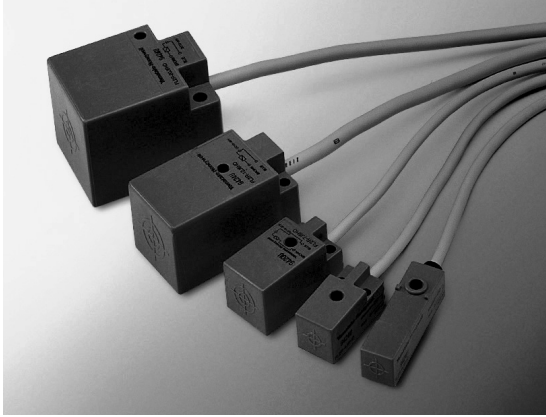


# FL2R/S Series

This DC 2-wire Square Proximity sensor Can Be Directly Connected to Programmable Controllers and N.C. Units. Wide Range of Models Available.



- **Reduced wiring costs**
- **Stable sensing area displayed by setting indicator** (on N.O. output type only)
- **Wide range of models available** (4/7/12/20mm, top/side, N.O./N.C.)
- **High-speed response** (1.5kHz at 4mm, 1kHz at 7mm)
- **Different-frequency types that are only slightly influenced by mutual interference** available for all models
- **High seal capabilities** (IP67)
- **Enhanced circuit protection** (surge absorption, loadshort-circuit, reverse connection)



CLICK

## ORDER GUIDE

### Standard (pre-leaded) model (cord length 1m)






Appearance		Sensing distance	Sensing face	Operation mode	Setting indication	Catalog listing
Sensor package style	Dimensions (mm)					
	12 x 12 x 45	4mm	Top	N.O.	●	FL2S-4J6HD
				N.C.		FL2S-4K6H
			Side	N.O.	●	FL2S-4J6SD
				N.C.		FL2S-4K6S
	15 x 15 x 32	4mm	Top	N.O.	●	FL2R-4J6HD
				N.C.		FL2R-4K6H
			Side	N.O.	●	FL2R-4J6SD
				N.C.		FL2R-4K6S
	20 x 20 x 38	7mm	Top	N.O.	●	FL2R-7J6HD
				N.C.		FL2R-7K6H
			Side	N.O.	●	FL2R-7J6SD
				N.C.		FL2R-7K6S
	30 x 30 x 52.5	12mm	Top	N.O.	●	FL2R-12J6HD
				N.C.		FL2R-12K6H
			Side	N.O.	●	FL2R-12J6SD
				N.C.		FL2R-12K6S
	40 x 40 x 53	20mm	Top	N.O.	●	FL2R-20J6HD
				N.C.		FL2R-20K6H
			Side	N.O.	●	FL2R-20J6SD
				N.C.		FL2R-20K6S

Note 1: Different-frequency types also available for all models. The catalog number of different-frequency types are appended with the letters "-F". Example: Different-frequency type of FL2R-4J6HD is expressed as FL2R-4J6HD-F.

"Different-frequency type" is a type having an oscillation frequency different to that of the standard type to reduce the influence of mutual interference. Select this type when mounting two or more proximity sensors close to each other.

Note 2: Bend-resistant cord type "-R" are also available. For details, contact your nearest Yamatake dealer.

● Pre-leaded connector model (cord length 30cm)

