1 -M1TGJ E2ERZ-X□D1 -M1TGJ	**XS5FR-D423-□80-RB1** D: 2-m cable G: 5-m cable J : 10-m cable	
	NC	E2ER-X□D2 -M1TGJ E2ERZ-X□D2 -M1TGJ	**XS5FR-D423-□80-RB1** D: 2-m cable G: 5-m cable J : 10-m cable	

Note: Different from Proximity Sensor wire colors.

Safety Precautions

Be sure to read the precautions for all models in the website at: http://www.ia.omron.com/.

Warning Indications

⚠ WARNING	**Warning level** Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.
Precautions for Safe Use	Supplementary comments on what to do or avoid doing, to use the product safely.
Precautions for Correct Use	Supplementary comments on what to do or avoid doing, to prevent failure to operate, malfunction or undesirable effect on product performance.

Meaning of Product Safety Symbols

	**General prohibition** Indicates the instructions of unspecified prohibited action.
	**Caution, explosion** Indicates the possibility of explosion under specific conditions.

⚠ WARNING

This product is not designed or rated for ensuring safety of persons either directly or indirectly.
Do not use it for such purposes.

Risk of explosion.
Do not connect sensor to AC power supply.

Precautions for Safe Use

The following precautions must be observed to ensure safe operation.

(1) Do not use the product in an environment where flammable or explosive gas is present.

(2) Do not attempt to disassemble, repair, or modify the product.

(3) Power Supply Voltage
Do not use a voltage that exceeds the rated operating voltage range. Applying a voltage that is higher than the operating voltage range may result in damage or burnout.

(4) Incorrect Wiring
Be sure that the power supply polarity and other wiring is correct. Incorrect wiring may cause explosion or burnout.

(5) Connection without a Load
If the power supply is connected directly without a load, the internal elements may explode or burn. Be sure to insert a load when connecting the power supply.

(6) Protective structure
Do not use the product with degrade protective structure such as swelling and crack in housing and/or sealing components. Otherwise cutting oil or other substance may enter the product. resulting in a risk of corruption or burning.

(7) Dispose of this product as industrial waste.

Precautions for Correct Use

Do not use this product under ambient conditions that exceed the ratings.

● Operating Environment

(1) Do not install the product in the following locations.
Doing so may result in product failure or malfunction.
1. Outdoor locations directly subject to sunlight, rain, snow, water droplets, or oil.
2. Locations subject to atmospheres with chemical vapors, in particular solvents and acids.
3. Locations subject to corrosive gases.

(2) The Sensor may malfunction if used near ultrasonic cleaning equipment, high-frequency equipment, transceivers, cellular phones, inverters, or other devices that generate a high-frequency electric field. Please refer to the Precautions for Correct Use on the OMRON website (www.ia.omron.com) for typical measures.

(3) Laying the Proximity Sensor wiring in the same conduit or duct as high-voltage wires or power lines may result in incorrect operation and damage due to induction. Wire the Sensor using a separate conduit or independent conduit.

(4) Never use thinner or other solvents. Otherwise, the Sensor surface may be dissolved.

(5) The following conditions shall be observed if you use the product under an environment using cutting oil that may affect product's life and/or performance.
- Usage under the cutting oil condition designated by the specification
- Usage under the cutting oil dilution ratio recommended by its manufacturer
- Usage in oil or water is prohibited

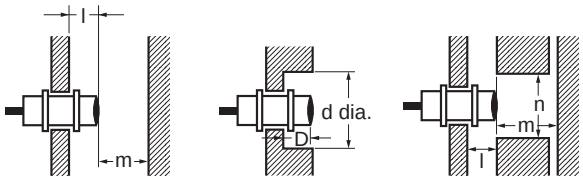
Impact on the product life may differ depending on the oil you use. Before using the cutting oil, make sure that it should not cause deterioration or degradation of sealing components.

(6) Connecting Connectors
- The E2ER/E2ERZ can be used in conditions of cutting oil use described in the specifications.
The oil resistance may not be ensured when the products are not mated to XS5□R Connectors, so use the products correctly.
- When mating the products to XS2 or other M12 Connectors, tighten the lock to a torque of 0.39 to 0.49 N·m.

● Design

Influence of Surrounding Metal

When mounting the Sensor within a metal panel, ensure that the clearances given in the following table are maintained. Failure to maintain these distances may cause deterioration in the performance of the Sensor.

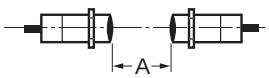


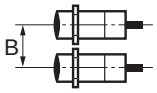
Influence of Surrounding Metal (Unit: mm)

Model	Item / Embedded material	l	d	D	m	n
E2ER-X2D□ E2ER-X2D□-M1TGJ	–	0	8	0	4.5	12
E2ER-X3D□ E2ER-X3D□-M1TGJ	–	0	12	0	8	18
E2ER-X7D□ E2ER-X7D□-M1TGJ	–	0	18	0	20	27
E2ER-X10D□ E2ER-X10D□-M1TGJ	–	0	30	0	40	45
E2ERZ-X2D□ E2ERZ-X2D□-M1TGJ	Iron	0	12	0	8	18
	Aluminum	2	25	2		36
E2ERZ-X4D□ E2ERZ-X4D□-M1TGJ	Iron	0	18	0	16	27
	Aluminum	5	40	5		54
E2ERZ-X8D□ E2ERZ-X8D□-M1TGJ	Iron	0	30	0	32	45
	Aluminum	10	70	10		90

Mutual Interference

When installing Sensors face-to-face or side-by-side, ensure that the minimum distances given in the following table are maintained.





Mutual Interference **(Unit: mm)**

Model / Item	A	B
E2ER-X2D□ E2ER-X2D□-M1TGJ	20	15
E2ER-X3D□ E2ER-X3D□-M1TGJ	30	20
E2ER-X7D□ E2ER-X7D□-M1TGJ	50	35
E2ER-X10D□ E2ER-X10D□-M1TGJ	100	70
E2ERZ-X2D□ E2ERZ-X2D□-M1TGJ	30	20
E2ERZ-X4D□ E2ERZ-X4D□-M1TGJ	40	50
E2ERZ-X8D□ E2ERZ-X8D□-M1TGJ	60	100

Aluminum and Iron Cuttings (Only for Chip-immune Proximity Sensors)

Normally aluminum or iron cuttings will not be detected even if they adhere to or accumulate on the sensing surface.
Detection signals may be output for the following:
If this occurs, remove the cuttings from the sensing surface.

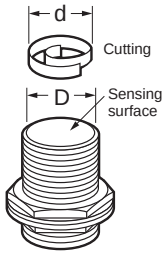
1. Relationship between the Size of the Cutting (d) and the Size of the Sensing Surface (D)

Cuttings of the size d ≥ $\frac{2}{3}$D on the sensing surface *

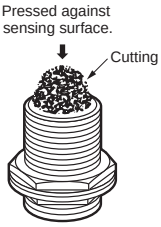
(Unit: mm)

Model Size	D
E2ERZ-X2D☐	10 *
E2ERZ-X4D☐	16
E2ERZ-X8D☐	28

* E2ERZ-X2D☐: d ≥ $\frac{1}{3}$ D on the sensing surface.



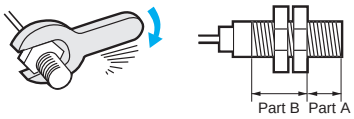
2. Cuttings Pressed against the Sensing Surface



● Mounting

Tightening Force

Do not tighten the nut with excessive force.
A washer must be used with the nut.



Note: 1. The allowable tightening strength depends on the distance from the edge of the head, as shown in the following table. (A is the distance from the edge of the head. B includes the nut on the head side. If the edge of the nut is in part A, the tightening torque for part A applies instead.)
2. The following strengths assume washers are being used.

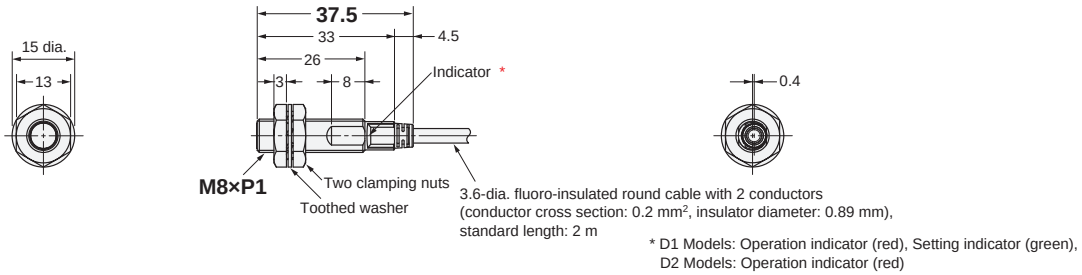
Type	Part A		Part B
	Dimension (mm)	Torque	Torque
M8	9	9 N·m	12 N·m
M12	30 N·m		
M18	70 N·m		
M30	180 N·m		

Dimensions

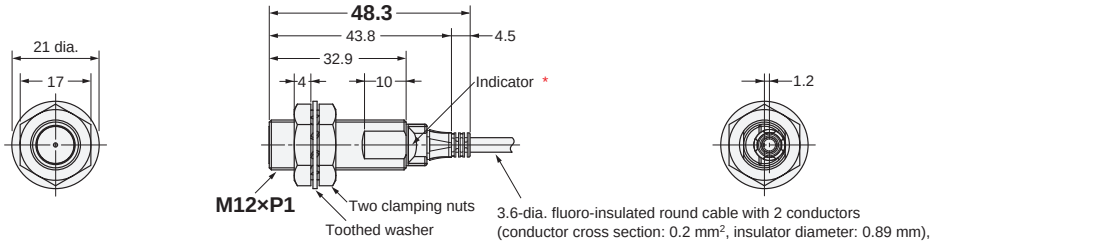
(Unit: mm)
Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.

Pre-wired Models

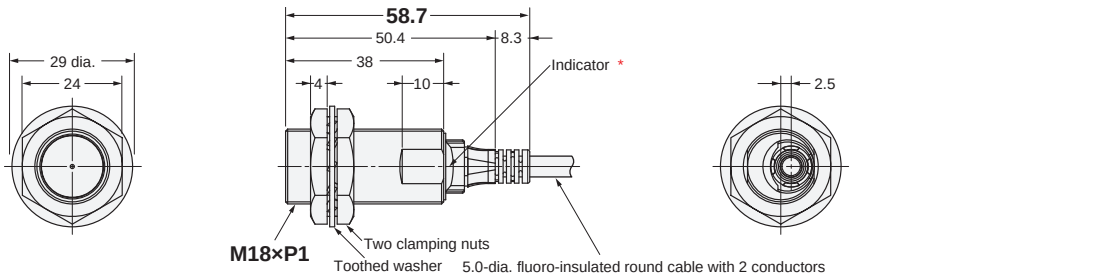
E2ER-X2D☐



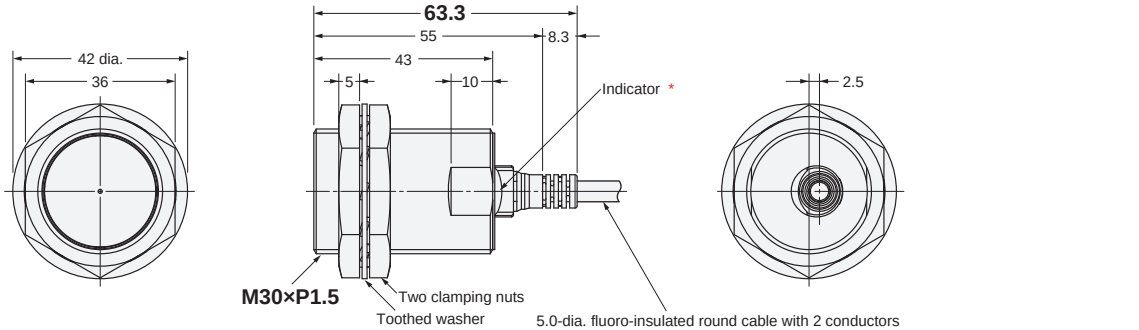
E2ER-X3D☐
E2ERZ-X2D☐



E2ER-X7D☐
E2ERZ-X4D☐



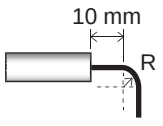
E2ER-X10D☐
E2ERZ-X8D☐



Mounting Hole Dimensions

Dimension	F (mm)
M8	$8.5^{+0.5}_{0}$ dia.
M12	$12.5^{+0.5}_{0}$ dia.
M18	$18.5^{+0.5}_{0}$ dia.
M30	$30.5^{+0.5}_{0}$ dia.

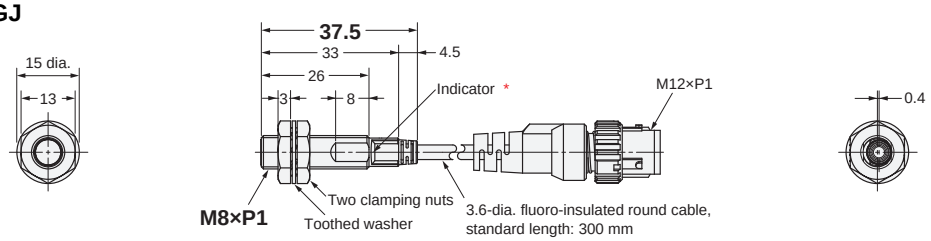
Angle R of the Bending Wire



Dimension	R (mm)
M8	22
M12	
M18	31
M30	

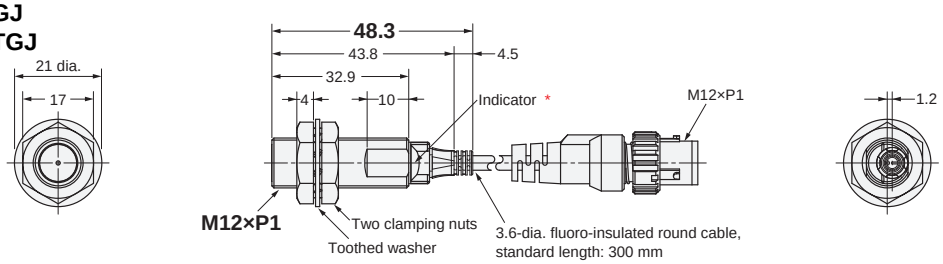
Pre-wired Connector Models

E2ER-X2D□-M1TGJ



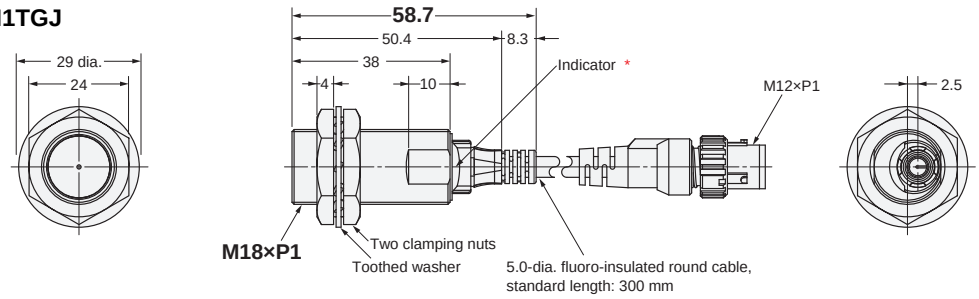
* D1 Models: Operation indicator (red), Setting indicator (green),
D2 Models: Operation indicator (red)

E2ER-X3D□-M1TGJ
E2ERZ-X2D□-M1TGJ



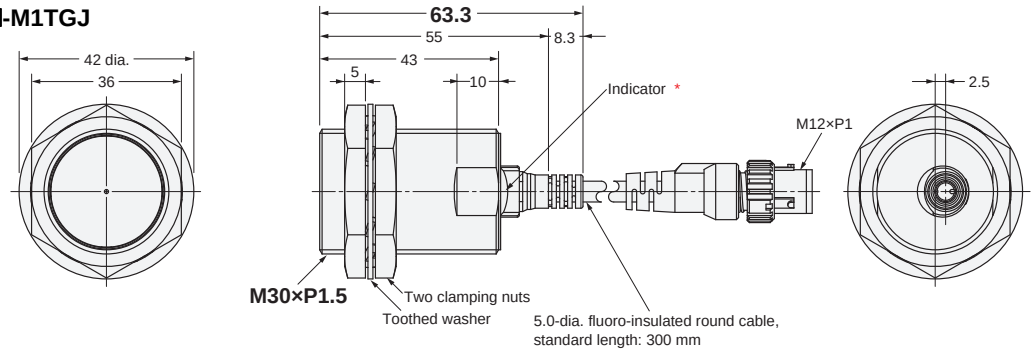
* D1 Models: Operation indicator (red), Setting indicator (green),
D2 Models: Operation indicator (red)

E2ER-X7D□-M1TGJ
E2ERZ-X4D□-M1TGJ



* D1 Models: Operation indicator (red), Setting indicator (green),
D2 Models: Operation indicator (red)

E2ER-X10D□-M1TGJ
E2ERZ-X8D□-M1TGJ

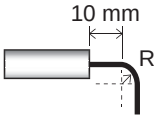


* D1 Models: Operation indicator (red), Setting indicator (green),
D2 Models: Operation indicator (red)

Mounting Hole Dimensions

Dimension	F (mm)
M8	$8.5^{+0.5}_{0}$ dia.
M12	$12.5^{+0.5}_{0}$ dia.
M18	$18.5^{+0.5}_{0}$ dia.
M30	$30.5^{+0.5}_{0}$ dia.

