

FL7M Series

AC/DC 2-wire Type Cylindrical Proximity Sensors

FEATURES

Wiring Polarity Free 2-wire Type. Easy-to-use General-purpose Type.

- 2-wire type for both AC and DC. Wiring man-hours greatly reduced.
- Stable sensing area displayed by setting indicator. (green/red LED)
- Indicator lamp can be confirmed even from the rear side. (pre-leaded model, pre-leaded connector model)
- Compact and space saving. (Overall length of M12 is 55mm, M18 48mm and M30 50mm.)
- High seal capabilities. (IP67)
- Enhanced circuit protection. (surge absorption, load short-circuit)



click

ORDER GUIDE

- Standard (pre-leaded) model (cord length 2m)

Actuation method	Appearance		Sensing distance	Operation mode	Setting indication	Spatter-guarded	Catalog listing
	Sensor package style	O.D.					
High-frequency oscillation type		M12	3mm	N.O.	<input type="radio"/>	<input type="radio"/>	FL7M-3T7HW
		M18	7mm	N.O.	<input type="radio"/>	<input type="radio"/>	FL7M-7T7HW
		M30	10mm	N.O.	<input type="radio"/>	<input type="radio"/>	FL7M-10T7W



- Connector model

Actuation method	Appearance		Sensing distance	Operation mode	Setting indication	Spatter-guarded	Catalog listing
	Sensor package style	O.D.					
High-frequency oscillation type		M12	3mm	N.O.	<input type="radio"/>		FL7M-3T7HD-CN
					<input type="radio"/>	<input type="radio"/>	FL7M-3T7HW-CN
		M18	7mm	N.O.	<input type="radio"/>		FL7M-7T7HD-CN
					<input type="radio"/>	<input type="radio"/>	FL7M-7T7HW-CN
		M30	10mm	N.O.	<input type="radio"/>		FL7M-10T7D-CN
					<input type="radio"/>	<input type="radio"/>	FL7M-10T7W-CN

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

Actuation method	Appearance		Sensing distance	Operation mode	Setting indication	Spatter-guarded	Catalog listing
	Sensor package style	O.D.					
High-frequency oscillation type		M12	3mm	N.O.	<input type="radio"/>	<input type="radio"/>	FL7M-3T7HW-CN03
		M18	7mm	N.O.	<input type="radio"/>	<input type="radio"/>	FL7M-7T7HW-CN03
		M30	10mm	N.O.	<input type="radio"/>	<input type="radio"/>	FL7M-10T7W-CN03

OPTIONAL ACCESSORIES (sold separately)

Name	Shape	O.D.	Catalog listing	Name	Shape	O.D.	Catalog listing
Mounting bracket		For M12	FL-PA112	Protective cover		For M12	FL-PA12
		For M18	FL-PA118			For M18	FL-PA18
		For M30	FL-PA130			For M30	FL-PA30