Appearance		Sensing distance	Sensing face	Operation mode	Setting indication	Catalog listing
Sensor package style	Dimensions (mm)					
	12 x 12 x 45	4mm	Top	N.O.	●	FL2S-4J6HD-CN03
				N.C.		FL2S-4K6H-CN03
			Side	N.O.	●	FL2S-4J6SD-CN03
				N.C.		FL2S-4K6S-CN03
	15 x 15 x 32	4mm	Top	N.O.	●	FL2R-4J6HD-CN03
				N.C.		FL2R-4K6H-CN03
			Side	N.O.	●	FL2R-4J6SD-CN03
				N.C.		FL2R-4K6S-CN03
	20 x 20 x 38	7mm	Top	N.O.	●	FL2R-7J6HD-CN03
				N.C.		FL2R-7K6H-CN03
			Side	N.O.	●	FL2R-7J6SD-CN03
				N.C.		FL2R-7K6S-CN03
	30 x 30 x 52.5	12mm	Top	N.O.	●	FL2R-12J6HD-CN03
				N.C.		FL2R-12K6H-CN03
			Side	N.O.	●	FL2R-12J6SD-CN03
				N.C.		FL2R-12K6S-CN03
	40 x 40 x 53	20mm	Top	N.O.	●	FL2R-20J6HD-CN03
				N.C.		FL2R-20K6H-CN03
			Side	N.O.	●	FL2R-20J6SD-CN03
				N.C.		FL2R-20K6S-CN03

Note 1: Different-frequency types also available for all models. The catalog number of different-frequency types are appended with the letters "F".

Example: Different-frequency type of FL2R-4J6HD-CN03 is expressed as FL2R-4J6HD-CN03F.

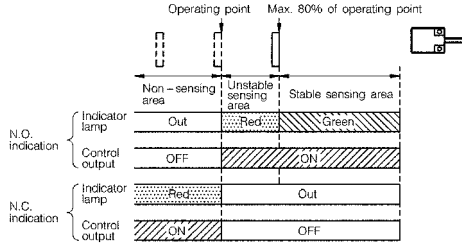
"Different-frequency type" is a type having an oscillation frequency different to that of the standard type to reduce the influence of mutual interference. Select this type when mounting two or more proximity sensors close to each other.

## SPECIFICATIONS

Catalog listing	FL2S-4□6□ (-CN03) FL2R-4□6□ (-CN03)	FL2R-7□6□ (-CN03)	FL2R-12□6□ (-CN03)	FL2R-20□6□ (-CN03)
Actuation method	High-frequency oscillating type (unshielded)			
Rated supply voltage	12/24Vdc			
Rated sensing distance	4±0.4mm	7±0.7mm	12±1.2mm	20±2mm
Usable setting distance	0 to 3.2mm	0 to 5.6mm	0 to 9.6mm	0 to 16mm
Standard target object	18 x 18 x 1mm iron	25 x 25 x 1mm iron	40 x 40 x 1mm iron	50 x 50 x 1mm iron
Differential travel	15% max. of sensing distance			
Operating voltage range	10 to 30Vdc			
Leakage current	1mA max.			
Control output	Switching current: 4 to 100mA max. Voltage drop: 3.3V max., Output dielectric strength: 30Vdc			
Operating frequency	1.5kHz	1kHz	800Hz	300Hz
Hysteresis	0.05mm max.			
Temperature characteristics	10% max. of sensing distance for the -25 to +70° range when taking +25° as standard temperature			
Supply voltage characteristics	1% max. of sensing distance with 15% voltage fluctuation, taking rated supply voltage as standard voltage			
Indicator lamps	N.O. type: Operation indication: lights (red or green) at output ON Setting indication: lights (green) in stable sensing area N.C. type: Operation indication: red light goes out (red) in sensing area			
Operating temperature range	-25 to +70°C			
Storage temperature range	-25 to +70°C			
Storage humidity range	35 to 95% RH			
Insulation resistance	50MΩ min. (at 500Vdc)			
Dielectric strength	500Vac, 50/60Hz for 1 minute			
Vibration resistance	10 to 55Hz, 1.5mm peak-to-peak amplitude, 2 hrs each in X, Y and Z directions			
Shock resistance	490m/s <sup>2</sup> 10 times each in X, Y and Z directions			
Protection	IP67 (IEC standard)			
Weight	Approx. 40g	Approx. 50g	Approx. 110g	Approx. 160g
Circuit protection	Surge absorption, load short-circuit protection, reverse connection protection			
Wiring method	Pre-leaded connector, pre-leaded			
Case material	ABS resin			
Connector material	Polyester elastomer			
Housing	Glass-lined polyester resin			
Holder	Gold-plated brass			
Contact				