Angle R of the Bending Wire



Dimension	R (mm)
M8	22
M12	
M18	31
M30	

D4ER-□N

Even Better Oil Resistance Than D4E-N Switches

- Material combining HNBR and fluororubber used for superior resistance to oil.
  Prevents ingress of cutting oil from moving sections.
- Fluororesin cable that withstands cutting oils is provided as standard.
- Models available with Smartclick connectors for easy connection.
- Minute load model with gold cladding is optimal for electronic control.
- Approved by EN (TÜV).
- Same mounting pitch as D4E-N Switches.
- IP67G degree of protection (JIS C 0920 Annex 1). *

Be sure to read *Safety Precautions* on pages 37 to 38 and *Safety Precautions for All Limit Switches*.

For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

* The IP67G is the degree of protection which is defined according to the JIS (Japanese Industrial Standards).
  The IP67 indicates the same level of protection as defined by the IEC, and the G indicates that a device has resistance to oil.

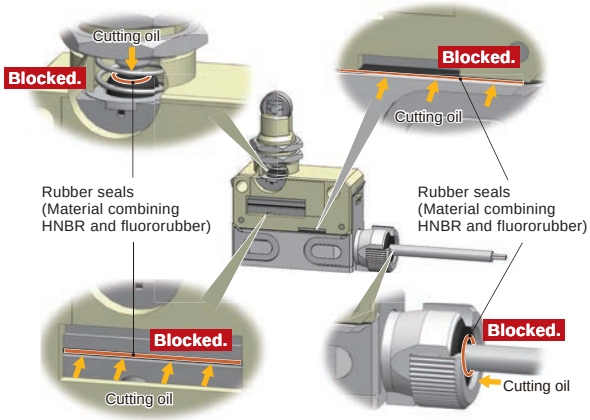
Features

Material Combining HNBR and Fluororubber for Superior Resistance to Oil

New Rubber Material

Moving sections are protected from ingress of cutting oil.

Important Sealing Sections for Moving Parts



Fluororesin Cable Provided as Standard to Withstand Cutting Oils

Fluororesin Sheath

In addition to prewired models, models are also available with prewired Smartclick connectors for easy connection.

Cable type

Pre-wired Connector type

Applications

Table Overrun Detection

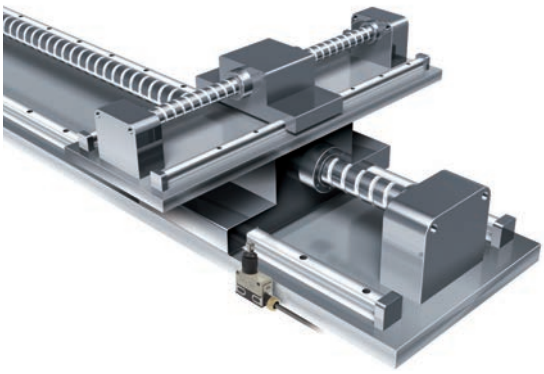
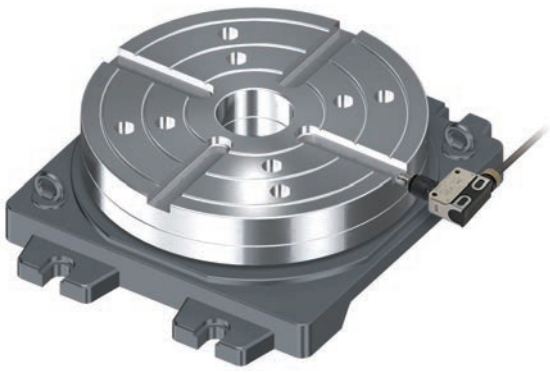


Table Position Detection



D4ER-□N

Model Number Structure

Model Number Legend (Not all combinations are possible. Ask your OMRON representative for details.)

D4ER-□□□□N□

(1) (2) (3) (4)

(1) Rated Current

1: 1 A at 30 VDC (Standard load)
2: 0.1 A at 30 VDC (Micro load)

(2) Actuator

A: Roller plunger
B: Crossroller plunger
C: Plunger
D: Sealed roller plunger
E: Sealed crossroller plunger
G: Roller lever
L: Long roller plunger

(3) Terminals

21: Cable (right-hand)
22: Cable (left-hand)

Note: The terminal specifications in model numbers are not the same for D4ER-□N and D4E Switches.

Comparison of New and Old Terminal Models

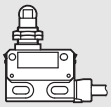
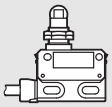
Model / Location of lead outlet	D4ER-□N	D4E
Right-hand	D4ER-□□21N	D4E-□□21
Left-hand	D4ER-□□22N	D4E-□□23
Bottom	–	D4E-□□22

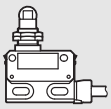
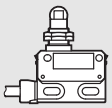
(4) Pre-wired Connector

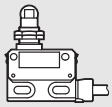
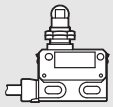
-DTK1EJ: Pre-wired connector
(30-cm oil-resistant cable, M12 Smartclick connector)
Blank : No connector (oil-resistance cable: 2 m)

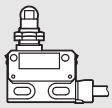
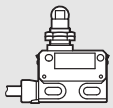
Note: D4ER-□N Switches are not available with operation indicators.

Ordering Information

Type	Cable type	
	Standard load	
	Right-hand	Left-hand
		
Actuator	Model	Model
Roller plunger	D4ER-1A21N	D4ER-1A22N
Crossroller plunger	D4ER-1B21N	D4ER-1B22N
Plunger	D4ER-1C21N	D4ER-1C22N
Sealed roller plunger	D4ER-1D21N	D4ER-1D22N
Sealed crossroller plunger	D4ER-1E21N	D4ER-1E22N
Roller lever	D4ER-1G21N	D4ER-1G22N
Long roller plunger	D4ER-1L21N	D4ER-1L22N

Type	Cable type	
	Micro load	
	Right-hand	Left-hand
		
Actuator	Model	Model
Roller plunger	D4ER-2A21N	D4ER-2A22N
Crossroller plunger	D4ER-2B21N	D4ER-2B22N
Plunger	D4ER-2C21N	D4ER-2C22N
Sealed roller plunger	D4ER-2D21N	D4ER-2D22N
Sealed crossroller plunger	D4ER-2E21N	D4ER-2E22N
Roller lever	D4ER-2G21N	D4ER-2G22N
Long roller plunger	D4ER-2L21N	D4ER-2L22N

Type	Pre-wired Connector type	
	Standard load	
	Right-hand	Left-hand
		
Actuator	Model	Model
Roller plunger	D4ER-1A21N-DTK1EJ	D4ER-1A22N-DTK1EJ
Crossroller plunger	D4ER-1B21N-DTK1EJ	D4ER-1B22N-DTK1EJ
Plunger	D4ER-1C21N-DTK1EJ	D4ER-1C22N-DTK1EJ
Sealed roller plunger	D4ER-1D21N-DTK1EJ	D4ER-1D22N-DTK1EJ
Sealed crossroller plunger	D4ER-1E21N-DTK1EJ	D4ER-1E22N-DTK1EJ
Roller lever	D4ER-1G21N-DTK1EJ	D4ER-1G22N-DTK1EJ
Long roller plunger	D4ER-1L21N-DTK1EJ	D4ER-1L22N-DTK1EJ

Type	Pre-wired Connector type	
	Micro load	
	Right-hand	Left-hand
		
Actuator	Model	Model
Roller plunger	D4ER-2A21N-DTK1EJ	D4ER-2A22N-DTK1EJ
Crossroller plunger	D4ER-2B21N-DTK1EJ	D4ER-2B22N-DTK1EJ
Plunger	D4ER-2C21N-DTK1EJ	D4ER-2C22N-DTK1EJ
Sealed roller plunger	D4ER-2D21N-DTK1EJ	D4ER-2D22N-DTK1EJ
Sealed crossroller plunger	D4ER-2E21N-DTK1EJ	D4ER-2E22N-DTK1EJ
Roller lever	D4ER-2G21N-DTK1EJ	D4ER-2G22N-DTK1EJ
Long roller plunger	D4ER-2L21N-DTK1EJ	D4ER-2L22N-DTK1EJ

Connector Sockets

For models with connectors, select one of the specified Connector Sockets from the following table.

Applicable Limit Switches	Current type	Appearance	No. of conductors	Cable length	Socket
D4ER-□□21N-DTK1EJ D4ER-□□22N-DTK1EJ	DC	Straight, Smartclick Oil-resistant Connectors 	4	2 m	**XS5FR-D423-D80-RB1**
				5 m	**XS5FR-D423-G80-RB1**
				10 m	**XS5FR-D423-J80-RB1**

Note: Refer to the XS5□R on page 53 for connector details and for information on cables with connectors on both ends.

Specifications

Approved Standards

Agency	Standard	File No.	Approved models
TÜV Rheinland	EN 60947-5-1	R9551015, J9951016	Ask your OMRON representative for information on approved models.
CCC	–	–	
UL	–	–	

Ratings

Rated voltage	Standard load								Micro load	
	Non-inductive load (A)				Inductive load (A)				Non-inductive load (A)	
	Resistive load		Lamp load		Inductive load		Motor load		Resistive load	
	NC	NO	NC	NO	NC	NO	NC	NO	NC	NO
8 VDC	1		–		1		–		0.1	
14 VDC	1		–		1		–		0.1	
30 VDC	1		–		1		–		0.1	

Inrush current		
	NC	10 A max.
	NO	10 A max.

Note: 1. The above current ratings are for a standard current.
2. Inductive loads have a power factor of 0.4 min. (AC) and a time constant of 7 ms max. (DC).
3. Lamp load has an inrush current of 10 times the steady-state current.
4. Motor load has an inrush current of 6 times the steady-state current.

Minimum applicable load	Standard load	Micro load
	160 mA at 5 VDC	1 mA at 5 VDC

Approved Standard Ratings

TÜV (EN 60947-5-1)

D4ER-$\frac{1}{I}$ $\frac{G}{II}$ $\frac{21}{III}$ N

Model			Applicable category and ratings	Thermal current (Ithe)
I	II	III		
1	□	21/22	DC-12 1 A/30 VDC	1 A
2	□	21/22	DC-12 0.1 A/30 VDC	0.1 A

Note: 1. □:Actuator variation of item II
2. DC-12 1 A/30 VDC means as follows:
Applicable category: DC-12
Rated operating current (I_e): 1 A
Rated operating voltage (U_e): 30 VDC

Characteristics (Standard Load Model and Micro Load Model)

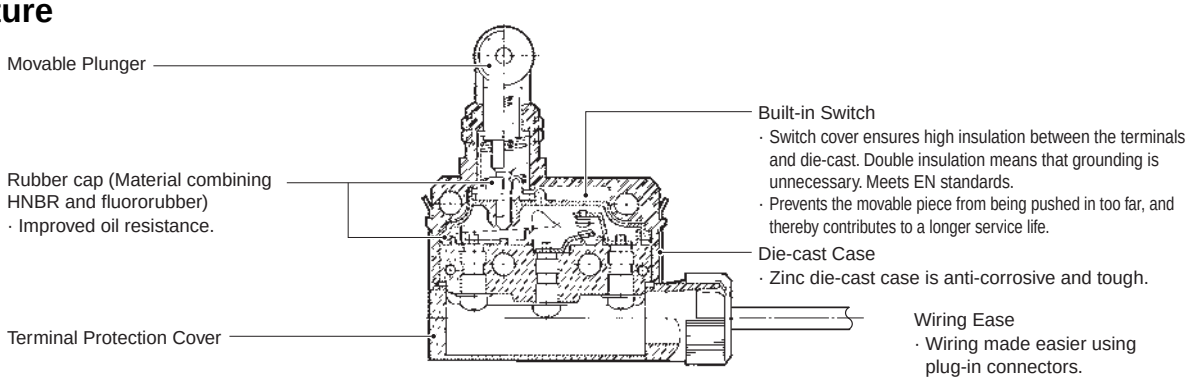
Degree of protection		IP67 (IEC 60529) and IP67G (JIS C 0920 Annex 1) *1 Passed OMRON's Oil-resistant Component Evaluation Standards *2 (Cutting oil type: specified in JIS K 2241:2000; Temperature: 35°C max.)
Durability	**Mechanical**	4,000,000 operations min.
	Electrical	500,000 operations min. (Standard load: 1 A at 30 VDC, resistive load/Micro load: 0.1 A at 30 VDC, resistive load) 4,000,000 operations min. (10 mA at 24 VDC, resistive load)
Operating speed		0.1 mm/sec to 0.5 m/sec
Operating frequency		Mechanical: 120 operations/min Electrical: 30 operations/min
Insulation resistance		100 MΩ min. (at 500 VDC) *3
Contact resistance		Standard load : D4ER-1□□□N□: 15 mΩ max. (initial value for the built-in switch whentested alone) Micro load : D4ER-2□□□N□: 50 mΩ max. (initial value for the built-in switch whentested alone)
Dielectric strength	**Between terminals of same polarity**	1,000 VAC, 50/60 Hz for 1 min
	Between each terminal and noncurrent-carrying metal part	1,500 VAC, 50/60 Hz for 1 min/Uimp at 2.5 kV (EN 60947-5-1)
Rated insulation voltage (Ui)		250 V
Pollution degree (operating environment)		3 (EN 60947-5-1)
Short-circuit protective device (SCPD)		10 A fuse (type gG or type gI, IEC 60269 approved)
Conditional short-circuit current		100 A (EN 60947-5-1)
Conventional enclosed thermal current (Ithe)		5 A (EN 60947-5-1)
Protection against electric shock		Class II (grounding not required with double insulation)
Vibration resistance	**Malfunction**	10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	**Destruction**	1,000 m/s^2 max. (IEC 68-2-27)
	Malfunction	300 m/s^2 max. (IEC 68-2-27)
Ambient operating temperature/Ambient storage temperature		5°C to 70°C (with no icing or condensation)
Ambient operating humidity		35% to 95%RH (with no condensation)
Weight		(in case of roller plunger) Cable type (2 m): Approx. 140 g Pre-wired Connector type: Approx. 103 g

Note: 1. The following values are initial values.
2. The following ratings may vary depending on the model. Contact your OMRON representative for further details.

*1. The IP67G is the degree of protection which is defined according to the JIS (Japanese Industrial Standards).
The IP67 indicates the same level of protection as defined by the IEC, and the G indicates that a device has resistance to oil.
*2. The Oil-resistant Component Evaluation Standards are OMRON's own durability evaluation standards.
The Pre-wired Connector type meets the degree of protection when it is correctly connected with an XS5□R Oil-resistant Connector.
The degree of protection is not satisfied with the part where there is no XS5FR Oil-resistant Connector connected and cable wires are uncovered. And as for the Cable type, the degree of protection is not satisfied with the part where cable wires are uncovered.
*3. This value represents the condition when the Switch is shipped from the factory.

Structure and Nomenclature

Structure



Degree of Protection

The D4ER-□N uses rubber seals to provide a protective structure for the charged parts to achieve an IP rating of IP67G* (JIS C 0920).
The charged parts in the switching section are sealed with the two rubber seals shown in figure 1. The charged parts in the terminal section are sealed with the two rubber seals shown in figure 2.
Material combining HNBR and fluororubber with excellent resistance to oil is used for the rubber seals.

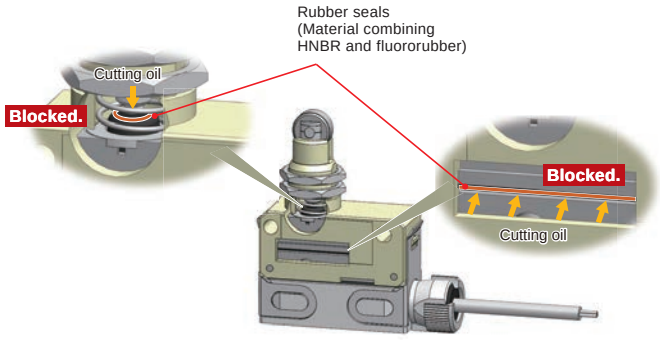


Figure 1. Switching Section Protective Structure

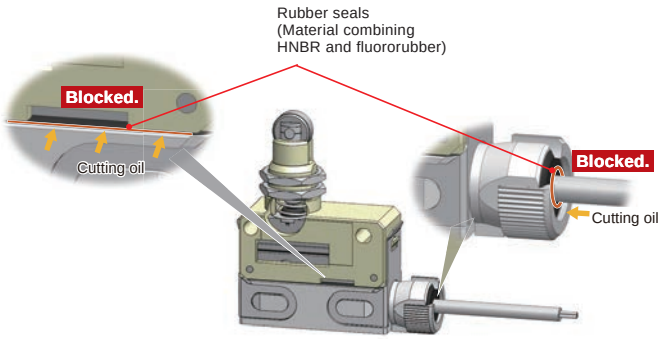
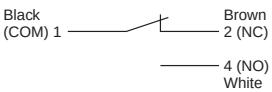


Figure 2. Terminal Section Protective Structure

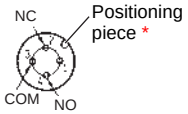
* The various parts of IP67G have the following meanings: IP6□ indicates that dust will not enter the interior, IP□7 indicates protection again submersion in water, and IP□□G indicates resistance to oil.