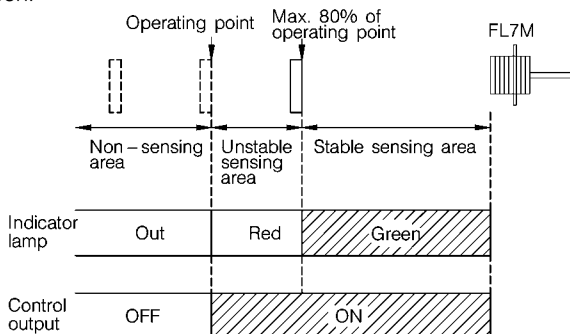
SPECIFICATIONS

Catalog listing	FL7M-3T7HD-CN FL7M-3T7HW(-CN, -CN03)	FL7M-7T7HD-CN FL7M-7T7HW(-CN, -CN03)	FL7M-10T7W-CN FL7M-10T7W(-CN, -CN03)
Actuation method	High-frequency oscillation type (shielded)		
Rated sensing distance	3±0.3mm	7±0.7mm	10 ⁺² ₋₁ mm
Usable sensing distance	0 to 2.1mm	0 to 4.9mm	0 to 7mm
Standard target object	12×12mm, 1mm thick iron	18×18mm, 1mm thick iron	30×30mm, 1mm thick iron
Differential travel	15% max. of sensing distance		
Rated supply voltage	100/200Vac, 50/60Hz 24Vdc		
Operating voltage range	40 to 250Vac, 20 to 250Vdc		20 to 250Vac/dc
Leakage current	When AC power supply is used: 2.0mA max. (100/200Vac), When DC power supply is used: 1.1mA max. (24Vdc)		
Control output	Switching current: 5 to 100mA (at 30Vdc supply voltage: 5 to 20mA) Voltage drop: When AC power supply is used 10V max., When DC power supply is used 6V max. Output dielectric strength: 250V (at both AC and DC power supplies)		
Operating frequency	When AC power supply is used 25Hz When DC power supply is used 500Hz	When AC power supply is used 25Hz When DC power supply is used 300Hz	When AC power supply is used 25Hz When DC power supply is used 500Hz
Temperature characteristics	±10% max. for the range of -25 to +70°C when +25°C is taken as standard temperature in sensing distance		
Supply voltage characteristics	±1% max. with +15% voltage fluctuation with rated supply voltage as standard voltage in sensing distance		
Indicator lamps	Operation indication: Lights (red or green) at output Setting indication: Lights (green) in stable sensing area		
Operating temperature range	-25 to +70°C		
Storage temperature range	-40 to +85°C		
Insulation resistance	50MΩ min. (at 500Vdc)		
Dielectric strength	1,500Vac, 50/60Hz for 1 minute		
Vibration resistance	10 to 55Hz, 1.5mm peak-to-peak amplitude, 2 hrs in X, Y and Z directions		
Shock resistance	490m/s ² 10 times in X, Y and Z directions		
Protection	IP67 (IEC standard)		
Weight	Approx. 110g Main unit with 2m pre-leaded cable	Approx. 140g Main unit with 2m pre-leaded cable	Approx. 240g Main unit with 2m pre-leaded cable
Circuit protection	Surge absorption, load short-circuit protection (at 20 to 30Vdc)		
Wiring method	Connector, pre-leaded connector, pre-leaded		
Material	Sensor	Ni-plated brass (W type: Ni-plated brass, fluorine resin coated)	
	Case	PBT (W type: fluorine resin)	
	Connector	-CN: Ni-plated brass, -CN03: polyester elastomer	
	Contact	Glass-lined polyester resin Gold-plated brass	

- Installation Instructions No.: CP-UM-3077E

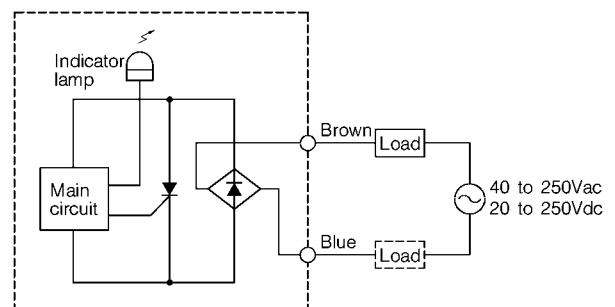
ABOUT SETTING INDICATION

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.



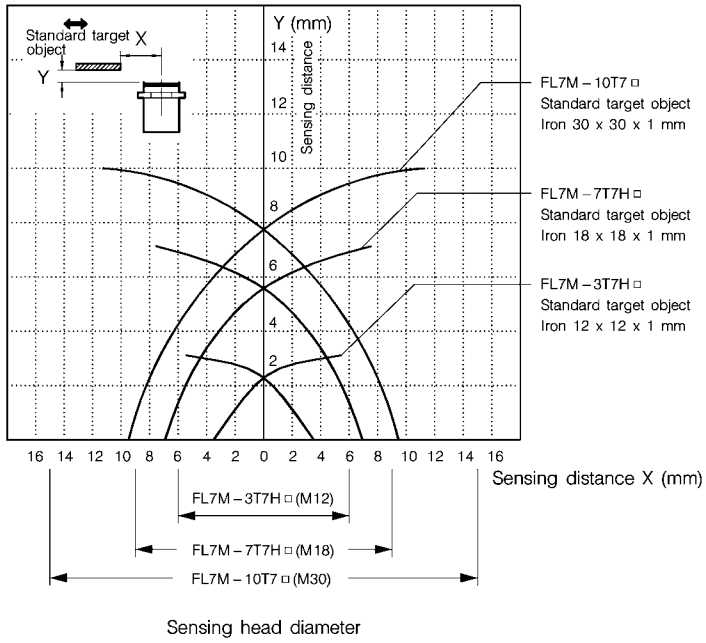
Note: When the target object is made of a different material such as aluminum, copper and stainless steel to the standard target object (iron), the setup point where the indicator lamp changes color is shorter than 80% maximum.