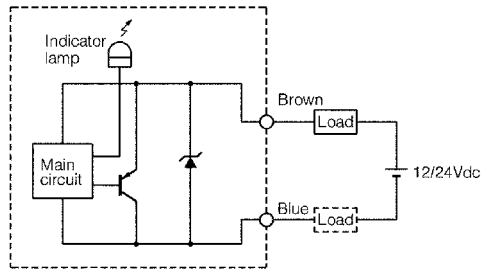
## ABOUT SETTING INDICATION

The proximity sensor can detect objects reliably by bringing the proximity sensor close to the target object and setting the sensor at the position where the indicator lamp changes from red to green.



Note: When the target object is made of a different material such as aluminum, copper and stainless steel to the standard target object (iron), the setup point where the indicator lamp changes color is shorter than 80% maximum.

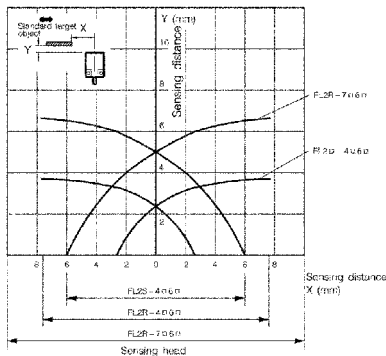
## WIRING DIAGRAM



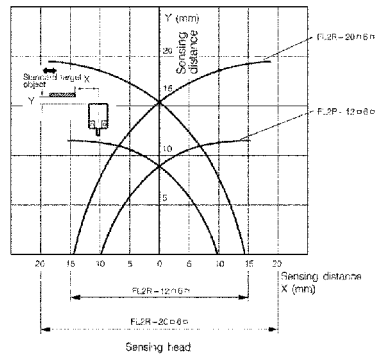
The load can be connected to either of the power supplies.