Contact Form

Cable type



Pre-wired Connector type



* The position of the positioning piece is not always the same. If using an L-shaped connector causes problems in application, use a straight connector.

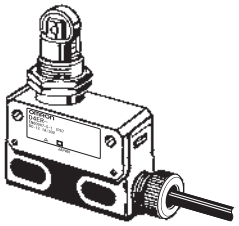
D4ER-□N

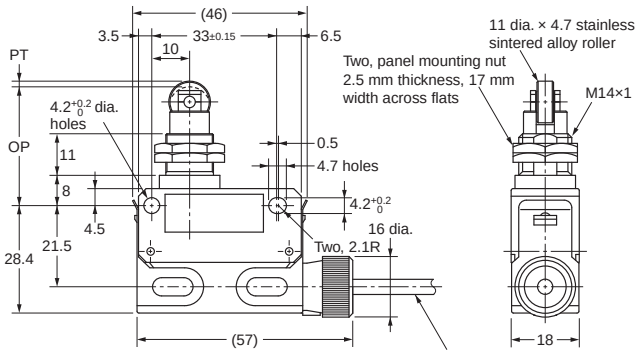
Dimensions and Operating Characteristics

(Unit: mm)

Cable type

Roller Plunger
D4ER-1A21N *
D4ER-2A21N *



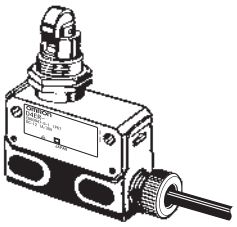


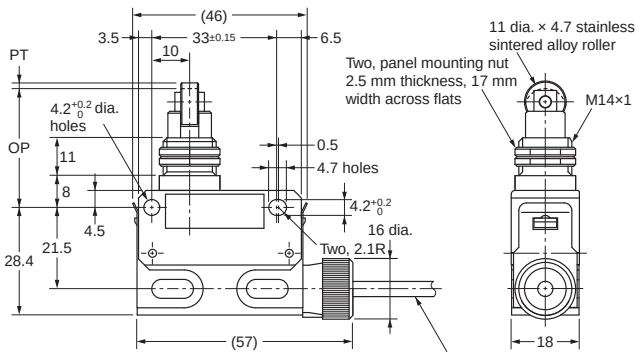
Operating force	**OF**	**max.**	11.77 N
Release force	**RF**	**min.**	4.90 N
Pretravel	**PT**	**max.**	1.5 mm
Overtravel	**OT**	**min.**	3 mm
Movement Differential	**MD**		(0.1 mm)
Operating Position	**OP**		31.4±0.8 mm

( ): Reference Value

4-dia. fluoro-insulated round cable with 3 conductors
(conductor cross section: 0.2 mm^2 (AWG25), insulator diameter: 1.2 mm),
standard length: 2 m

Cross Roller Plunger
D4ER-1B21N *
D4ER-2B21N *



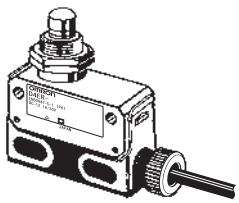


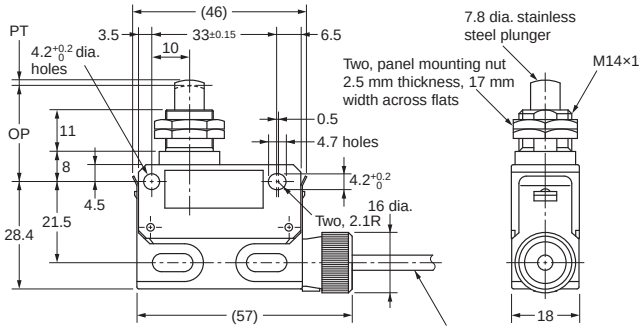
OF	**max.**	11.77 N
RF	**min.**	4.90 N
PT	**max.**	1.5 mm
OT	**min.**	3 mm
MD		(0.1 mm)
OP		31.4±0.8 mm

( ): Reference Value

4-dia. fluoro-insulated round cable with 3 conductors
(conductor cross section: 0.2 mm^2 (AWG25), insulator diameter: 1.2 mm),
standard length: 2 m

Plunger
D4ER-1C21N *
D4ER-2C21N *



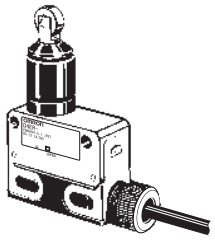


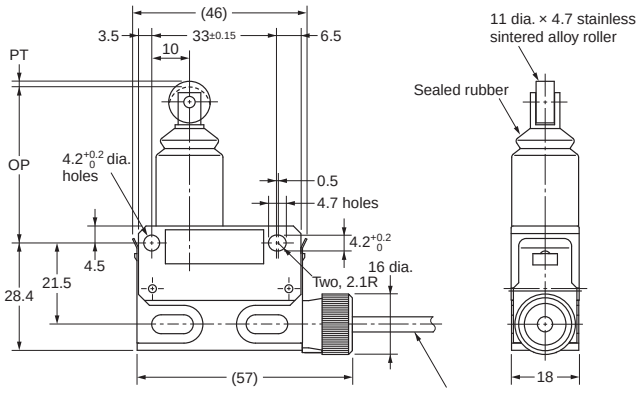
OF	**max.**	11.77N
RF	**min.**	4.90N
PT	**max.**	1.5 mm
OT	**min.**	3 mm
MD		(0.1 mm)
OP		25.4±0.8 mm

( ): Reference Value

4-dia. fluoro-insulated round cable with 3 conductors
(conductor cross section: 0.2 mm^2 (AWG25), insulator diameter: 1.2 mm),
standard length: 2 m

Sealed Roller Plunger
D4ER-1D21N *
D4ER-2D21N *





OF	**max.**	11.77 N
RF	**min.**	4.90 N
PT	**max.**	1.5 mm
OT	**min.**	3 mm
MD		(0.1 mm)
OP		41.3±0.8 mm

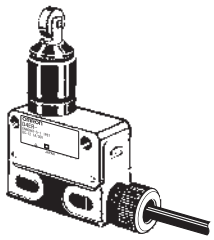
( ): Reference Value

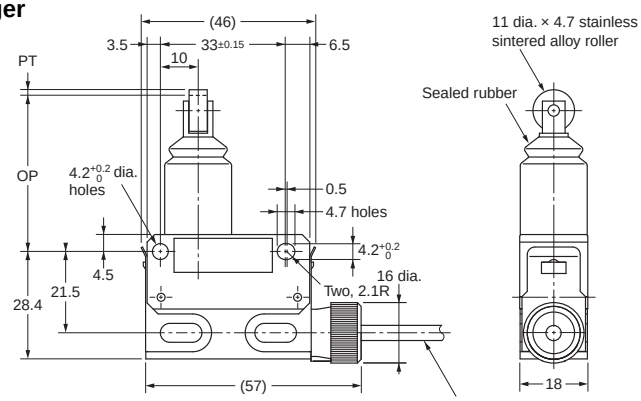
4-dia. fluoro-insulated round cable with 3 conductors
(conductor cross section: 0.2 mm^2 (AWG25), insulator diameter: 1.2 mm),
standard length: 2 m

Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
* Only the model with a terminal specification of 21 is shown. The cable is attached to the left side for models with a terminal specification of 22.

Sealed Cross Roller Plunger

D4ER-1E21N *
D4ER-2E21N *





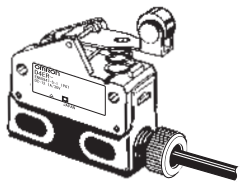
4-dia. fluoro-insulated round cable with 3 conductors
(conductor cross section: 0.2 mm² (AWG25), insulator diameter: 1.2 mm),
standard length: 2 m

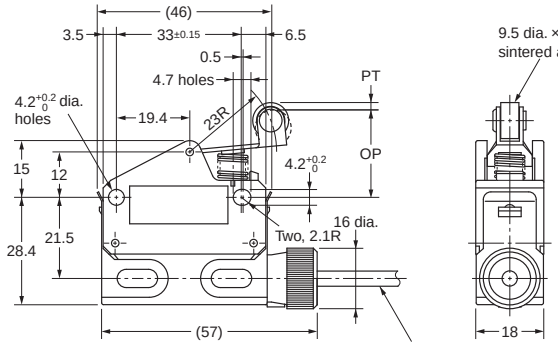
OF	**max.**	11.77 N
RF	**min.**	4.90 N
PT	**max.**	1.5 mm
OT	**min.**	3 mm
MD		(0.1 mm)
OP		41.3±0.8 mm

( ): Reference Value

Roller Lever

D4ER-1G21N *
D4ER-2G21N *





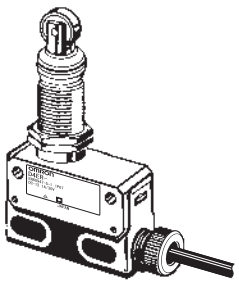
4-dia. fluoro-insulated round cable with 3 conductors
(conductor cross section: 0.2 mm² (AWG25), insulator diameter: 1.2 mm),
standard length: 2 m

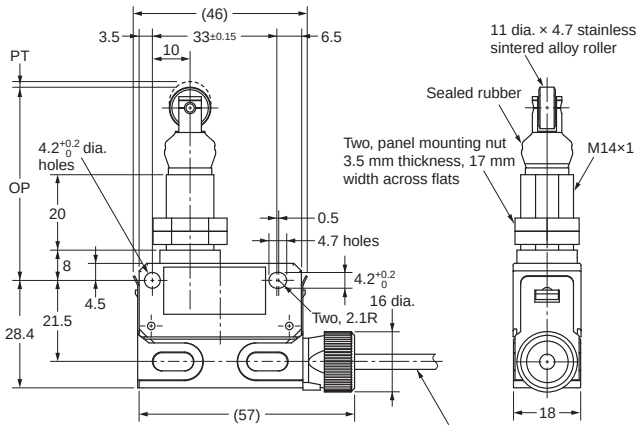
OF	**max.**	3.92 N
RF	**min.**	0.78 N
PT	**max.**	2 mm
OT	**min.**	4 mm
MD		(0.3 mm)
OP		23.1±0.8 mm

( ): Reference Value

Long Roller Plunger

D4ER-1L21N *
D4ER-2L21N *





4-dia. fluoro-insulated round cable with 3 conductors
(conductor cross section: 0.2 mm² (AWG25), insulator diameter: 1.2 mm),
standard length: 2 m

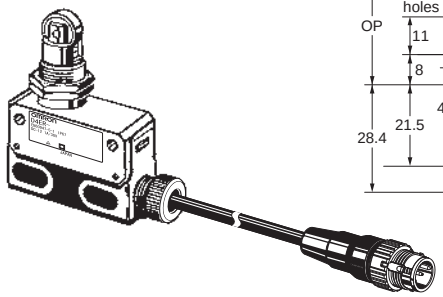
OF	**max.**	11.77 N
RF	**min.**	4.90 N
PT	**max.**	1.5 mm
OT	**min.**	3 mm
MD		(0.1 mm)
OP		51±0.8 mm

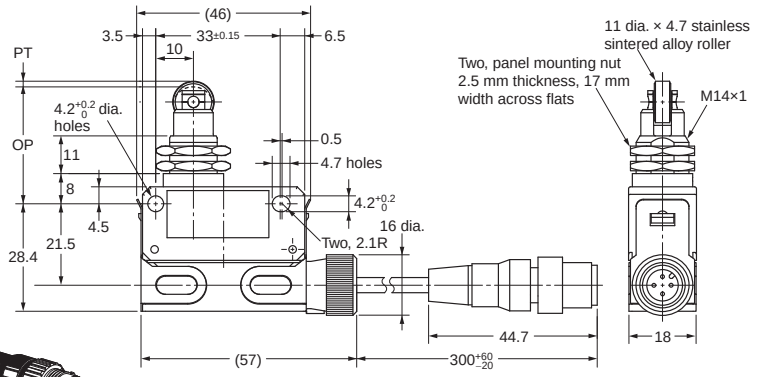
( ): Reference Value

Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
* Only the model with a terminal specification of 21 is shown. The cable is attached to the left side for models with a terminal specification of 22.

Pre-wired Connector type

Roller Plunger
D4ER-1A21N-DTK1EJ *
D4ER-2A21N-DTK1EJ *

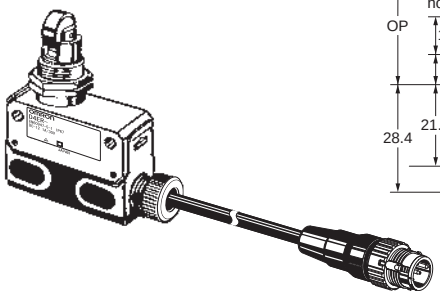


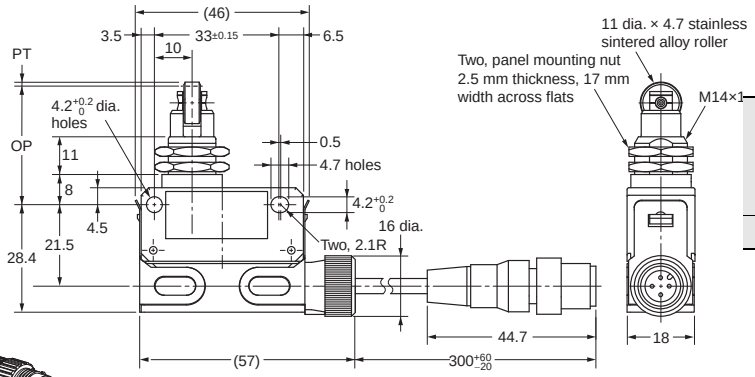


OF	**max.**	11.77 N
RF	**min.**	4.90 N
PT	**max.**	1.5 mm
OT	**min.**	3 mm
MD		(0.1 mm)
OP		31.4±0.8 mm

( ): Reference Value

Cross Roller Plunger
D4ER-1B21N-DTK1EJ *
D4ER-2B21N-DTK1EJ *

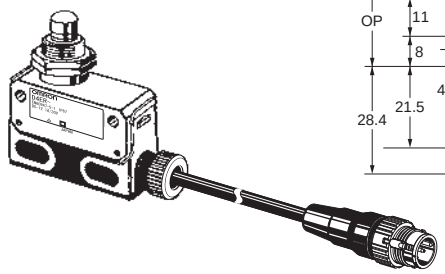


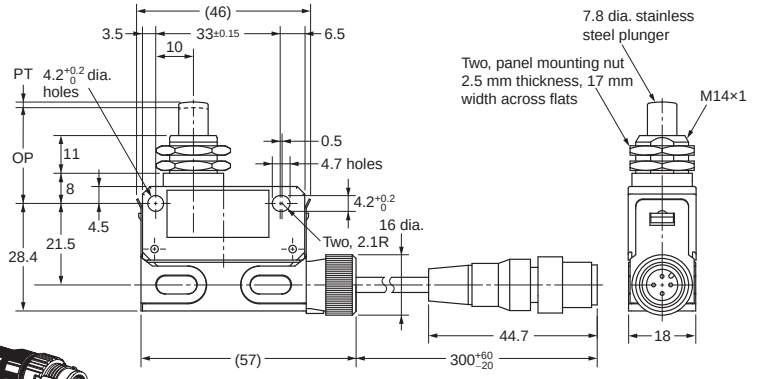


OF	**max.**	11.77 N
RF	**min.**	4.90 N
PT	**max.**	1.5 mm
OT	**min.**	3 mm
MD		(0.1 mm)
OP		31.4±0.8 mm

( ): Reference Value

Plunger
D4ER-1C21N-DTK1EJ *
D4ER-2C21N-DTK1EJ *





OF	**max.**	11.77 N
RF	**min.**	4.90 N
PT	**max.**	1.5 mm
OT	**min.**	3 mm
MD		(0.1 mm)
OP		25.4±0.8 mm

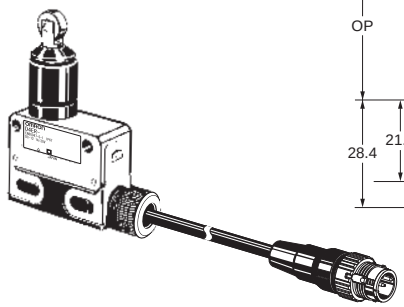
( ): Reference Value

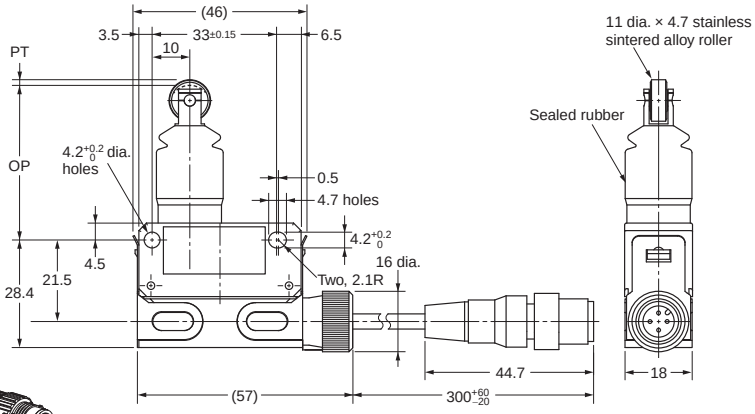
Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. The location of the positioning piece on the connector is not always the same.