WIRING DIAGRAM



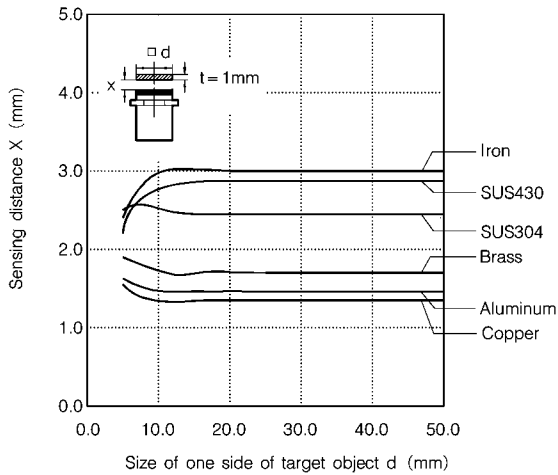
The load can be connected to either of the power supplies. However, we recommend connecting the load to the non-earthed side to prevent short-circuiting of the power supply if a ground fault caused by damage to the proximity sensor occurs.

SENSING AREA DIAGRAM (typical example)

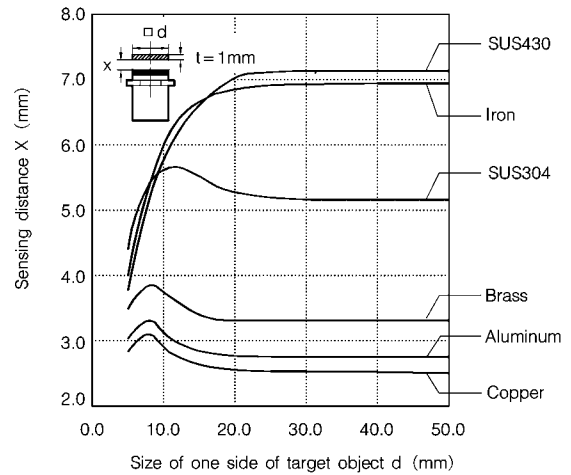


SENSING DISTANCE ACCORDING TO MATERIAL & SIZE OF OBJECT (typical examples)

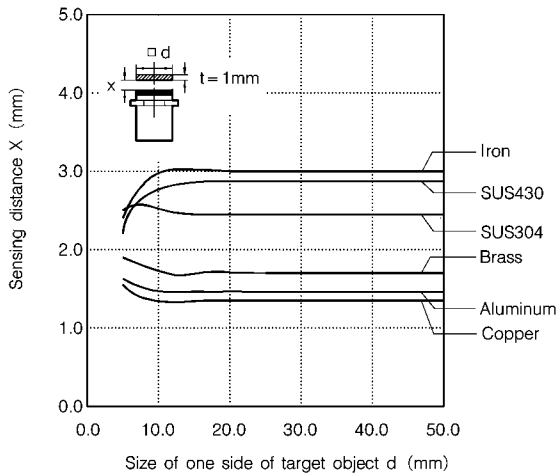
FL7M-3T7H □



FL7M-7T7H □

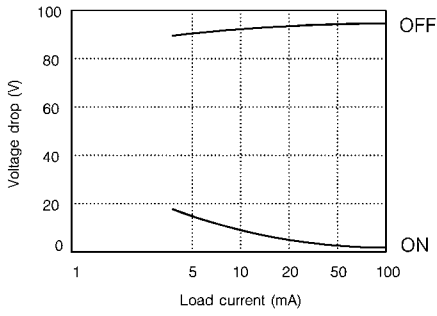


FL7M-10T7 □

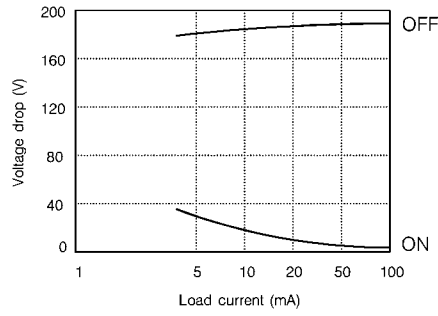


VOLTAGE DROP CHARACTERISTICS (typical examples)