## SENSING AREA DIAGRAM (typical)

FL2-4-6/FL2R-7-6

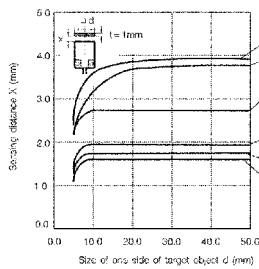


FL2R-12-6/FL2R-20-6

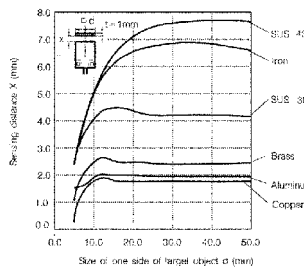


## SENSING DISTANCE ACCORDING TO MATERIAL & SIZE OF OBJECT (typical)

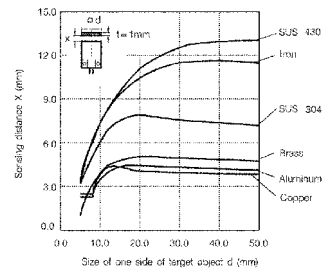
FL2S-4-6/FL2R-4-6



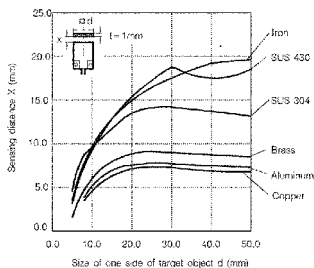
FL2R-7-6



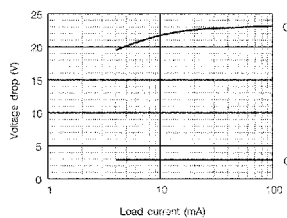
FL2R-12-6



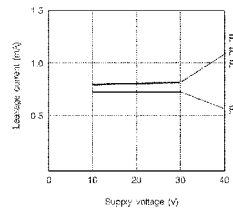
FL2R-20-6



## VOLTAGE DROP CHARACTERISTICS (typical)



## LEAKAGE CURRENT CHARACTERISTICS (typical)

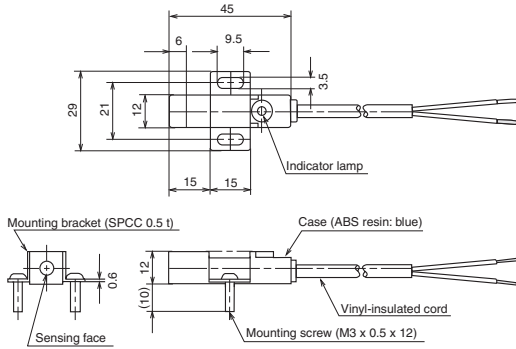


# EXTERNAL DIMENSIONS

(unit: mm)

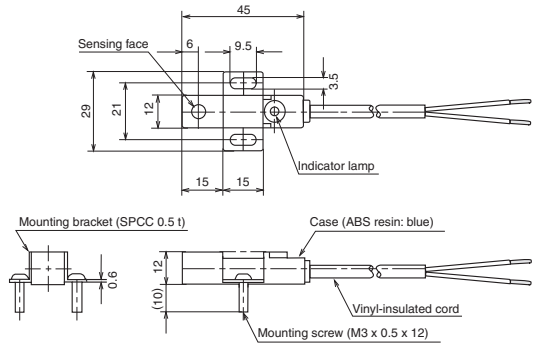
## ● Standard (pre-leaded) model

### FL2S-4□6H□



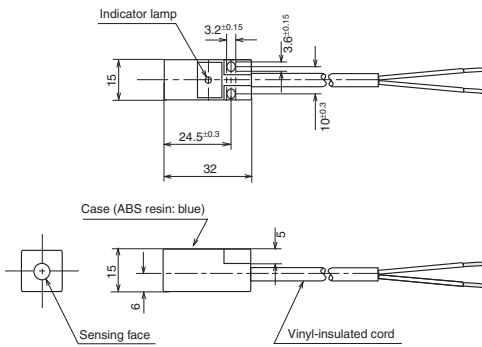
Vinyl-insulated cord (oil-resistant: 0.3mm<sup>2</sup>, 27/0.12, 2-core) 4.2mm dia.  
Note: A mounting bracket and two mounting screws are provided.  
The case color of different-frequency types "-F" is green.

### FL2S-4□6S□



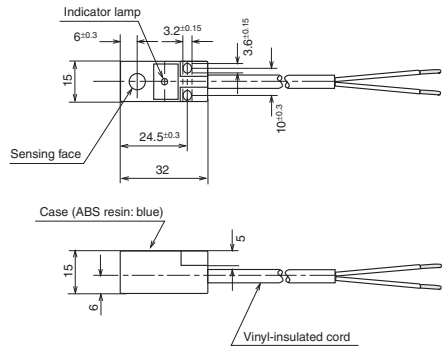
Vinyl-insulated cord (oil-resistant: 0.3mm<sup>2</sup>, 27/0.12, 2-core) 4.2mm dia.  
Note: A mounting bracket and two mounting screws are provided.  
The case color of different-frequency types "-F" is green.

### FL2R-4□6H□



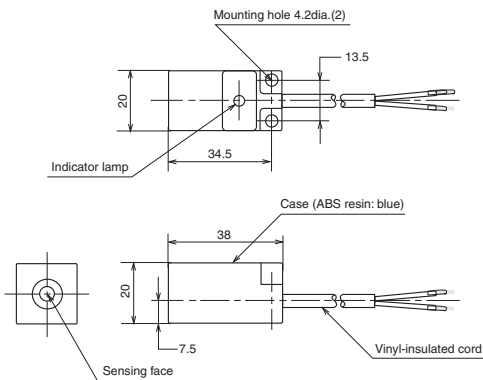
Vinyl-insulated cord (oil-resistant: 0.3mm<sup>2</sup>, 27/0.12, 2-core) 4.2mm dia.  
The case color of different-frequency types "-F" is green.