* Only the model with a terminal specification of 21 is shown. The cable is attached to the left side for models with a terminal specification of 22.

Sealed Roller Plunger

D4ER-1D21N-DTK1EJ *
D4ER-2D21N-DTK1EJ *



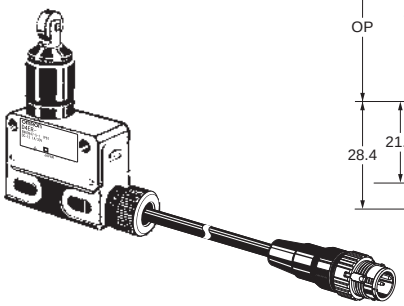


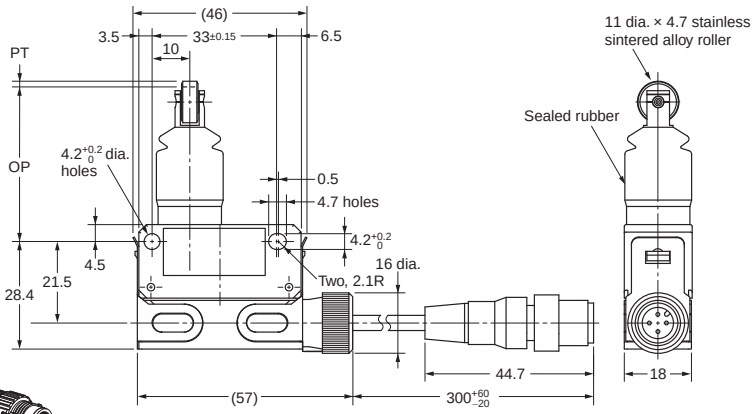
OF	**max.**	11.77 N
RF	**min.**	4.90 N
PT	**max.**	1.5 mm
OT	**min.**	3 mm
MD		(0.1 mm)
OP		41.3±0.8 mm

( ): Reference Value

Sealed Cross Roller Plunger

D4ER-1E21N-DTK1EJ *
D4ER-2E21N-DTK1EJ *





OF	**max.**	11.77 N
RF	**min.**	4.90 N
PT	**max.**	1.5 mm
OT	**min.**	3 mm
MD		(0.1 mm)
OP		41.3±0.8 mm

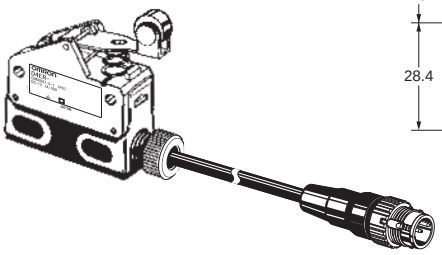
( ): Reference Value

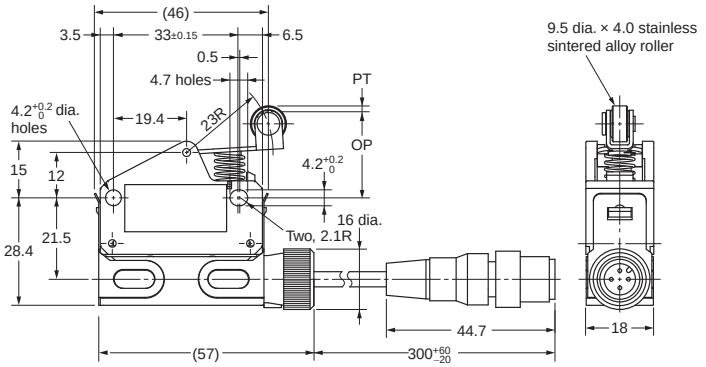
Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. The location of the positioning piece on the connector is not always the same.

* Only the model with a terminal specification of 21 is shown. The cable is attached to the left side for models with a terminal specification of 22.

Roller Lever

D4ER-1G21N-DTK1EJ *
D4ER-2G21N-DTK1EJ *



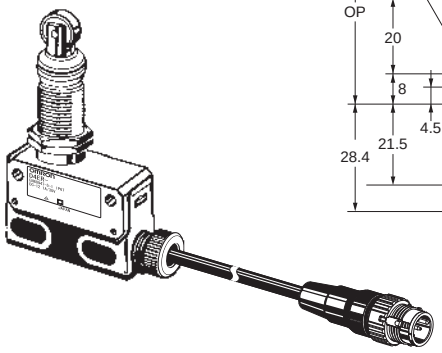


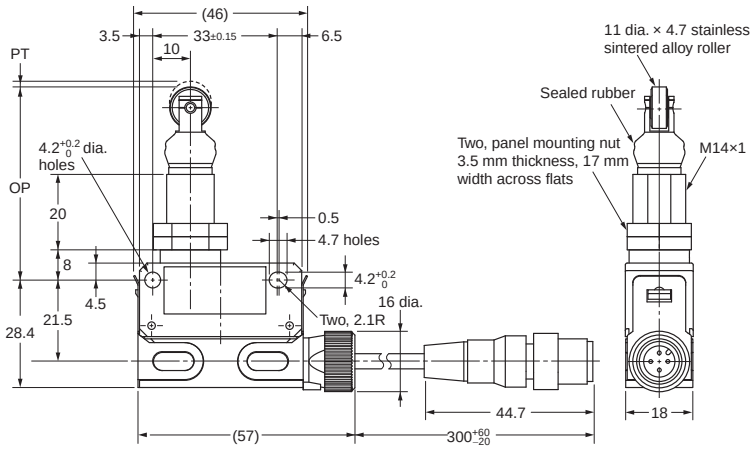
OF	**max.**	3.92 N
RF	**min.**	0.78 N
PT	**max.**	2 mm
OT	**min.**	4 mm
MD		(0.3 mm)
OP		23.1±0.8 mm

( ): Reference Value

Long Roller Plunger

D4ER-1L21N-DTK1EJ *
D4ER-2L21N-DTK1EJ *





OF	**max.**	11.77 N
RF	**min.**	4.90 N
PT	**max.**	1.5 mm
OT	**min.**	3 mm
MD		(0.1 mm)
OP		51±0.8 mm

( ): Reference Value

Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. The location of the positioning piece on the connector is not always the same.

* Only the model with a terminal specification of 21 is shown. The cable is attached to the left side for models with a terminal specification of 22.

Safety Precautions

Refer to *Safety Precautions for All Limit Switches* on your OMRON website for general precautions.

Warning Indications

Precautions for Safe Use	**Supplementary comments on what to do or avoid doing, to use the product safely.**
Precautions for Correct Use	**Supplementary comments on what to do or avoid doing, to prevent failure to operate, malfunction or undesirable effect on product performance.**

Precautions for Safe Use

- Protective structure
  Do not use the product with degrade protective structure such as swelling and crack in housing and/or sealing components. Otherwise cutting oil or other substance may enter the product, resulting in a risk of corruption or burning.
- Do not disassemble or remodel the switch in any case, or the switch will not operate normally.
- The durability of the Switch greatly varies with switching conditions. Before using the Switch, be sure to test the Switch under actual conditions. Make sure that the number of switching operations is within the permissible range.
- If an actuator is kept pressed for an extended period of time, the actuator will deteriorate quickly and faulty reset of the Switch may occur. Check the Switch periodically and replace it when necessary.

Precautions for Correct Use

- The following conditions shall be observed if you use the product under an environment using cutting oil that may affect product's life and/or performance.
  - Usage under the cutting oil condition designated by the specification
  - Usage under the cutting oil dilution ration recommended by its manufacturer
  - Usage in oil or water is prohibited

  Impact on the product life may differ depending on the oil you use. Before using the cutting oil, make sure that it should not cause deterioration or degradation of sealing components.
- The D4ER-□□□□N-DTK1EJ can be used in conditions of cutting oil use described in the specifications.
  The oil resistance may not be ensured when the products are not mated to XS5□R Connectors, so use the products correctly.
- When mating the products to XS2 or other M12 Connectors, tighten the lock to a torque of 0.39 to 0.49 N·m.
- To protect the Switch from damage due to short-circuits, be sure to connect a quick-response fuse with a breaking current 1.5 to 2 times larger than the rated current in series with the Switch.
- Do not connect lead wires directly to the terminals. Use crimp terminals and attached them securely.
- The switch is intended for indoor use only.
  Do not use the switch outdoor, or the switch will malfunction.
- Do not use the switch in the atmosphere of hazardous gases (H_2S, SO_2, NH_3, HNO_3, Cl_2, etc.) or high temperature and humidity, or it will cause the imperfect closing of the contacts or the breakage thereof stemming from corrosion.
- When storing the Switch, do not subject it to hazardous gases (H_2S, SO_2, NH_3, HNO_3, Cl_2, etc.), dust, dirt, high temperature, or high humidity.
- Do not use the switch under any of the conditions mentioned below.
  - Locations subject to severe temperature changes
  - Locations where the interior of a protective door may come into direct contact with cutting chips, metal filings, or chemicals
  - Locations subject to high humidity or condensation
  - Locations subject to severe vibration
  - Locations subject to detergents, thinners, or other solvents
  - Locations where flammable or explosive gases are present
- If the Switch is not turned ON and OFF for an extended period of time, contact oxidation may reduce the contact reliability. Continuity failure may result in an accident.
- Do not drop the Switch. Doing so may prevent it from functioning to its full capacity.
- Do not place an excessive load on the Switch.
- Be sure to keep the load current less than the rated value.
- Do not supply electric power when wiring. Otherwise electric shock may result.
- Setting the stroke close to the operating position (OP) or releasing position (RP) will cause unstable contact. If the full stroke is set to the total travel position (TTP), the actuator or Switch may be damaged due to the inertia of the dog. Therefore, adjust the stroke with the mounting panel or the dog.
- The body of the Switch is protected from the ingress of dirt, water, and other foreign matter, but the head is not protected from water or fine foreign matter. You must take measures to prevent water and fine foreign matter from entering the head. Not providing sufficient protection may result in accelerated wear or damage.
- Perform inspections and tests to confirm the operating characteristics, insulation resistance, dielectric strength, and contact resistance of the Switch if it is left in a location that does not meet the storage conditions, if it is subjected to condensation, if it is dropped, or if it is stored for more than one year.
- The user of the system must not attempt to perform maintenance and repairs. Contact the manufacturer of the system concerning maintenance and repairs.

- Make sure that the dog does not strike the actuator of the Switch at an angle. If a load is placed on the actuator at an angle, the actuator may be deformed or damaged or the rotary shaft may be deformed or damaged.
- Do not normally leave the Switch in oil or water. Water or oil may enter the Switch.
- Perform scheduled, periodic inspections.

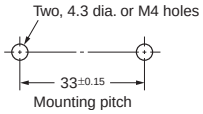
Handling

- Be sure to connect a fuse with a breaking current 1.5 to 2 times the rated current to the Limit Switch in series in order to protect the Limit Switch from damage due to short-circuiting. When using the Limit Switch under the EN ratings, use a gI or gG 10-A fuse that conforms to IEC 60269.

Mounting

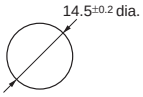
- Use M4 screws to mount the Switch. Use washers or other means to prevent the screws from becoming loose and tighten the screws to a torque of 1.18 to 1.37 N·m.

Mounting Holes



- When mounting the panel mount-type Switch with screws on a side surface, remove the hexagonal nuts from the actuator.
- When mounting the panel mount type on a panel, tighten the hexagonal nuts of the actuator to a torque less than 7.85 N·m. The two nuts can be attached at the top or bottom and from either side.

Mounting Hole



- Operating method, shape of cam or dog, operating frequency, and the overtravel (OT) have significant effect on the service life and precision of the Limit Switch. Make sure that the shape of the cam or dog is smooth enough.
- If the Limit Switch is used in a normally open condition (NO), sufficiently press the actuator to 70% to 100% of the value specified for the OT.
- Do not change the operating position by remodeling the actuator.
- Do not bend the cable to a radius that is smaller than 25 mm.

E32-T11NF□

Fiber Units for Reliable, Stable Operation in Cutting Oil Environments

- Fluororesin cable and glass lens that withstand cutting oil.
- Mechanical seal structure that eliminates gaps works together with resin filling to block ingress of cutting oil.
- Maintains high-power output for stable workpiece detection even when covered in cutting oil.
- IP68G * degree of protection (JIS C 0920 Annex 1).
- Highly-requested M4-mounting models join the series. With retaining the oil resistance performance, they can be used in locations with limited space.

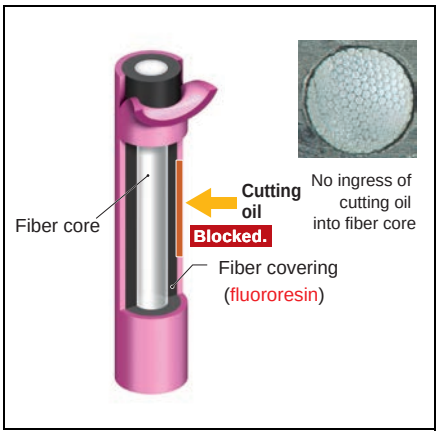
* The IP68G is the degree of protection which is defined according to the JIS (Japanese Industrial Standards). The IP68 indicates the same level of protection as defined by the IEC, and the G indicates that a device has resistance to oil.

Features

Fluororesin Outer Cable Sheath

Fluororesin Sheath

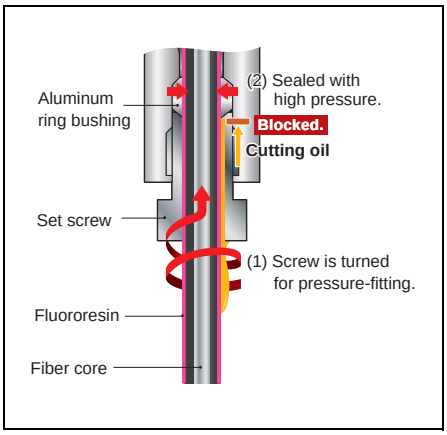
The fluororesin that covers the entire surface of the cable sheath (fiber covering) prevents the penetration of cutting oil.



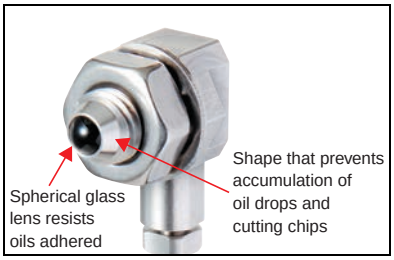
Mechanical Seal Structure

Mechanical Seal

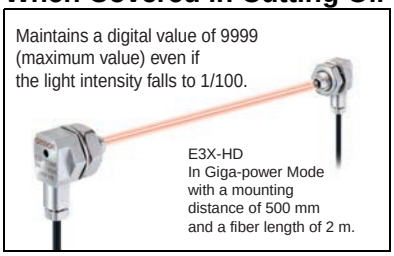
An aluminum ring bushing is compressed and deformed by a set screw to seal the structure by pressing against the fluororesin part of the fiber core. This prevents the ingress of cutting oil from the joined surfaces.