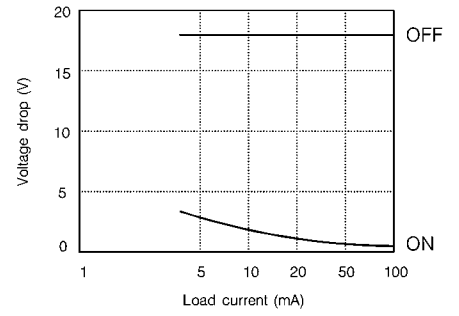
● 100Vac



● 200Vac

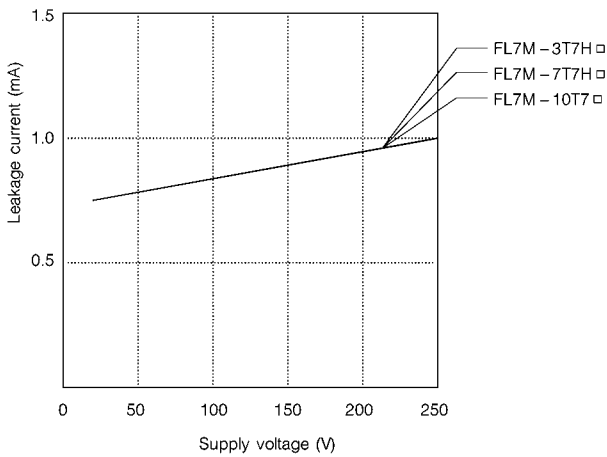


● 24Vdc

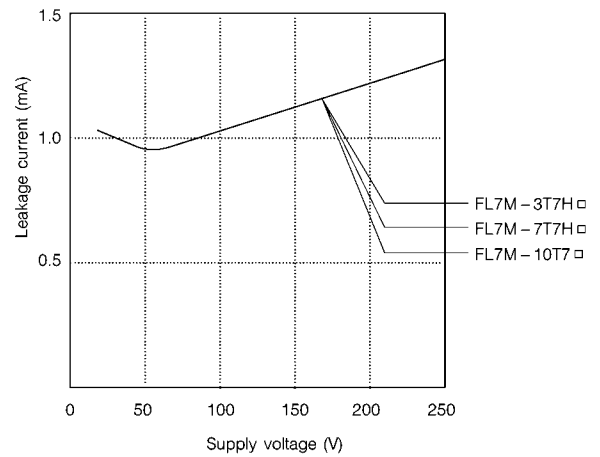


LEAKAGE CURRENT CHARACTERISTICS (typical examples)

● When DC power supply is used



● When AC power supply is used

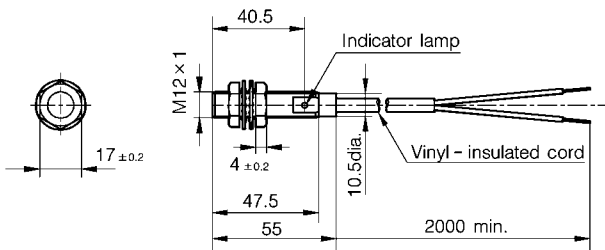


EXTERNAL DIMENSIONS

● Standard (pre-leaded) model

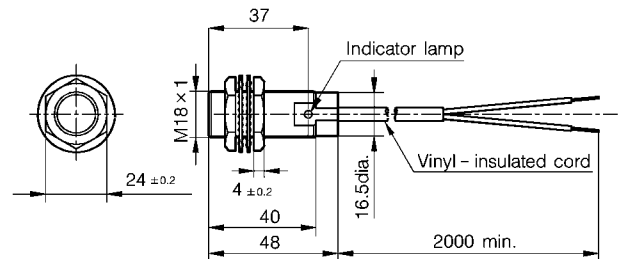
(unit: mm)