### FL2R-4□6S□



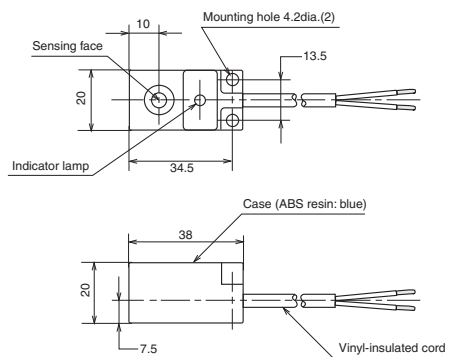
Vinyl-insulated cord (oil-resistant: 0.3mm<sup>2</sup>, 27/0.12, 2-core) 4.2mm dia.  
The case color of different-frequency types "-F" is green.

### FL2R-7□6H□



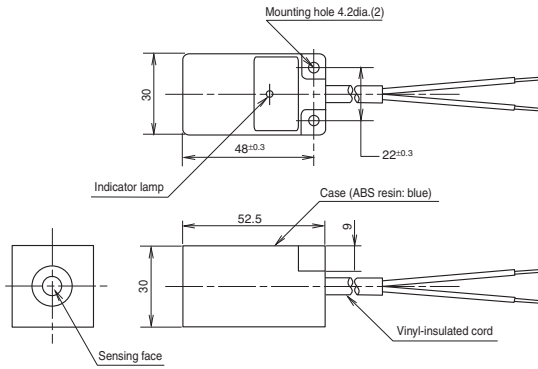
Vinyl-insulated cord (oil-resistant: 0.3mm<sup>2</sup>, 27/0.12, 2-core) 4.2mm dia.  
The case color of different-frequency types "-F" is green.

### FL2R-7□6S□



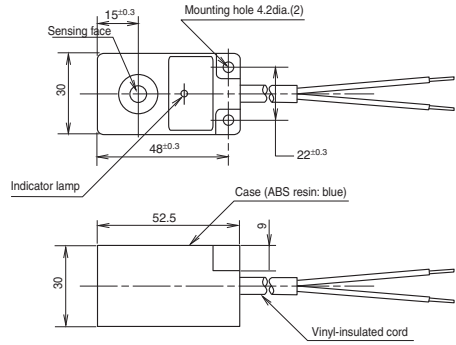
Vinyl-insulated cord (oil-resistant: 0.3mm<sup>2</sup>, 27/0.12, 2-core) 4.2mm dia.  
The case color of different-frequency types "-F" is green.

FL2R-12□6H□



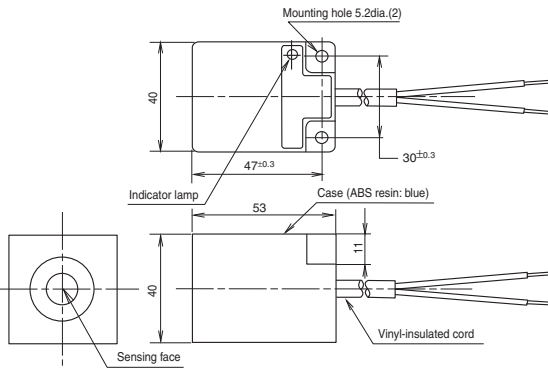
Vinyl-insulated cord (oil-resistant: 0.5mm<sup>2</sup>, 20/0.18, 2-core) 5.7mm dia.  
The case color of different-frequency types "F" is green.

FL2R-12□6S□



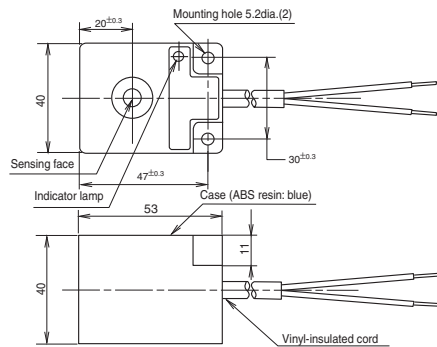
Vinyl-insulated cord (oil-resistant: 0.5mm<sup>2</sup>, 20/0.18, 2-core) 5.7mm dia.  
The case color of different-frequency types "F" is green.