Structure Around Sensing Surface Also Resists Cutting Oil and Cutting Chips

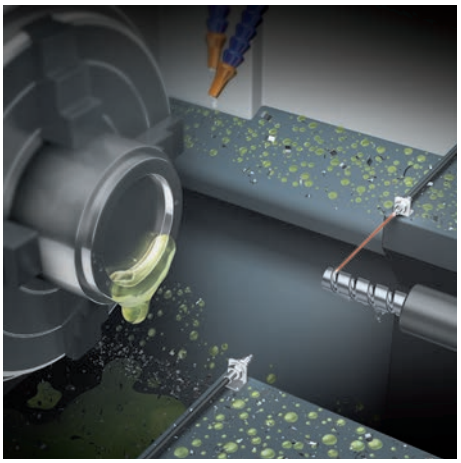


High-power Output Even When Covered in Cutting Oil

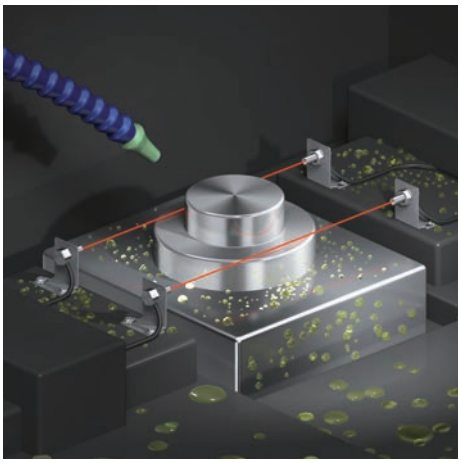


Applications

Detection of Drill Breakage



Detection of Cutting Workpieces

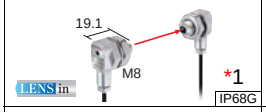
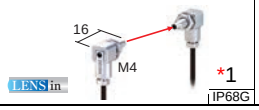


E32-T11NF□

Ratings and Specifications

Specifications

Through-beam Fiber Units

Type	Sensing direction	Appearance (mm)	Bending radius of cable	Sensing distance (mm)				Optical axis diameter (minimum sensing object)	Model
				E3X-HD		E3NX-FA			
				GIGA HS	Other modes	GIGA HS	Other modes		
Oil-resistant	Right-angle		Flexible, R1	4,000 *2 4,000 *2	*2 ST: 4,000 SHS: 2,200	4,000 *2 4,000 *2	*2 ST: 4,000 SHS: 2,200	4 dia. (0.1 dia./ 0.03 dia.)	**E32-T11NF 2M**
			Flexible, R1	2,200 730	ST: 1,100 SHS: 270	3,300 1,100	ST: 1,600 SHS: 270	2 dia. (0.1 dia./ 0.03 dia.)	**E32-T11NFS 2M**

*1. The IP68G is the degree of protection which is defined according to the JIS (Japanese Industrial Standards).
The IP68 indicates the same level of protection as defined by the IEC, and the G indicates that a device has resistance to oil.
Passed OMRON's Oil-resistant Component Evaluation Standards (OMRON's own durability evaluation standards)
(Cutting oil type: specified in JIS K 2241:2000; Temperature: 35 °C max.)
*2. The optical fiber is 2 m long on each side, so the sensing distance is 4,000 mm.
Note: 1. The following mode names and response times apply to the modes given in the Sensing distance column.
[E3X-HD] GIGA: Giga-power mode (16 ms), HS: High-speed mode (250 µs), ST: Standard mode (1 ms), and SHS: Super-high-speed mode (NPN output: 50 µs, PNP output: 55 µs)
[E3NX-FA] GIGA: Giga-power mode (16 ms), HS: High-speed mode (250 µs), ST: Standard mode (1 ms), and SHS: Super-high-speed mode (30 µs)
2. The values for the minimum sensing object are reference values that indicate values obtained in standard mode with the sensing distance and sensitivity set to the optimum values. The first value is for the E3X-HD and the second value is for the E3NX-FA.

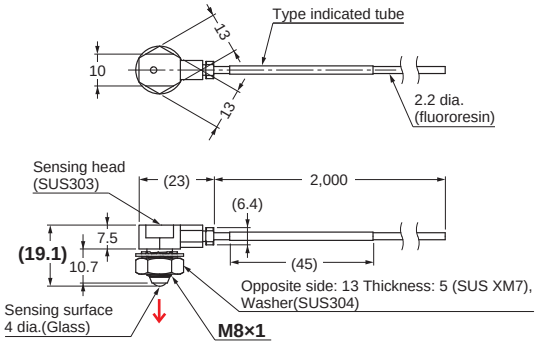
Installation Information

Models	Installation			Cable						Weight (packed state) (g)
	Ambient temperature	Tightening torque	Mounting hole	Bending radius	Unbendable length	Tensile strength	Sheath material	Core material	Emitter/receiver differentiation	
E32-T11NF 2M	–25 to 70 °C	12 N·m	8.5 $^{+0.5}_{0}$ dia.	R1	0	29.4 N	Fluororesin	Plastic	None	80
E32-T11NFS 2M	–25 to 70 °C	0.78 N·m	4.2 $^{+0.5}_{0}$ dia.	R1	0	29.4 N	Fluororesin	Plastic	None	70

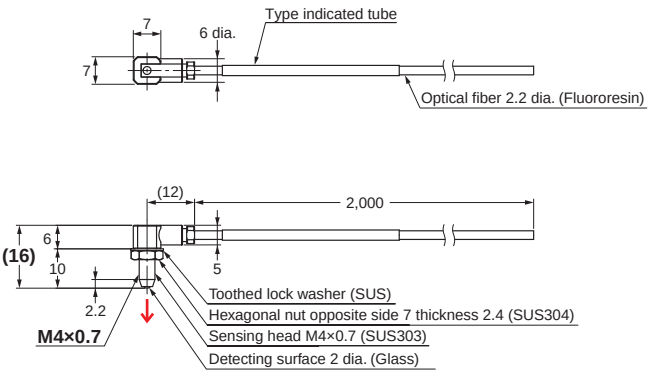
Dimensions

(Unit: mm)
Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.

E32-T11NF 2M (Free Cutting)



E32-T11NFS 2M (Free Cutting)



Combined Fiber Amplifier Units

Item / Series	E3X-HD Series	E3NX-FA Series
Appearance		
Output	1 output	1 or 2 outputs (depending on the model)
External input	Not supported	Supported or not supported (depending on the model)
Response time *	50 µs (55 µs)/250 µs/1 ms/16 ms (Default: 250 µs)	30 µs (32 µs)/250 µs/1 ms/16 ms (Default: 250 µs)

Note: The Fiber Amplifier Units are not oil resistant.
* These are the response times for super-high-speed mode (SHS), high-speed mode (HS), standard mode (ST), and GIGA-power mode (GIGA). The value in parentheses for the super-high-speed mode is for a model with a PNP output.

E3ZR-C

Photoelectric Sensors That Withstand Cutting Oil to Reduce Failures Caused by Ingress of Cutting Oil

- Fluororesin cables that strongly resist cutting oil.
- Sealing methods that prevent gaps at joints block the ingress of cutting oil.
- IP67G * degree of protection (JIS C 0920 Annex 1).

Refer to *Safety Precautions* on page 47.

*The IP67G is the degree of protection which is defined according to the JIS (Japanese Industrial Standards).
The IP67 indicates the same level of protection as defined by the IEC, and the G indicates that a device has resistance to oil.

For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

Features

Fluororesin Outer Cable Sheath

Fluororesin Sheath

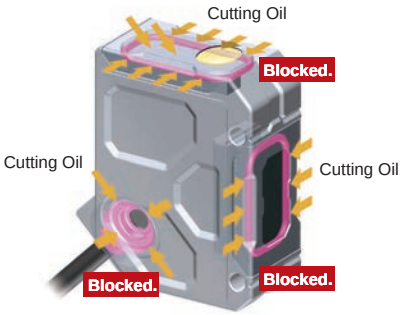
Fluororesin, which provides superior resistance to corrosion, is used for the outer cable sheath to suppress cable swelling and deterioration and prevent the ingress of cutting oil into the PCB inside the Sensor.

New Rubber Material Combining HNBR and Fluororubber Provides Superior Resistance to Oil

New Rubber Material

This new rubber material has been used in all vital seals to prevent the ingress of cutting oils.

Important Sealing Sections

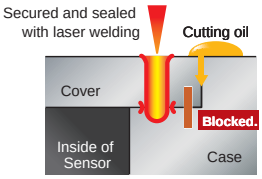


Method for Complete Sealing without Adhesive

Laser Welding

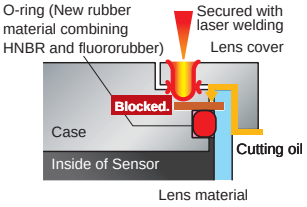
Joints between Metal Parts

Gaps are sealed by fusing the metal case and cover with a laser beam.



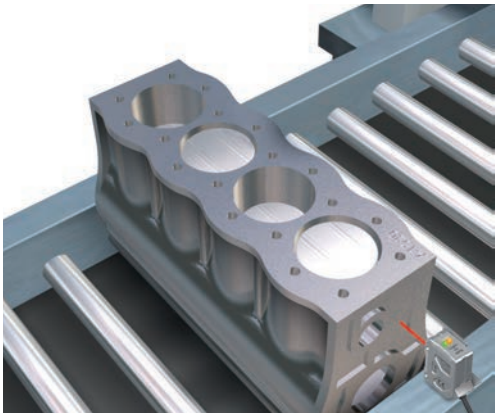
Joints between Metal and Non-metal Parts

Securing the metal case and lens cover with laser welding makes the compressed O-ring seal the gap.

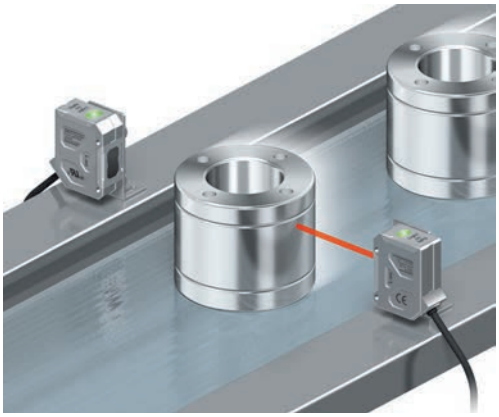


Applications

Engine Block Passage Detection



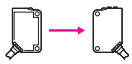
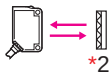
Metal Workpiece Detection



Ordering Information

Sensors [Refer to *Dimensions* on page 49.]

Red light

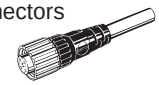
Sensing method	Appearance	Connection method	Sensing distance	Operation mode	Model	
					NPN output	PNP output
Through-beam (Emitter + Receiver) *1		Pre-wired (2 m) *4	 30 m	Light ON	**E3ZR-CT61L 2M** Emitter E3ZR-CT61L-L 2M Receiver E3ZR-CT61L-D 2M	**E3ZR-CT81L 2M** Emitter E3ZR-CT81L-L 2M Receiver E3ZR-CT81L-D 2M
		M12 Smartclick pre-wired connector (0.3 m)			**E3ZR-CT61L-M1TJ 0.3M** Emitter E3ZR-CT61L-L-M1TJ 0.3M Receiver E3ZR-CT61L-D-M1TJ 0.3M	**E3ZR-CT81L-M1TJ 0.3M** Emitter E3ZR-CT81L-L-M1TJ 0.3M Receiver E3ZR-CT81L-D-M1TJ 0.3M
		Pre-wired (2 m) *4		Dark ON	**E3ZR-CT61D 2M** Emitter E3ZR-CT61D-L 2M Receiver E3ZR-CT61D-D 2M	**E3ZR-CT81D 2M** Emitter E3ZR-CT81D-L 2M Receiver E3ZR-CT81D-D 2M
		M12 Smartclick pre-wired connector (0.3 m)			**E3ZR-CT61D-M1TJ 0.3M** Emitter E3ZR-CT61D-L-M1TJ 0.3M Receiver E3ZR-CT61D-D-M1TJ 0.3M	**E3ZR-CT81D-M1TJ 0.3M** Emitter E3ZR-CT81D-L-M1TJ 0.3M Receiver E3ZR-CT81D-D-M1TJ 0.3M
Retro-reflective with MSR function	 *2	Pre-wired (2 m) *4	 2.5 m *3 (100 mm) (When using E39-R1R Oil-resistant Reflector)	Light ON	**E3ZR-CR61L 2M**	**E3ZR-CR81L 2M**
		M12 Smartclick pre-wired connector (0.3 m)			**E3ZR-CR61L-M1TJ 0.3M**	**E3ZR-CR81L-M1TJ 0.3M**
		Pre-wired (2 m) *4		Dark ON	**E3ZR-CR61D 2M**	**E3ZR-CR81D 2M**
		M12 Smartclick pre-wired connector (0.3 m)			**E3ZR-CR61D-M1TJ 0.3M**	**E3ZR-CR81D-M1TJ 0.3M**
Diffuse-reflective		Pre-wired (2 m) *4	 0.5 m	Light ON	**E3ZR-CD61L 2M**	**E3ZR-CD81L 2M**
		M12 Smartclick pre-wired connector (0.3 m)			**E3ZR-CD61L-M1TJ 0.3M**	**E3ZR-CD81L-M1TJ 0.3M**
		Pre-wired (2 m) *4		Dark ON	**E3ZR-CD61D 2M**	**E3ZR-CD81D 2M**
		M12 Smartclick pre-wired connector (0.3 m)			**E3ZR-CD61D-M1TJ 0.3M**	**E3ZR-CD81D-M1TJ 0.3M**

*1. Through-beam Sensors are sold in sets that include both the Emitter and Receiver. An order for the Emitter or Receiver alone cannot be accepted.
*2. The Reflector is sold separately. Select the Reflector model most suited to the application.
*3. Values in parentheses indicate the minimum required distance between the Sensor and Reflector.
*4. Models with 5-m cable length are also available with "5M" suffix. (Example: E3ZR-CT61L 5M)

Accessories (Sold Separately)

Sensor I/O Connectors (M12, Sockets on One Cable End)

(Models for Pre-wired Connectors) A Sensor I/O Connector is not provided with the Sensor. It must be ordered separately as required.

Appearance	Cable diameter (mm)	Cable length	Sensor I/O Connector model number	Applicable Photoelectric Sensor model number
Straight, Smartclick Oil-resistant Connectors 	4 dia.	2 m	**XS5FR-D423-D80-RB1**	E3ZR-C□□1□-M1TJ
		5 m	**XS5FR-D423-G80-RB1**	
		10 m	**XS5FR-D423-J80-RB1**	

Note: Refer to the *XS5□R* on page 53 for connector details and for information on cables with connectors on both ends.

Slit (A Slit is not provided with Through-beam Sensors) Order a Slit separately if required.

Slit width	Sensing distance (Reference value)	Model	Contents
	E3ZR-CT□		
1-mm dia.	0.2 m	**E39-S77A**	One set (contains Slits for both the Emitter and Receiver)
2-mm dia.	0.8 m	**E39-S77B**	

Mounting Brackets A Mounting Bracket is not provided with the Sensor. Order a Mounting Bracket separately if required.

Appearance	Model (material)	Quantity	Remarks
	**E39-L153 (SUS304)**	1	Mounting Brackets
	**E39-L104 (SUS304)**	1	
	**E39-L196 (SUS304)**	1	
	**E39-L197 (SUS304)**	1	
	**E39-L98 (SUS304)**	1	Metal Protective Cover Bracket

Note: **1.** When using Through-beam models, order one bracket for the Receiver and one for the Emitter.
2. Refer to *Mounting Brackets on E39-L/E39-S/E39-R* on your OMRON website for details.

Reflector (A Reflector is required for each Retro-reflective Sensor: A Reflector is not provided with the Sensor. Be sure to order a Reflector.)

Name	E3ZM-CR sensing distance		Model	Quantity	Remarks
	Rated value	Reference value			
Oil-resistant Reflector	2.5 m (100 mm) *	---	**E39-R1R**	1	· Reflectors are not provided with Retro-reflective models. · The MSR function is enabled.

Note: Refer to *Reflectors on E39-L/E39-S/E39-R* on your OMRON website for details.
*Values in parentheses indicate the minimum required distance between the Sensor and Reflector.