FL7M-3T7H/W



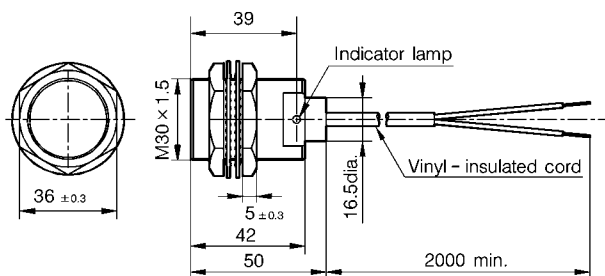
Vinyl-insulated cord (flame-resistant, oil-resistant: 0.5mm², 21/0.18, 2-core) 5.7mm dia.
Cap color: (spatter-guarded model: white)

FL7M-7T7H/W



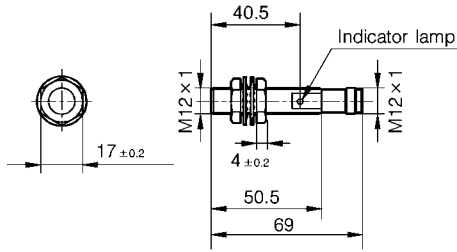
Vinyl-insulated cord (flame-resistant, oil-resistant: 0.5mm², 21/0.18, 2-core) 5.7mm dia.
Cap color: (spatter-guarded model: white)

FL7M-10T7W



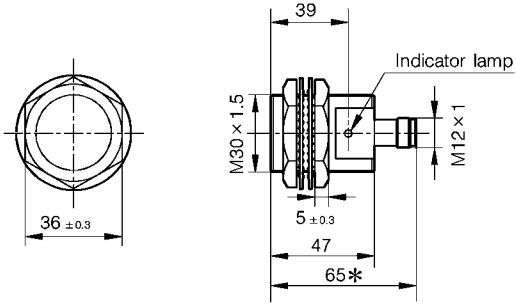
Vinyl-insulated cord (flame-resistant, oil-resistant: 0.5mm², 21/0.18, 2-core) 5.7mm dia.
Cap color: (spatter-guarded model: white)

● Connector model
FL7M-3T7H□-CN



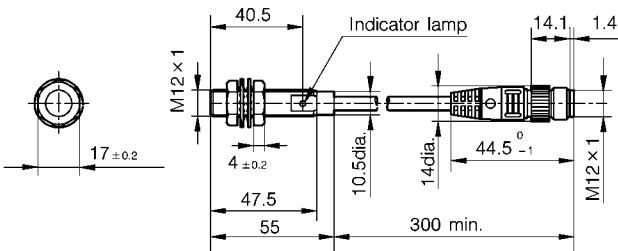
Cap color: (standard model: orange, spatter-guarded model: white)

FL7M-10T7□-CN



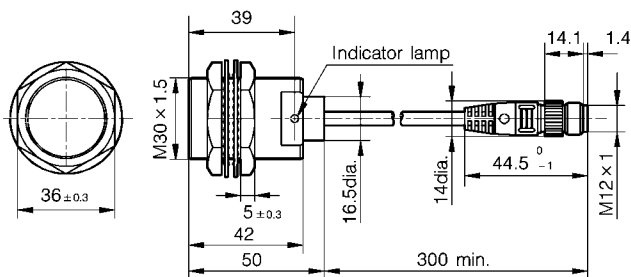
Cap color: (standard model: orange, spatter-guarded model: white)

● Pre-leaded connector model
FL7M-3T7H□-CN03



Cap color: (spatter-guarded model: white)

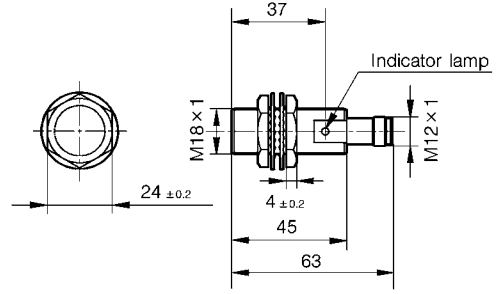
FL7M-10T7□-CN03



Cap color: (spatter-guarded model: white)

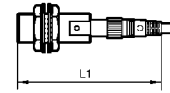
FL7M-7T7H□-CN

(unit: mm)