FL2R-20□6H□



Vinyl-insulated cord (oil-resistant: 0.5mm<sup>2</sup>, 20/0.18, 2-core) 5.7mm dia.  
The case color of different-frequency types "F" is green.

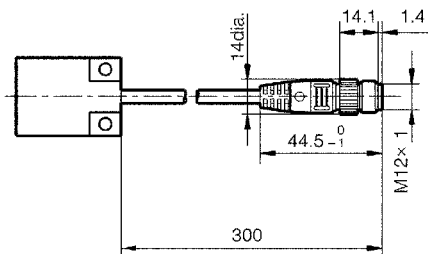
FL2R-20□6S□



Vinyl-insulated cord (oil-resistant: 0.5mm<sup>2</sup>, 20/0.18, 2-core) 5.7mm dia.  
The case color of different-frequency types "F" is green.

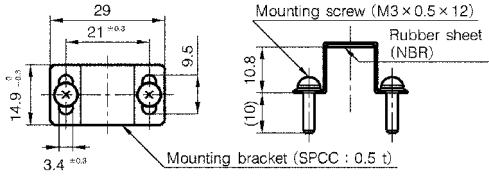
● Pre-leaded connector model (connector external dimensions)

FL2□-□□6□□-CN03

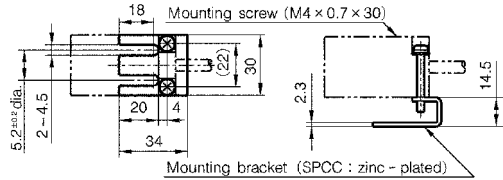


● **Mounting bracket (ordered separately)**

**FL2-PA5**



**FL2-PA12**



Mounting brackets are made of iron.  
Two screws and two washers are provided for each bracket.

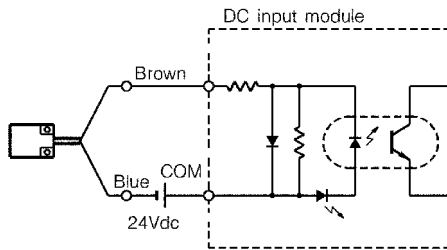
Catalog listing	Applicable models
<b>FL2-PA5</b>	<b>FL2S-4□6□</b>
<b>FL2-PA12</b>	<b>FL2R-12□6□</b>

Note: FL2-PA5 is provided with the proximity sensor.

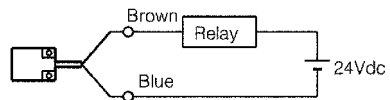
**WIRING**

● **Standard (pre-leaded) model**

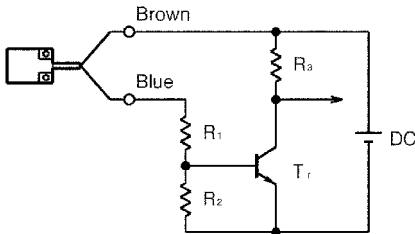
• Wiring to programmable controller



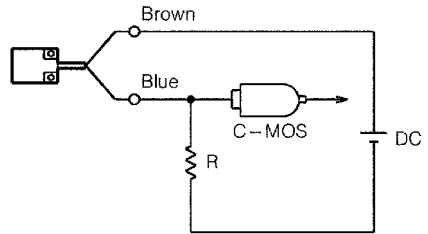
• Wiring to relay load



• Wiring to transistor circuit



• Wiring to C-MOS circuit

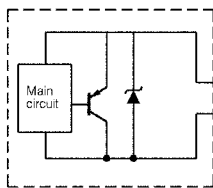


● **Pre-leaded connector model**

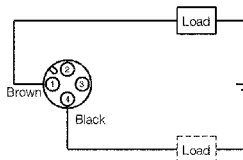
The connectors have four pins. Contacts are laid out as follows. (Lead colors are for when the PA5 is used.)