E3ZR-C

Ratings and Specifications

Sensors

Item \ Model		Sensing method	Through-beam	Retro-reflective with MSR function	Diffuse-reflective
	NPN output		E3ZR-CT61☐ (-M1TJ)	E3ZR-CR61☐ (-M1TJ)	E3ZR-CD61☐ (-M1TJ)
	PNP output		E3ZR-CT81☐ (-M1TJ)	E3ZR-CR81☐ (-M1TJ)	E3ZR-CD81☐ (-M1TJ)
Sensing distance			30 m	2.5 m [100 mm] *1 (Using E39-R1R)	0.5 m (White paper 300 × 300 mm)
Standard sensing object			Opaque: 12-mm dia. min.	Opaque: 75-mm dia. min.	---
Differential travel			---		20% of sensing distance max.
Directional angle			Emitter, Receiver: 3° to 15° (Distance between emitter and receiver. Rated sensing distance)	Sensor: 2° to 10° Reflector: 30° (Distance to Reflector. Rated sensing distance)	---
Light source (wavelength)			Red LED (624 nm)	Red LED (660 nm)	Red LED (624 nm)
Power supply voltage			12 to 24 VDC ±10%, ripple (p-p) 10% max.		
Current consumption			35 mA max. (Emitter 15 mA max., Receiver 20 mA max.)	30 mA max.	
Control output			Output power supply voltage: 26.4 VDC max., Output current: 100 mA max. (Residual voltage: 2 V max.) Open-collector output (NPN/PNP output depending on model)		
Protection circuits			Reversed power supply polarity protection, output short-circuit protection, and reversed output polarity protection	Reversed power supply polarity protection, output short-circuit protection, reversed output polarity protection, and mutual interference prevention function (with up to two Units)	
Response time			Operate or reset: 1 ms max.		
Sensitivity adjustment			None		
Ambient illumination (Receiver side)			Incandescent lamp: 5,000 lx max., Sunlight: 10,000 lx max.		
Ambient temperature range			Operating: –25 to 55°C, Storage: –40 to 70°C (with no icing or condensation)		
Ambient humidity range			Operating: 35% to 85%, Storage: 35% to 95% (with no condensation)		
Insulation resistance			20 MΩ min. at 500 VDC		
Dielectric strength			1,000 VAC, 50/60 Hz for 1 min		
Vibration resistance			Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions		
Shock resistance			Destruction: 1,000 m/s^2 3 times each in X, Y, and Z directions		
Degree of protection			IP67 (IEC 60529) and IP67G *2 (JIS C 0920 Annex 1) Passed OMRON's Oil-resistant Component Evaluation Standards *3 (Cutting oil type: specified in JIS K 2241:2000; Temperature: 35°C max.)		
Connection method			Pre-wired (standard length: 2 m), -M1TJ: Pre-wired connector (standard length: 0.3 m)		
Indicators			Operation indicator (orange) and stability indicator (green) (The Emitter has only a power indicator (green).)		
Weight (packed state)	Pre-wired models		Approx. 200 g	Approx. 100 g	
	Pre-wired connector		Approx. 140 g	Approx. 70 g	
Housing material			SUS316L		
Cable material			Fluororesin		
Lens material			Methacrylate resin (Oil-resistant high molecular weight type)		
Indicator material			Polyetherimide resin		
Accessories			Instruction manual		

*1. Values in parentheses indicate the minimum required distance between the Sensor and Reflector.
*2. The IP67G is the degree of protection which is defined according to the JIS (Japanese Industrial Standards).
The IP67 indicates the same level of protection as defined by the IEC, and the G indicates that a device has resistance to oil.
*3. The Oil-resistant Component Evaluation Standards are OMRON's own durability evaluation standards.
The Pre-wired Connector Model meets the degree of protection when it is correctly connected with an XS5☐R Oil-resistant Connector.
The degree of protection is not satisfied with the part where there is no XS5FR Oil-resistant Connector connected and cable wires are uncovered.
And as for the Pre-wired Models, the degree of protection is not satisfied with the part where cable wires are uncovered.

Accessories (Sold Separately)

Reflector

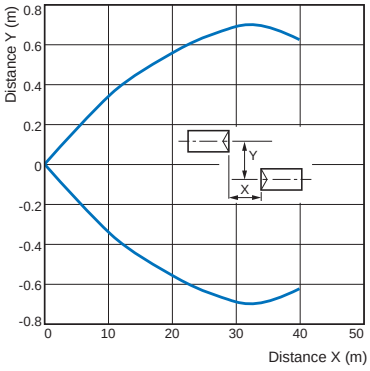
Item \ Name / Model	Oil-resistant Reflector E39-R1R
Directional angle	30° min.
Ambient temperature range	Operating: –25 to 55°C, Storage: –40 to 70°C (with no icing or condensation)
Ambient humidity range	Operating: 35% to 85%, Storage: 35% to 95% (with no condensation)
Degree of protection	IP67 (IEC 60529) and IP67G *1 (JIS C 0920 Annex 1) Passed OMRON's Oil-resistant Component Evaluation Standards *2 (Cutting oil type: specified in JIS K 2241:2000, Temperature: 35°C max.)

*1. The IP67G is the degree of protection which is defined according to the JIS (Japanese Industrial Standards).
The IP67 indicates the same level of protection as defined by the IEC, and the G indicates that a device has resistance to oil.
*2. The Oil-resistant Component Evaluation Standards are OMRON's own durability evaluation standards.

Engineering Data (Reference Value)

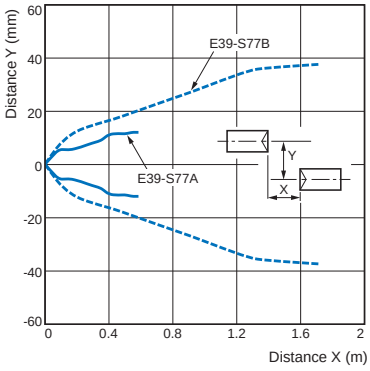
Parallel Operating Range

Through-beam Models
E3ZR-CT□1□

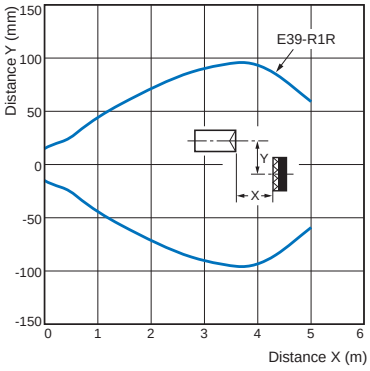


Through-beam Models Retro-reflective Models
E3ZR-CT□1□ and Slit

(A Slit is mounted to the Emitter and Receiver.)

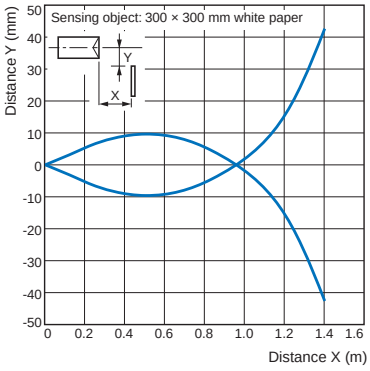


Retro-reflective Models
E3ZR-CR□1□



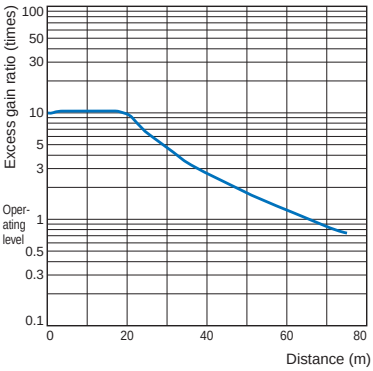
Operating Range

Diffuse-reflective Models
E3ZR-CD□1□

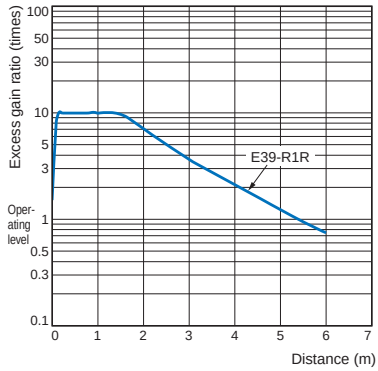


Excess Gain vs. Distance

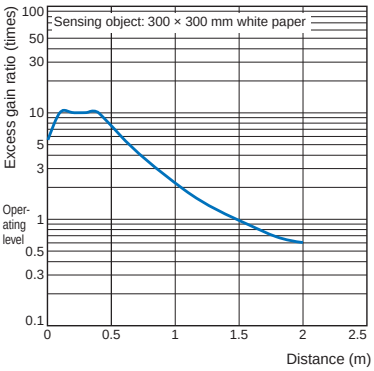
Through-beam Models
E3ZR-CT□1□



Retro-reflective Models
E3ZR-CR□1□

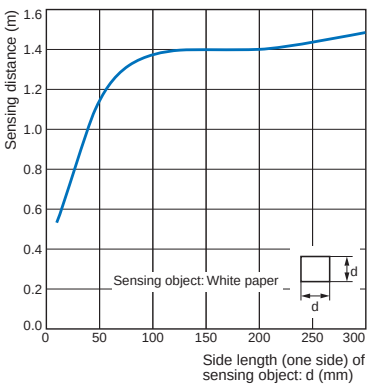


Diffuse-reflective Models
E3ZR-CD□1□



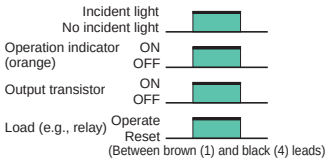
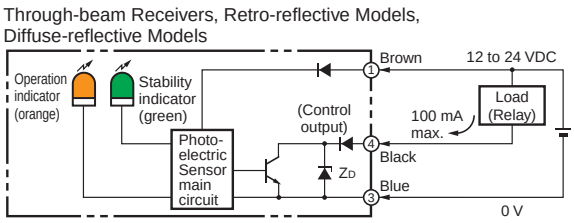
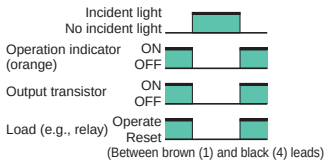
Sensing Object Size vs. Distance

Diffuse-reflective Models
E3ZR-CD□1□

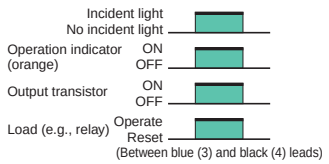
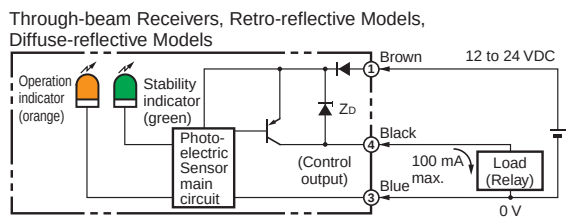
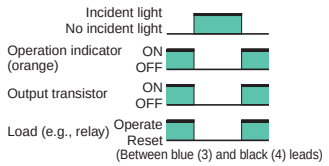


I/O Circuit Diagrams

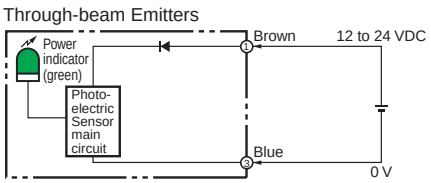
NPN Output

Model	Operation mode	Timing charts	Output circuit
E3ZR-CT61L E3ZR-CR61L E3ZR-CD61L	Light ON		
E3ZR-CT61D E3ZR-CR61D E3ZR-CD61D	Dark ON		

PNP Output

Model	Operation mode	Timing charts	Output circuit
E3ZR-CT81L E3ZR-CR81L E3ZR-CD81L	Light ON		
E3ZR-CT81D E3ZR-CR81D E3ZR-CD81D	Dark ON		

Emitter (Either NPN or PNP Output)

Model	Circuit
E3ZR-CT61□ E3ZR-CT81□	

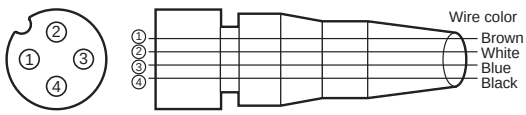
Connector Pin Arrangement

M12 Pre-wired Connector

M12 Connector Pin Arrangement

Plugs (Sensor I/O Connectors)

M12 Smartclick Connector



XS5FR-D423-D80-RB1 (2 m)
XS5FR-D423-G80-RB1 (5 m)
XS5FR-D423-J80-RB1 (10 m)

Nomenclature

Sensors with Sensitivity Adjuster and Operation Selector

Through-beam Models

E3ZR-CT□1□-D (Receiver)

Retro-reflective Models

E3ZR-CR□1□

Diffuse-reflective Models

E3ZR-CD□1□

Safety Precautions

Be sure to read the precautions for all models in the website at: http://www.ia.omron.com/.

Warning Indications

⚠ WARNING	**Warning level** Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.
⚠ CAUTION	**Caution level** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.
Precautions for Safe Use	Supplementary comments on what to do or avoid doing, to use the product safely.
Precautions for Correct Use	Supplementary comments on what to do or avoid doing, to prevent failure to operate, malfunction or undesirable effect on product performance.

Meaning of Product Safety Symbols

	**General prohibition** Indicates the instructions of unspecified prohibited action.
	**Caution, fire** Indicates the possibility of fires under specific conditions.
	**Caution, explosion** Indicates the possibility of explosion under specific conditions.
	**General caution** Indicates unspecified general alert.
	**Caution, high temperature** Indicates the possibility of injuries by high temperature under specific conditions.

⚠ WARNING

This product is not designed or rated for ensuring safety of persons either directly or indirectly.
Do not use it for such purposes.

⚠ CAUTION

Do not use it exceeding the rated voltage.
There is a possibility of failure and fire.

Risk of explosion.
Do not connect the product to an AC power supply.

Do not jet the high pressure water concentrating on one place when washing the product, because it might damage of parts and deteriorate the degree of protection.

Do not use this product under ambient conditions that exceed the ratings.
High-temperature environments may result in burn injury.

Precautions for Safe Use

The following precautions must be observed to ensure safe operation.

(1) Operating Environment

1. Do not use the product in an environment where flammable or explosive gas is present.

2. Do not use the product in environments subject to cleaners and disinfectants. They may reduce the degree of protection.

(2) Output short-circuit

Please do not connect a output short-circuit. Please do not throw the current that exceeds ratings into the control output. When an excessive electric current was thrown, the output short-circuit protection function installed, but it'll be the cause which breaks down.

(3) Low-temperature Environments

Do not touch the metal surface with your bare hands when the temperature is low.
Touching the surface may result in a cold burn.

(4) Modifications

Do not attempt to disassemble, repair, or modify the product.

(5) Protective structure

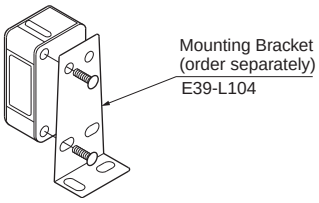
Do not use the product with degrade protective structure such as swelling and crack in housing and/or sealing components.
Otherwise cutting oil or other substance may enter the product, resulting in a risk of corruption or burning.

Precautions for Correct Use

(1) Do not install the product in the following locations.
1. In the place exposed to the direct sunlight.
2. In the place where humidity is high and condensation may occur.
3. In the place where corrosive gas exists.
4. In the place where vibration or shock is directly transmitted to the product.

(2) Connection and Mounting
- Be sure that before making supply the supply voltage is less than the maximum rated supply voltage. (26.4V DC)
- If the Sensor wiring is placed in the same conduits or ducts as high-voltage or high-power lines, inductive noise may cause malfunction or damage. Wire the cables separately or use a shielded cable.
- For extending cable, use a cable 0.3 mm^2 min. and 100 m max. in length.
- Do not pull the cable strongly.
- Excessive force (hitting by hammer, etc.) should not be put on the Sensor because it may damage its water-resistance and oil-resistance characteristic.
- Mount the Sensor either using the bracket (sold separately) or on a flat surface.
- Use M3 screws to mount the Sensor.
- Use tightening torque 0.5 N·m max.
- Be sure to turn OFF the power supply before inserting or removing the connector.

Mounting Diagram



(3) Connecting Connectors
- Be sure to hold the connector cover when inserting or removing the connector.
  Be sure to tighten the connector lock by hand; do not use pliers or other tools.
  If the tightening is insufficient, the degree of protection will not be maintained and the Sensor may become loose due to vibration.

(4) Pre-wired Connector Model
- The E3ZR-C can be used in conditions of cutting oil use described in the specifications.
  The oil resistance may not be ensured when the products are not mated to XS5□R Connectors, so use the products correctly.
- When mating the products to XS2 or other M12 Connectors, tighten the lock to a torque of 0.39 to 0.49 N·m.

(5) Oil resistance
The following conditions shall be observed if you use the product under an environment using cutting oil that may affect product's life and/or performance.
- Usage under the cutting oil condition designated by the specification
- Usage under the cutting oil dilution ratio recommended by its manufacturer
- Usage in oil or water is prohibited
  Impact on the product life may differ depending on the oil you use.

Before using the cutting oil, make sure that it should not cause deterioration or degradation of sealing components.

(6) Water resistance
This product fit in with IP67/67G, but this product isn't perfect waterproofing.
Avoid using the product in the water or locations subject to water drops.

(7) Power supply
When using a commercially available switching regulator, be sure to ground the FG (Frame Ground) terminals.

(8) Power supply reset time
The Sensor will begin sensing no later than 100 ms after the power is turned on.
If the load and the Sensor is connected to different power supply, the Sensor must be always turned on first.

(9) Turning off the power supply
When turning off the power, output pulse may be generated. We recommend turning off the power supply of the load or load line first.

(10) Overcurrent
External overcurrent protection of 1 A for AWG25 wire must be provided for cable protection.

(11) Output short-circuit protection
If the output short-circuit occurs, the output will turn off. Check the wiring before turning ON the power supply again.
The output short-circuit protection will operate when the current flow reaches 1.8 times the rated load current.
When using a capacitive load, use an inrush current of 1.8 times the rated load current or lower.