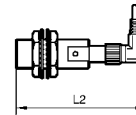


Cap color: (standard model: orange, spatter-guarded model: white)

Note:

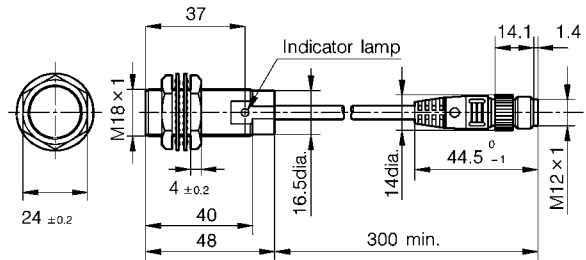


When a straight-type connector is fitted, the dimension L1 is the overall length plus about 30mm.



When an angle-type connector is fitted, the dimension L2 becomes the overall length plus 20mm.

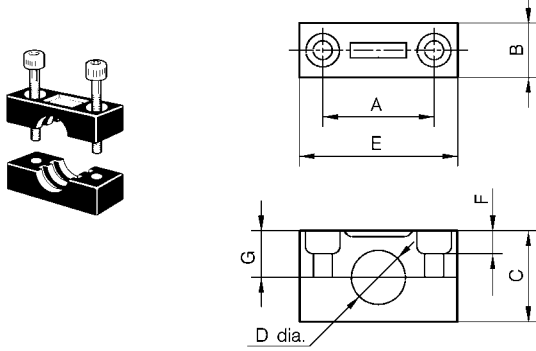
FL7M-7T7H□-CN03



Cap color: (spatter-guarded model: white)

MOUNTING BRACKET (sold separately)

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



FL-PA118 and **FL-PA130** screw holes are oblong.

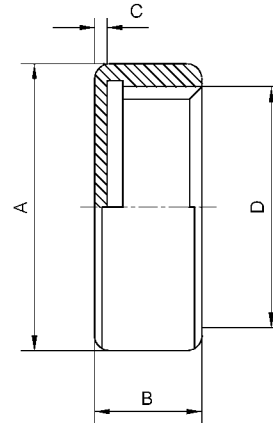
Catalog listing	Dimensions (mm)								Screw dimensions	
	A	B	C	D	E	F	G	Diameter	Neck	
FL-PA112	25	12	20	12	36	6	9.5	M4	25	
FL-PA118	30/32	15	30	18	45	7.5	14.5	M5	35	
FL-PA130	40/45	15	50	30	60	10	24.5	M5	55	

• Allowable tightening strength of bracket

Catalog listing	Allowable tightening strength (N-m)	Remarks
FL-PA112	0.98	M4 screw used
FL-PA118	1.5	M5 screw used
FL-PA130	1.5	M5 screw used

PROTECTIVE COVER (sold separately)

Protective covers (material: polyacetal resin) are available for shielded models. Select a model according to the sensor's external dimensions.



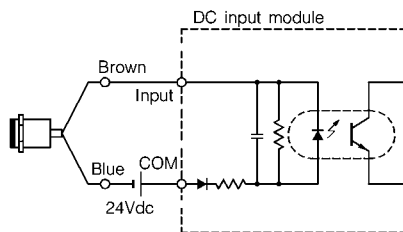
Catalog listing	Dimensions (mm)			
	A	B	C	D
FL-PA12	14dia.	5	$0.5^{+0.2}_{-0.1}$	M12 × 1
FL-PA18	21dia.	6	$0.5^{±0.2}$	M18 × 1
FL-PA30	33dia.	8	$1.5^{±0.2}$	M30 × 1.5