Body side

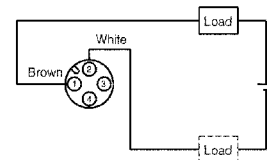
PA5 connector side



**N.O. type**



**N.C. type**



## CONNECTOR SPECIFICATIONS \*1

Item	Specifications
Insulation resistance	Max. 100MΩ (by 500Vdc megger)
Dielectric strength	1,500Vac for 1 minute (between contacts, and between contact and connector housing)
Initial contact resistance	Max. 40mΩ (with 3A current to connected male and female connectors. Semiconductor lead-specific resistance not included.)
Mating/unmating force	0.4 to 4.0 N per contact
Mating cycles	50
Connector nut tightening torque	Min. 0.8N·m*2
Cable pullout strength	Min. 100 N
Vibration resistance	10 to 55Hz, 1.5mm peak-to-peak amplitude, for 2 hours each in X, Y and Z directions
Impact resistance	300m/s <sup>2</sup> , 3 times each in X, Y and Z directions
Protective structure	IP67
Ambient operating temperature	-10 to +70°C
Ambient storage temperature	-20 to +80°C
Ambient operating humidity	Max. 95% RH
Material	Contacts: Gold-plated brass Contact holder: Glass-lined polyester resin Housing: Polyester elastomer Coupling: Ni-plated brass O-ring: NBR

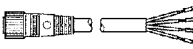

\*1: Specifications assume Yamatake male/female connectors.

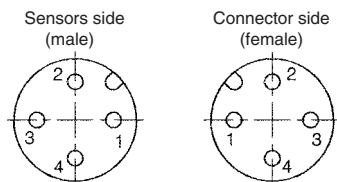
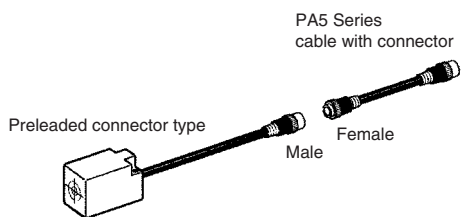
\*2: The recommended torque is 0.4 to 0.6N·m. If fastened poorly, the IP67 protection is lost, or looseness occurs. Fasten the connector securely by hand.

## CABLE WITH CONNECTOR

Be sure to use PA5 Series cables with connector to connect preleaded type connectors and connector type limit switches.

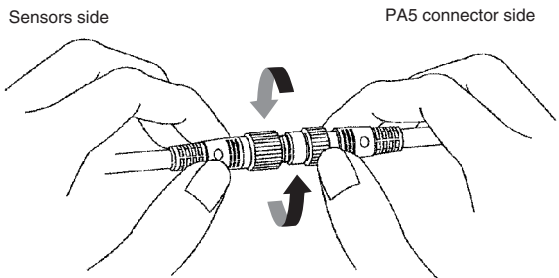
### PA5 Series cable with connector

Shape	Power supply	Cable properties	Cable length	Catalog listing	Lead colors
	DC	Oil-resistant, flexible; UL2464; flame-resistant; EN-compliant	2m	PA5-4I SX2MK-E	1: brown, 2: white, 3: blue, 4: black
			5m	PA5-4I SX5MK-E	1: brown, 2: white, 3: blue, 4: black
			2m	PA5-4I LX2MK-E	1: brown, 2: white, 3: blue, 4: black
			5m	PA5-4I LX5MK-E	1: brown, 2: white, 3: blue, 4: black



### Tightening the connector

Align the grooves and rotate the fastening nut on the PA5 connector by hand until it fits tightly with the connector on the sensors side.



## PRECAUTIONS

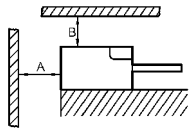
### 1.1 Mounting

Tighten the screws to the torque shown below.