(12) Cleaning
Never use thinner or other solvents. Otherwise, the Sensor surface may be dissolved.

(13) Disposing
Please process this product as industrial waste.

Dimensions

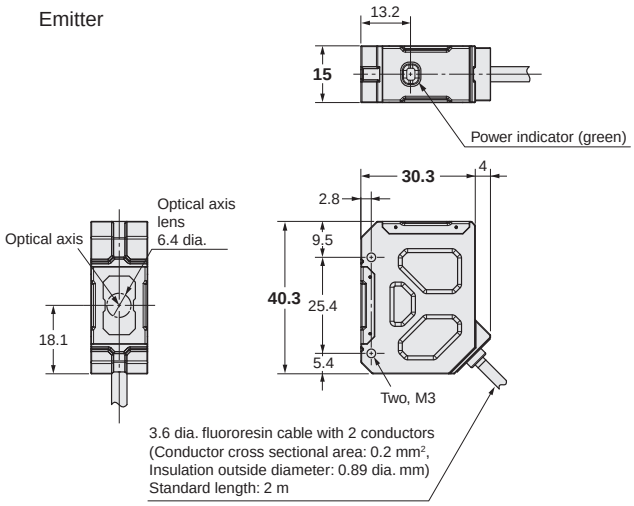
(Unit: mm)
Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.

Sensors

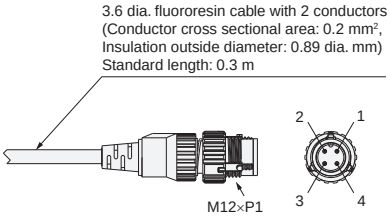
Through-beam Models*

Pre-wired Models
E3ZR-CT61□
E3ZR-CT81□

Emitter

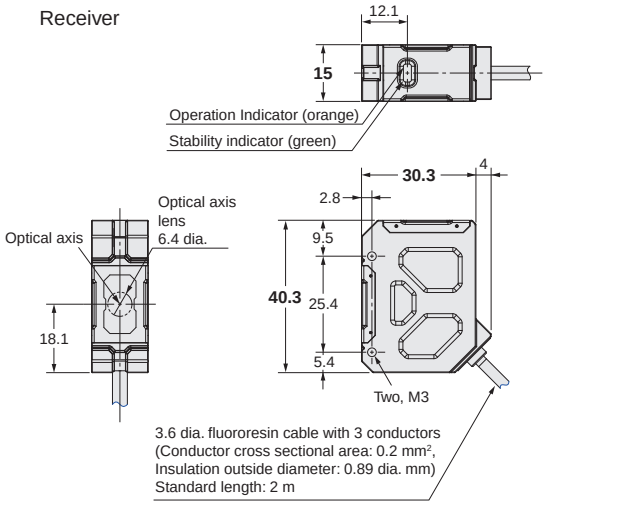


M12 Pre-wired Connector (E3ZR-C□□1□-M1TJ)

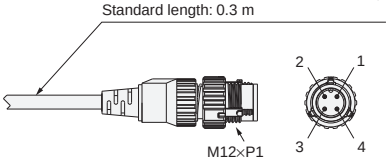


Terminal No.	Specifications
1	+V
2	---
3	0V
4	---

Receiver



M12 Pre-wired Connector (E3ZR-C□□1□-M1TJ)



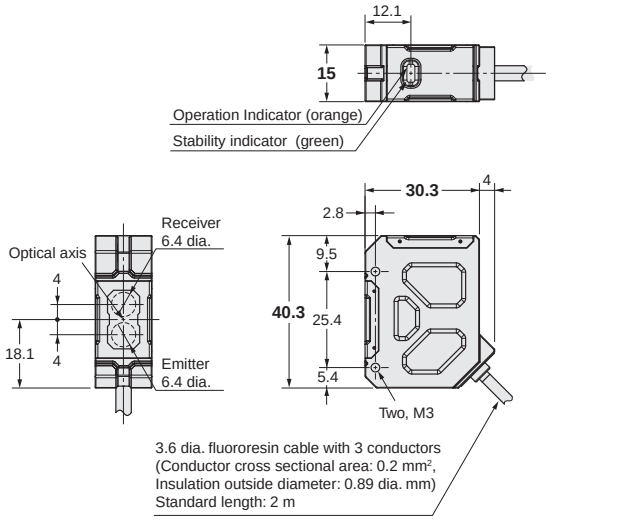
Terminal No.	Specifications
1	+V
2	---
3	0V
4	Output

Retro-reflective Models

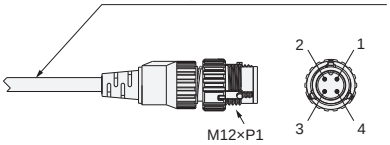
Pre-wired Models
E3ZR-CR61□
E3ZR-CR81□

Diffuse-reflective Models

Pre-wired Models
E3ZR-CD61□
E3ZR-CD81□



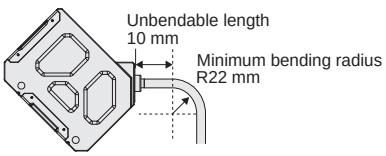
M12 Pre-wired Connector (E3ZR-C□□1□-M1TJ)



Terminal No.	Specifications
1	+V
2	---
3	0V
4	Output

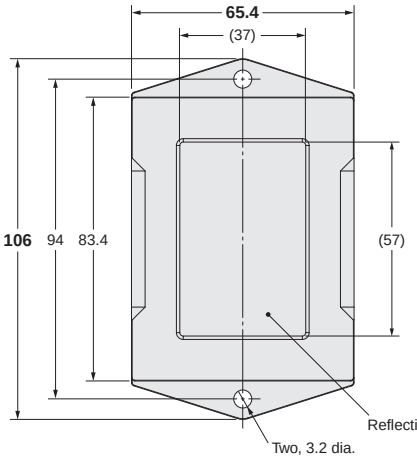
*Models numbers for Through-beam Sensors (E3ZR-CT□1□(-M1TJ)) are for sets that include both the Emitter and Receiver.
The model number of the Emitter is expressed by adding "-L" to the set model number (example: E3ZR-CT61L-L 2M), the model number of the Receiver, by adding "-D" (example: E3ZR-CT61L-D 2M.) Refer to *Ordering Information* to confirm model numbers for Emitters and Receivers.

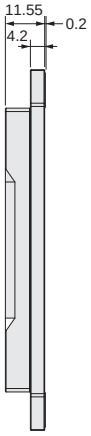
Cable bend radius

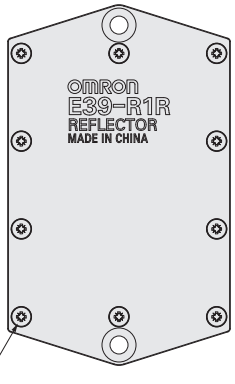


Accessories (Sold Separately)

Oil-resistant Reflector
E39-R1R



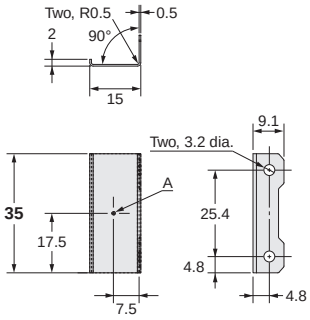




Ten oil-resistant M3 special screws
Note: Do not remove the M3 screws.

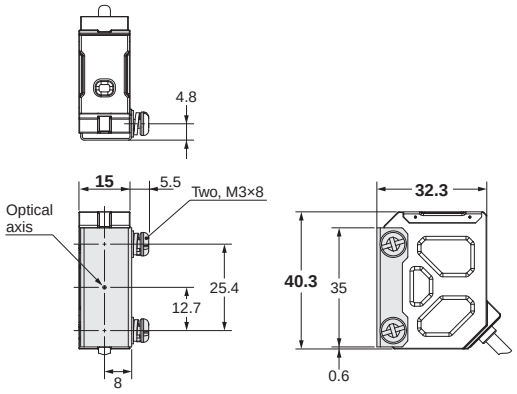
Material
Reflective surface: Methacrylate resin
(Oil-resistant high molecular weight type)
Rear surface: Aluminium
Oil-resistant M3 special screws:
Stainless steel (SUS302)

Slits
E39-S77A
E39-S77B

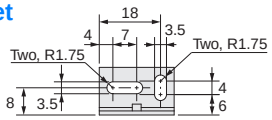


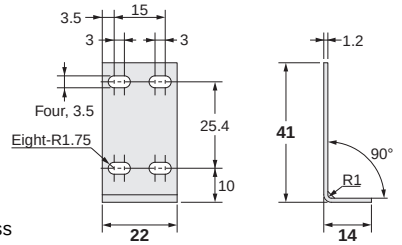
Model	A	Material
E39-S77A	1 dia.	Stainless (SUS304)
E39-S77B	2 dia.	

Photoelectric Sensor Accessory are installed (Example of E3ZR-CT61L)



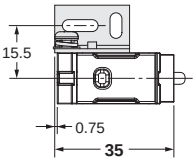
Mounting Bracket
E39-L153

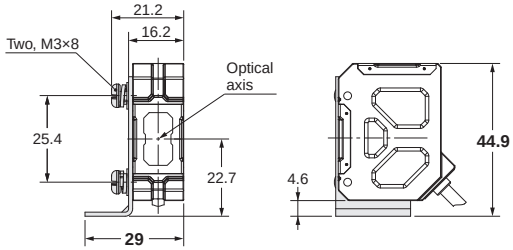




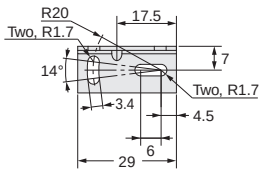
Note: Material Stainless (SUS304)

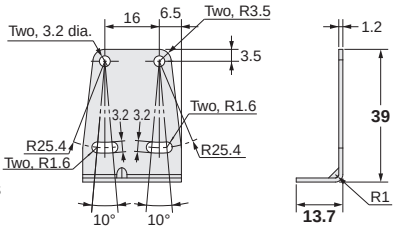
Photoelectric Sensor Accessory are installed (Example of E3ZR-CT61L)





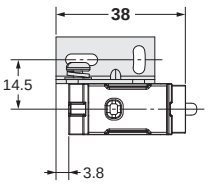
Mounting Bracket
E39-L104

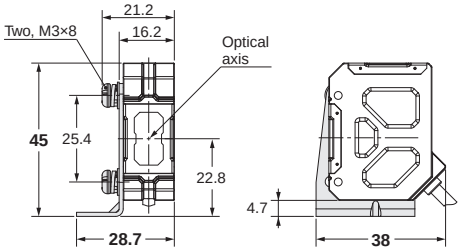




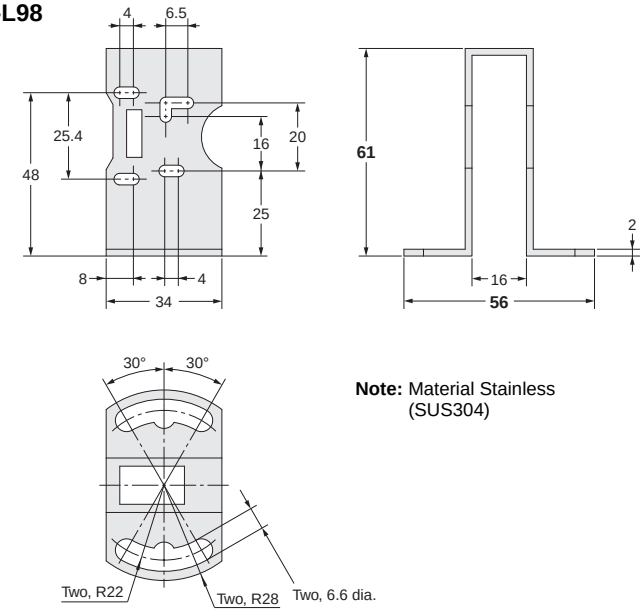
Note: Material Stainless (SUS304)

Photoelectric Sensor Accessory are installed (Example of E3ZR-CT61L)



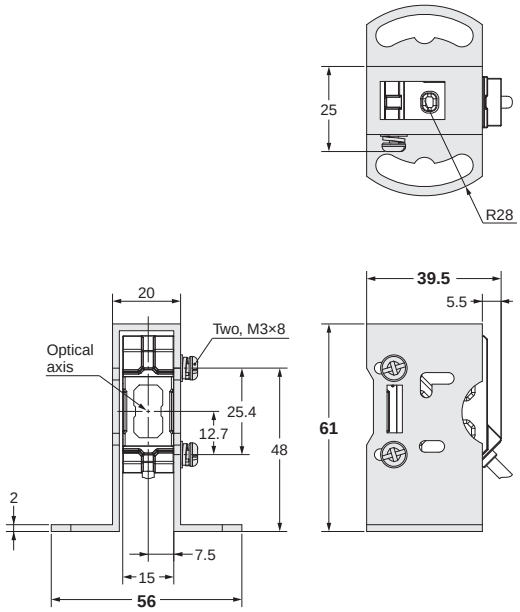


Mounting Bracket
E39-L98



Note: Material Stainless (SUS304)

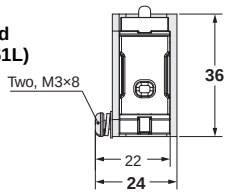
Photoelectric Sensor Accessory are installed (Example of E3ZR-CT61L)

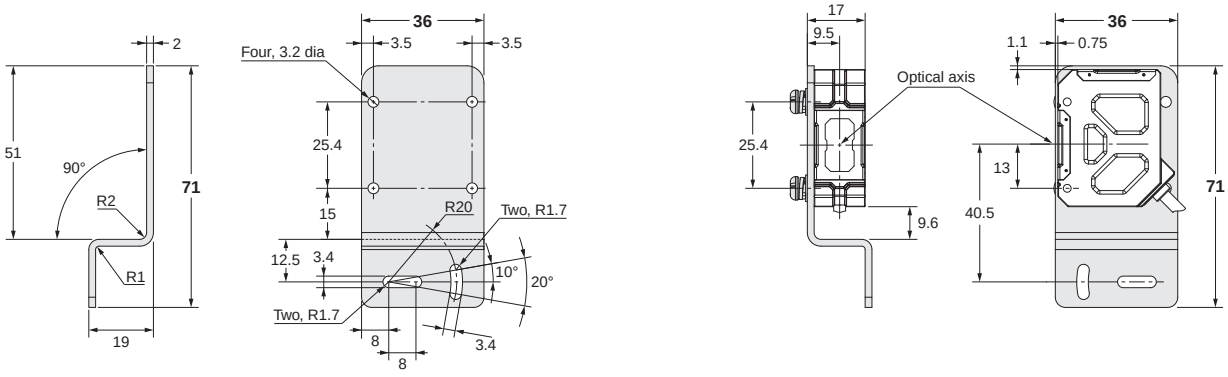


Mounting Bracket
E39-L196

Note: Material Stainless (SUS304)

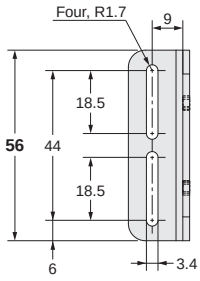
Photoelectric Sensor Accessory are installed (Example of E3ZR-CT61L)



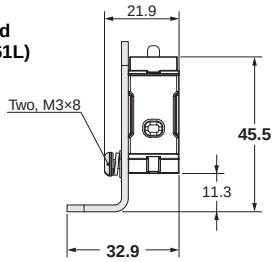


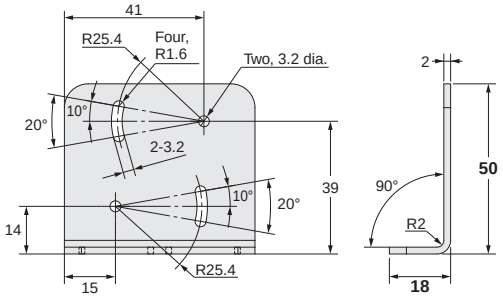
Mounting Bracket
E39-L197

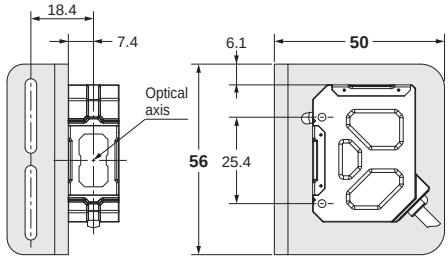
Note: Material Stainless (SUS304)



Photoelectric Sensor Accessory are installed (Example of E3ZR-CT61L)







MEMO

Smartclick Oil-resistant Connectors with Improved Oil Resistance

- Fluororesin cable that withstands cutting oil.
- Structured to provide greater oil resistance.
- A newly developed lock mechanism that is compatible with round M12 connectors.
- Simply insert the Connectors, then turn them approx. 1/8 of a turn to complete the connection and block the ingress of cutting oil.
- A positive click indicates locking.
- IP67G degree of protection (JIS C 0920 Annex 1). *

Refer to *Safety Precautions* on page 57.