WIRING

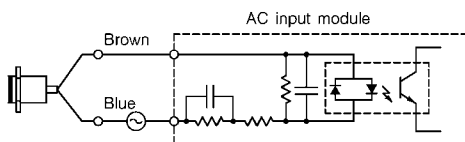
• Standard (pre-leaded) model

(1) Wiring to programmable controller

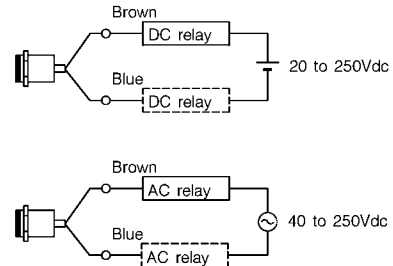
• When connected to a DC input module



(2) Wiring to relay load



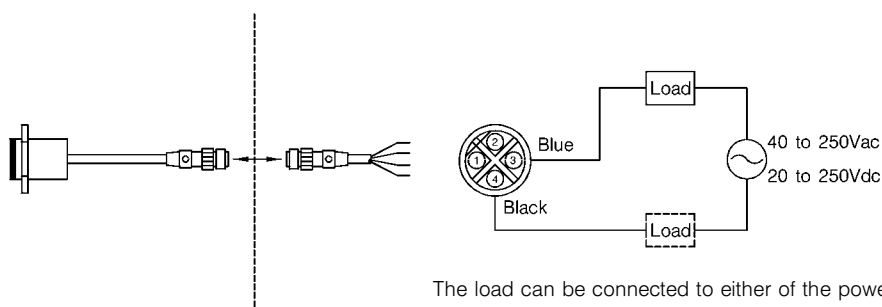
• When connected to an AC input module



• Connector model, pre-leaded connector model

(Lead colors are for when the **PA5** is used.)

The connectors have four pins. Contacts are laid out as follows:



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

CONNECTOR SPECIFICATIONS Note 1

Item	Specifications
Insulation resistance	100M Ω min. (at 500Vdc)
Dielectric strength	1,500Vac for 1 minute (across contacts, and contacts and connector housing)
Initial contact resistance	40m Ω max. (excluding code conductor-intrinsic when energized by 3A on a male-female contact combination)
Connector withstand stress	0.4 to 4.0N (per contact)
Number of connector insertions	50 times
Connector tightening strength	0.8N-m min. (Note 2)
Cord pullout strength	100N min.
Vibration resistance	10 to 55Hz, 1.5mm peak-to-peak amplitude, 2 hrs in X, Y and Z directions
Shock resistance	300m/s ² , 3 times in X, Y and Z directions
Protection	IP67
Operating temperature range	- 10 to + 70°C
Storage temperature range	- 20 to + 80°C
Operating humidity range	95%RH max.
Material	Contact: gold-plated brass Contact holder: glass-lined polyester resin Housing: polyester elastomer Coupling: Ni-plated brass, orange paint O-ring: NBR

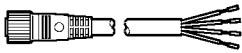
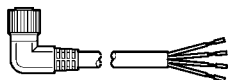
Note 1: Specifications assume Yamatake **PA5** Series with **VA** connectors.

Note 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.

CONNECTION CORD WITH CONNECTOR

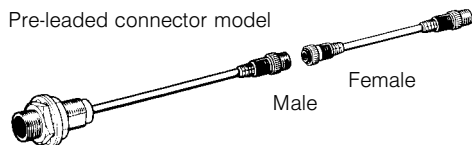
Be sure to use **PA5** Series cord with **VA** connector when connecting a pre-leaded connector or connector sensors.

● PA5 Series cord with VA connector

Shape	Power supply	Cord length	Catalog listing	Lead color
	ac/dc common	2m	PA5-4ISX2HK	1-brown, 2-white, 3-blue, 4-black
		5m	PA5-4ISX5HK	
		2m	PA5-4ILX2HK	
		5m	PA5-4ILX5HK	

PA5 Series cord with **VA** connector

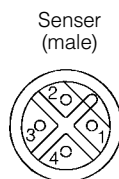
Pre-leaded connector model



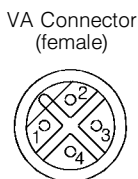
Connector model



Male



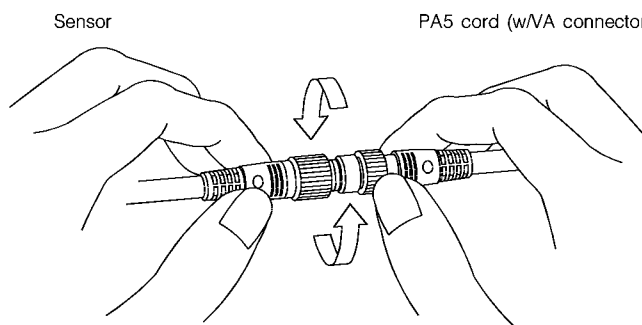
Sensor (male)



VA Connector (female)

● Fastening the connector

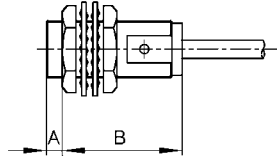
Align the grooves of the connectors and turn the fastening screw of the **VA** connector of the **PA5** cord by hand until it fits tightly with the screw on the sensor side.