Catalog listing	Allowable tightening torque (N-m)	Recommended screw diameter
FL2S-4□6□	0.5	Screw provided
FL2R-4□6□	0.5	M3
FL2R-7□6□	0.5	M4
FL2R-12□6□	0.5	M4
FL2R-20□6□	0.5	M5

### 1.2 Influence of surrounding metal

Metal other than the object surrounding the sensor may influence operating characteristics. Maintain the following space between the switch and surrounding metal.



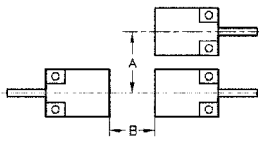
Note: Shaded areas indicate surrounding metal other than the target object.

Catalog listing	A(mm)	B(mm)
FL2S-4□6H	20	10
FL2S-4□6S	10	20
FL2R-4□6H	20	10
FL2R-4□6S	10	20
FL2R-7□6H	30	15
FL2R-7□6S	15	30
FL2R-12□6H	50	25
FL2R-12□6S	25	50
FL2R-20□6H	80	40
FL2R-20□6S	40	80

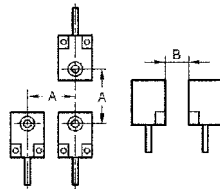
### 1.3 Mutual interference prevention

When mounting proximity sensors in parallel or facing each other, mutual interference may cause the sensor to malfunction. Maintain at least the spaces indicated in the figures above. When standard frequency types and different-frequency types “-F” are used alternately in a row, maintain at least the spaces indicated in parentheses “( )” for dimensions A and B in the table below.

Front sensing type



Side sensing type



Catalog listing	A(mm)	B(mm)
FL2S-4□6□	30 ( 15)	40 ( 20)
FL2R-4□6□	30 ( 15)	40 ( 20)
FL2R-7□6□	80 ( 40)	80 ( 40)
FL2R-12□6□	120 ( 60)	120 ( 60)
FL2R-20□6□	200 (100)	200 (100)

### 1.4 Cautions during series or parallel connection

#### Series connection (AND connection)

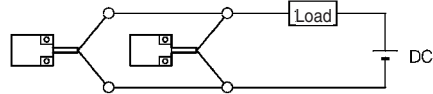
When connecting two or more proximity sensors in series, erroneous output (1 to 3ms) may occur without the rated current being supplied to each of the sensors. For this reason, series connection of proximity sensors is not recommended. However, if proximity sensors must be connected in series, a resistor of 10kΩ must be provided in parallel to each of the sensors. However, note that the maximum leakage current in a series connection will be 3.5mA. Operation lag also will occur, resulting in increased voltage drop, and the operation indicator lamp will not light.

Operation lag = 40ms x (number of series connections - 1)

Voltage drop = voltage drop of single x sensornumber of series connected sensors

#### Parallel connection (OR connection)

- When connecting two or more proximity sensors in parallel, leakage current increases as follows, and may result in faulty load restore. (Leakage current = Leakage current of single sensor x number of series connected sensors)
- When two or more sensors turn ON in a parallel connection, one (or some) of the sensors may not indicate operation. This is not an abnormality.



### 1.5 Relay loads

The voltage drop of the FL2R/S Series is 3.3V. Pay attention to this voltage drop when using a relay load. (With 12Vdc relays, switching is not possible.)a

### 1.6 Operation at power ON

After the power is turned ON, it takes 40ms or less until the proximity sensor is ready for sensing. When the load and the proximity sensor use different power supplies, be sure to turn the proximity sensor ON before turning the load ON.

### 1.7 Influence of leakage current

Minimal current flows as leakage current for operating the circuits even when the proximity sensor is OFF.

Take sufficient care when restoring connected loads.

### 1.8 Minimum cord bending radius (R)

The minimum bending radius (R) of the cord is 3 times cord diameter, take care not to excessively bend the cord beyond this radius. Also, do not excessively bend the cord within 30mm of the cord lead-in port.