* The IP67G is the degree of protection which is defined according to the JIS (Japanese Industrial Standards).
The IP67 indicates the same level of protection as defined by the IEC, and the G indicates that a device has resistance to oil.

For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

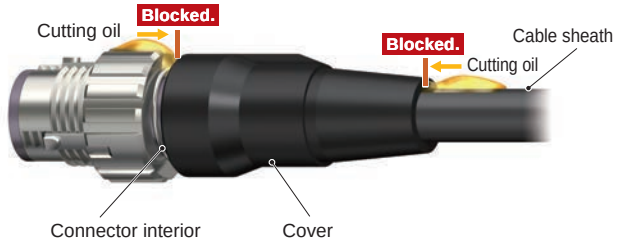
Features

Fluororesin Cable and Structure to Increase Oil Resistance

Fluororesin, which suppresses deterioration by either water-insoluable or water-soluable cutting oils, is used for the cable sheath. Ingress from the joined surfaces is prevented by unique OMRON technology that combines forming and sealing methods with surface bonding techniques. Ingress between Connectors is prevented by the unique Smartclick mechanism.

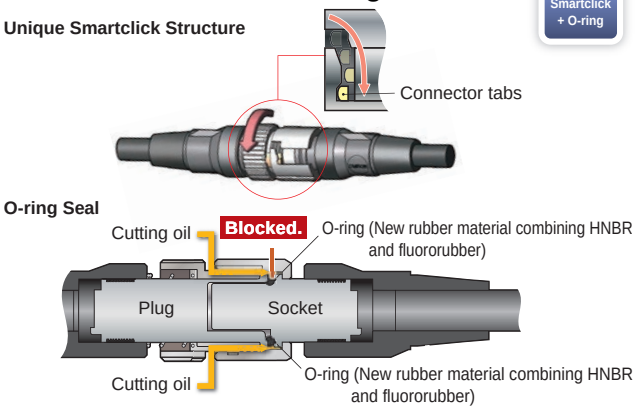
Forming and Sealing Method + Surface Bonding Technique

Forming/ Sealing + Surface Bonding



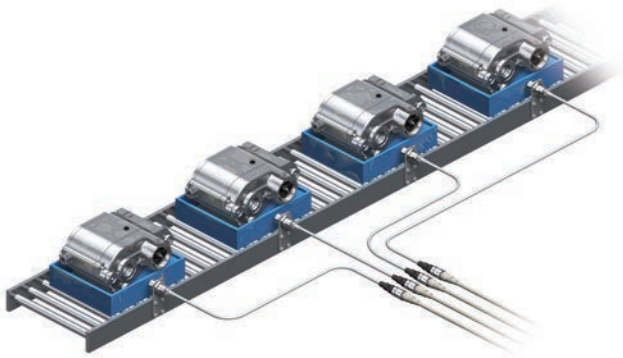
Smartclick Structure + O-ring

Smartclick + O-ring



Application

Replacement of Sensors and Wiring

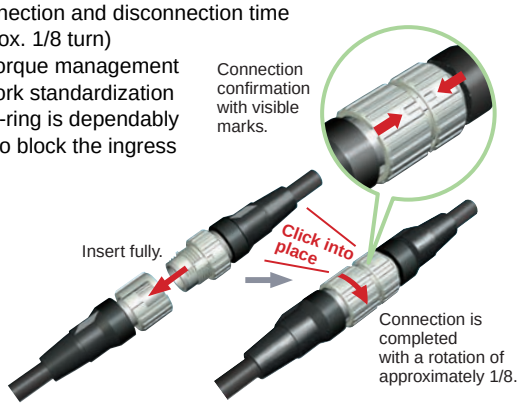


Benefits of Using Connectors:

- Less wiring work in comparison with connecting discrete wires to terminal blocks
- No wiring mistakes

Additional Benefits of Using Smartclick Connectors:

- Reduced connection and disconnection time (1 click, approx. 1/8 turn)
- No need for torque management to facilitate work standardization
- The built-in O-ring is dependably compressed to block the ingress of cutting oil.



Ratings and Specifications

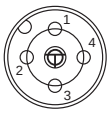
Rated current	1 A
Rated voltage	30 VDC
Contact resistance (connector)	40 mΩ max. (20 mV max., 100 mA max.)
Insulation resistance	1,000 MΩ min. (at 500 VDC) *1
Dielectric strength (connector)	1,500 VAC for 1 min (leakage current: 1 mA max.)
Degree of protection	IP67 (IEC 60529) and IP67G (JIS C 0920 Annex 1) *2 Passed OMRON's Oil-resistant Component Evaluation Standards*3 (Cutting oil type: specified in JIS K 2241:2000; Temperature: 35°C max.)
Insertion tolerance	50 times min.
Lock strength	Tensile: 100 N/15 s, Torsion: 1 N·m/15 s
Cable holding strength	Tensile: 100 N/15 s
Ambient operating temperature range/ Ambient storage temperature range	-25 to +70°C
Ambient humidity range	20% to 85%

*1. This value represents the condition when the Connector is shipped from the factory.
*2. The IP67G is the degree of protection which is defined according to the JIS (Japanese Industrial Standards).
The IP67 indicates the same level of protection as defined by the IEC, and the G indicates that a device has resistance to oil.
*3. The Oil-resistant Component Evaluation Standards are OMRON's own durability evaluation standards.
The Pre-wired Connector type meets the degree of protection when it is correctly connected with an XS5□R Oil-resistant Connector.
The degree of protection is not satisfied with the part where there is no XS5FR Oil-resistant Connector connected and cable wires are uncovered.

Materials and Finishes

Contacts	Phosphor bronze/Gold plating
Fixtures	Zinc alloy/Nickel plating
Fixtures (Lock)	Stainless steel
Pin block	PA resin (UL 94 HB)
O-ring	New rubber material combining HNBR and fluororubber
Cover	PA resin (UL 94 HB)
Cable	Cable with fluororesin sheath: 4-mm dia. Core wire: 0.2mm^2

Connector Pinout Diagram (from Mating Side)

Item	No. of poles	4 poles
A-coding (For DC sensor)	**Male (plug) contacts**	
	Female (socket) contacts	

Smartclick

XS5FR Connector Connected to Cable, Socket on One Cable End

Cable with fluororesin sheath **XS5FR-D423-□80-RB1**

Model Number Structure

Model Number Legend

XS5FR-D423-□80-RB1
1 2 3 4 5 6 7 8

Use this model number legend to identify products from their model number. When ordering, use a model number from the table in *Ordering Information*.

1. Type
F: Connector connected to cable, socket on one cable end

2. Mating Section Form
D: A-coding (For DC sensor)

3. Connector Poles
4: 4 poles

4. Contact Plating
2: Gold plating

5. Cable Connection Direction, Cable Outer Diameter
3: Straight, 4-mm dia.

6. Cable Length
D: 2 m G: 5 m J: 10 m

7. Connections (Numbers inside circles are terminal numbers)
8: ① Brown, ② White, ③ Blue, ④ Black

8. Connectors on One End/Both Ends
0: One end

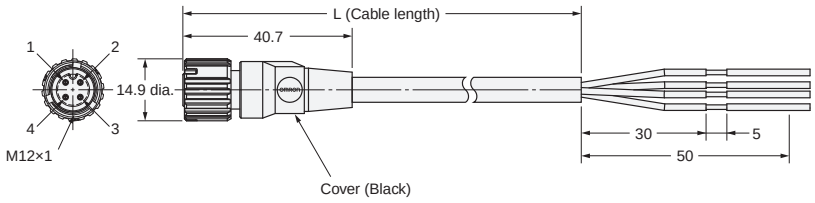
Ordering Information

Type	Cable outer diameter (mm)	No. of conductors	Cable length (m)	Model	UL
Socket on One Cable End	4 dia.	4	2	**XS5FR-D423-D80-RB1**	---
			5	**XS5FR-D423-G80-RB1**	
			10	**XS5FR-D423-J80-RB1**	

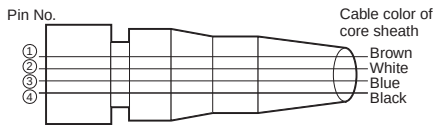
Dimensions

(Unit: mm)

Straight



Wiring Diagram for 4 Cores



XS5WR Connectors Connected to Cable, Socket and Plug on Cable Ends

Cable with fluororesin sheath **XS5WR-D425-□81-RB1**

Model Number Structure

Model Number Legend

XS5WR-D425-□81-RB1

(1) (2) (3) (4) (5) (6) (7) (8)

Use this model number legend to identify products from their model number. When ordering, use a model number from the table in *Ordering Information*.

1. Type
W: Connectors connected to cable, socket and plug on cable ends

2. Mating Section Form
D: A-coding (For DC sensor)

3. Connector Poles
4: 4 poles

4. Contact Plating
2: Gold plating

5. Cable Connection Direction, Cable Outer Diameter
5: Straight (Socket)/straight (Plug), 4-mm dia.

6. Cable Length
D: 2 m G: 5 m J: 10 m

7. Connections (Numbers inside circles are terminal numbers)
8: ① Brown, ② White, ③ Blue, ④ Black

8. Connectors on One End/Both Ends
1: Both ends

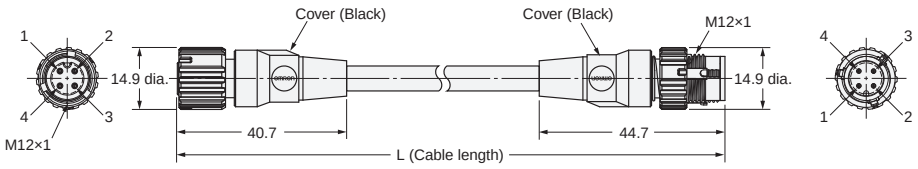
Ordering Information

Type	Cable outer diameter (mm)	No. of conductors	Cable length (m)	Model	UL
Socket and Plug on Cable Ends	4 dia.	4	2	**XS5WR-D425-D81-RB1**	---
			5	**XS5WR-D425-G81-RB1**	
			10	**XS5WR-J81-RB1**	

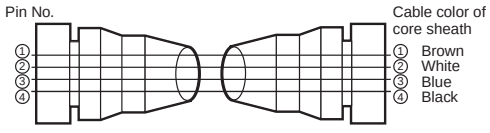
Dimensions

(Unit: mm)

Straight (Socket)/straight (Plug)



Wiring Diagram for 4 Cores



Safety Precautions

Warning Indications

Precautions for Safe Use	**Supplementary comments on what to do or avoid doing, to use the product safely.**
Precautions for Correct Use	**Supplementary comments on what to do or avoid doing, to prevent failure to operate, malfunction or undesirable effect on product performance.**

Precautions for Safe Use

Protective structure

- Do not use the product with degrade protective structure such as swelling and crack in housing and/or sealing components. Otherwise cutting oil or other substance may enter the product, resulting in a risk of corruption or burning.

Connector Connection and Disconnection

- When connecting or disconnecting Connectors, be sure to hold the Connectors by hand.
- Do not hold the cable when disconnecting Connectors. Check the direction of the key groove before you use the Connector.
- Do not wiring the Connector when your hands are wet. Malfunctions or device damage may occur when power is supplied to a device.
- When mating Connectors, be sure to insert the plug all the way to the back of the socket before attempting to lock the Connectors. After you lock a Connector, always confirm that it is mated properly.
- Do not use tools of any sort to mate the Connectors. Always use your hands. Pliers or other tools may damage the Connectors.
- When you replace a Connector, make sure that there is no liquid, cutting oil, or other foreign matter on the mating surfaces before you mate the Connector.

Precautions for Correct Use

- Do not use the Connectors in an atmosphere or environment that exceeds the specifications.
- Always turn OFF the power supply before wiring the Connector. Electric shock or device damage may result.
- The following conditions shall be observed if you use the product under an environment using cutting oil that may affect product's life and/or performance.
  - Usage under the cutting oil condition designated by the specification
  - Usage under the cutting oil dilution ratio recommended by its manufacturer
  - Usage in oil or water is prohibited

  Impact on the product life may differ depending on the oil you use. Before using the cutting oil, make sure that it should not cause deterioration or degradation of sealing components.
- The XS5□R can be used in conditions of cutting oil use described in the specifications.
  The oil resistance may not be ensured when the products are not mated to OMRON Oil-resistant Components or XS5□R Connectors, so use the products correctly.
- Do not use a Connector in a location subject to corrosive gas, high humidity, or high temperatures. Contact failure or corrosion may damage the Connector and interfere with functionality.
- Do not pull excessively on the Connectors or cables.
- Install the Connectors and cables where they will not be stepped on to prevent the wires inside the cables from being broken and to prevent the Connectors from being damaged. If the Connectors or cables must be installed where they might be stepped on, protect them with covers.
- If a sensor or switch is not connected during installation or if the plug connector is not mated, use a XS5Z-11 or XS2Z-11 Waterproof Cover or XS2Z-14/15 Dust Cover to protect the mating surface of the Connector.

Wiring

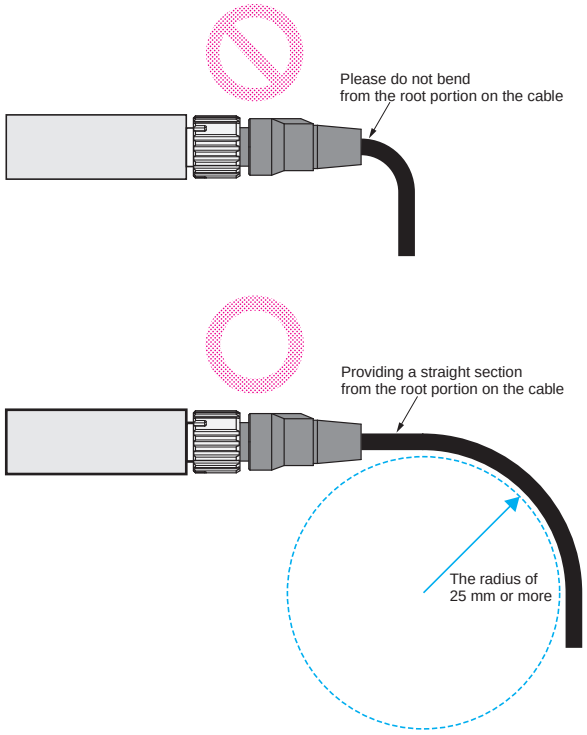
- Do not wire the ends of the cable in any location that is subject to water, cutting oils, or other liquids.
- Wire the cable according to the wiring diagram. Before you use a sensor or limit switch, confirm that connection is possible.
- Lay the cables so that external force is not applied to the Connectors. Otherwise, the degree of protection (IP67G) may not be achieved.

Degree of Protection (IP67)

- The degree of protection of Connectors (IP67) is not for a fully watertight structure. Do not use the Connectors underwater.
- Do not step on or place any objects on the Connectors. Doing so may damage the Connectors.

Setup

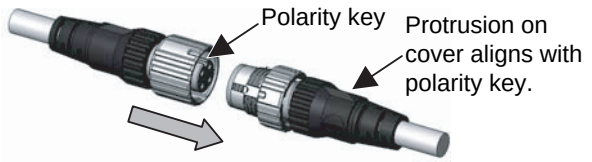
- Do not install the Connectors or cables in any way that would place a load directly on the mating section or cable connections. Doing so can damage the Connectors or break the wires inside the cables.
- Do not bend the cable to a radius that is smaller than 25 mm.



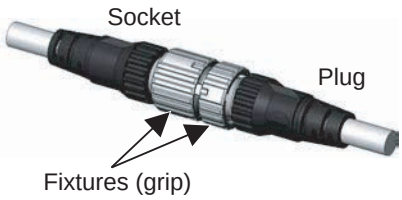
Connecting

1. Connecting the XS5□R Plug and Socket

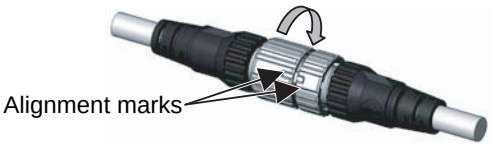
- Align the projection on the plug cover with the polarity key on the socket, then insert the plug all the way in.



- Hold the knurled socket grip, then insert the projection on the plug into the groove of the socket.



- Turn the knurled grips of the socket clockwise approximately 1/8 turn in respect to the plug. A click will indicate that the Connectors are locked. The locking condition can also be confirmed by the alignment marks on the plug and socket.



2. Connecting the XS5□R and XS2

- Align the projection on the plug cover with the polarity key on the socket, then insert the plug all the way in.
- In the same way as when connecting two XS2 Connectors, screw the knurled grip in the clockwise direction.
- When mating the products to XS2 or other M12 Connectors, tighten the lock to a torque of 0.39 to 0.49 N·m.

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