PRECAUTIONS

● Mounting

The allowable tightening torque varies according to the distance from the tip of the sensing head.

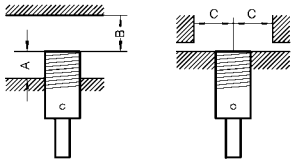


Catalog listing	A dimensions (mm)	Allowable tightening torque (N·m)	
		A	B
FL7M-3T7H□	17	11.8	19.6
FL7M-7T7H□	15	29.4	49
FL7M-10T7□	17	49	147

Note: The table shows the allowable strength when toothed washers (provided) are used.

● Influence of surrounding metal

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



- A: Dimension to tip (sensing face) of proximity sensor from mounting surface
 B: Dimension to front iron plate from tip (sensing face) of proximity sensor
 C: Dimension to front iron plate of proximity sensor when A=0

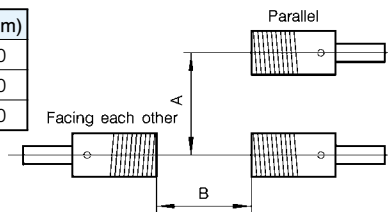
Shaded areas indicate surrounding metal other than the target object.

Catalog listing	A (mm)	B (mm)	C (mm)
FL7M-3T7H□	0	8	9
FL7M-7T7H□	0	20	13.5
FL7M-10T7□	0	40	22.5

● 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 below.

Catalog listing	A (mm)	B (mm)
FL7M-3T7H□	20	30
FL7M-7T7H□	35	50
FL7M-10T7□	70	100



● Cautions during series or parallel connection

(1) Series connection (AND connection)

● When used on a DC power supply

Series connection is not possible.

● When used on an AC power supply

- When connecting two or more proximity sensors in series, erroneous output (3 to 10ms) 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 15kΩ (at 100Vac) or a resistor of 30kΩ (200Vac) must be provided in parallel to each of the sensors.

However, note that the maximum leakage current in a series connection will be 8mA.

Operation lag also will occur, resulting in increased voltage drop, and the operation indicator lamp will not light.

$$\text{Operation lag} = 40\text{ms} \times (\text{number of series connections} - 1) \text{ resistance}$$

$$\text{Voltage drop} = \text{voltage drop of single sensor} \times \text{number of series connected sensors}$$

(2) Parallel connection (OR connection)

● When used on a DC power supply

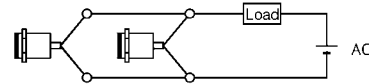
Series connection is not possible.

● When used on an AC power supply

- When connecting two or more proximity sensors in parallel, leakage current increases as follows, and may result in faulty load restore.

$$(\text{Leakage current} = \text{Leakage current of single sensor} \times \text{number of series connected sensors})$$

- 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.



● Loads that cause rush current

When the proximity sensor is connected to a load such as an electromagnetic switch, lamp or motor that causes rush current, use the sensor within the rated current that includes the rush current.

● Connection to power supply and load

Be sure to connect the proximity sensor to the power supply via the load. If the sensor is connected directly to the power supply, the sensor will become damaged. Also, output is not subject to polarity, and so the load can be connected to either power supply. However, we recommend connecting the load to the non-earthed side to prevent short-circuiting of the power supply if a ground fault caused by damage to the proximity sensor occurs.

● Operation at power ON

After the power is turned ON, it takes 80ms 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.

● 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.

● 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.



RESTRICIONS ON USE

This product has been designed, developed and manufactured for general-purpose application in machinery and equipment. Accordingly, when used in applications outlined below, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.

- Safety devices for plant worker protection
- Start/stop control devices for transportation and material handling machines
- Aeronautical/aerospace machines
- Control devices for nuclear reactors

Never use this product in applications where human safety may be put at risk.

YAMATAKE

Specifications are subject to change without notice.

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