Photoelectric Sensors for Harsh Environments

HP800 Series

For even harsher environments

- Die-cast housing for strength and shock resistance
- High-performance seal
- Resistance to the most advanced cutting oils
- Preleaded connector models are available

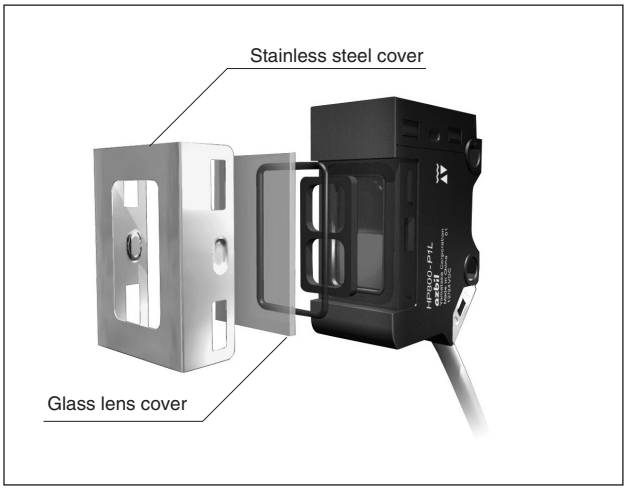
EXPLANATION OF MAJOR FUNCTIONS AND FEATURES

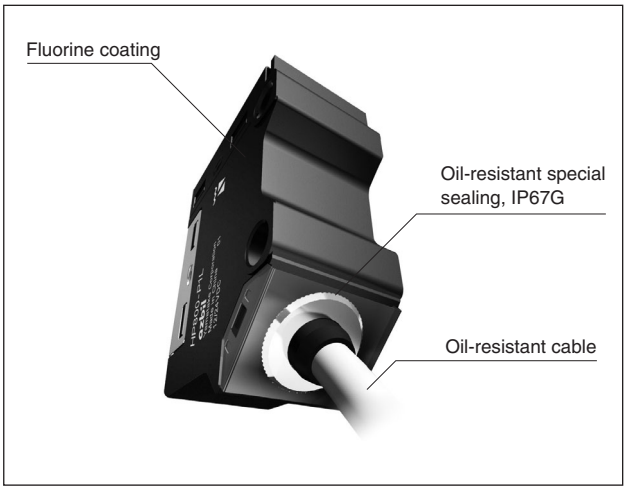
Rugged: Die-cast housing

Rugged: Shock resistant to 1000m/s²

Oil resistant: Glass lens cover

Oil resistant: Stainless steel cover





Oil resistant: Fluorine coating

Oil resistant: special sealing, IP67G

Oil resistant: special cable

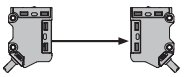
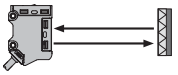
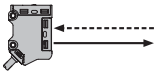
ABOUT OIL RESISTANCE

- As shown below, these photoelectric sensors pass the JEM IP67G oil resistance tests for oil solution and 2 types of water-soluble cutting oil which are widely used for tooling processes.
- With regard to water-soluble cutting oil, the sensors pass the product life test by the accelerated test method, as shown below.

Classification of test oil	JIS classification	Details of test	Name of test oil	Kinematic viscosity (mm^2/s) (40˚C)	PH
Water-insoluble cutting fluid	Equivalent to type 3 No.8	Immersion in 50˚C oil for 240 hours	Yushiron Cut Abas BM405	15.1	—
Water-miscible cutting fluid	Equivalent to type A1 No.1	Immersion in 30˚C and 60˚C oil for 2 hours each, 250 cycles (1000 hours)	Yushiroken EC50-T3	—	10.1(x30)
	Equivalent to type A2 No.1		Yushiroken PFS760	—	9.9(x20)

Note: The three types of cutting oil are made by Yushiro Chemical Industry Co., Ltd.

CATALOG LISTINGS

Detection method	Scanning distance	Configuration	L-ON	D-ON	Sensitivity adjustment	Wiring method	Cable length	Power supply	Output mode	Catalog listing
Thru-scan	15m		●			Preleaded	2m	10 to 30Vdc	NPN open collector	**HP800-T1L**
				●						**HP800-T1D**
			●				5m			**HP800-T1L-L05**
				●						**HP800-T1D-L05**
			●				50cm			**HP800-T1L-LP5**
				●						**HP800-T1D-LP5**
			●			Preleaded connector	30cm			**HP800-T1L-CN03**
				●						**HP800-T1D-CN03**
			●				50cm			**HP800-T1L-CN05**
				●						**HP800-T1D-CN05**
			●				1m			**HP800-T1L-CN1**
				●						**HP800-T1D-CN1**
			●			Preleaded	2m		PNP open collector	**HP800-T2L**
				●						**HP800-T2D**
			●				5m			**HP800-T2L-L05**
				●						**HP800-T2D-L05**
			●				50cm			**HP800-T2L-LP5**
				●						**HP800-T2D-LP5**
			●			Preleaded connector	30cm			**HP800-T2L-CN03**
				●						**HP800-T2D-CN03**
			●				50cm			**HP800-T2L-CN05**
				●						**HP800-T2D-CN05**
			●				1m			**HP800-T2L-CN1**
				●						**HP800-T2D-CN1**
Polarized retroreflective	4.5m (when used with **FE-RR8** or **FE-RR17** or **FE-RR21**)		●			Preleaded	2m		NPN open collector	**HP800-P1L**
				●						**HP800-P1D**
			●				5m			**HP800-P1L-L05**
				●						**HP800-P1D-L05**
			●				50cm			**HP800-P1L-LP5**
				●						**HP800-P1D-LP5**
			●			Preleaded connector	30cm			**HP800-P1L-CN03**
				●						**HP800-P1D-CN03**
			●				50cm			**HP800-P1L-CN05**
				●						**HP800-P1D-CN05**
			●				1m			**HP800-P1L-CN1**
				●						**HP800-P1D-CN1**
			●			Preleaded	2m		PNP open collector	**HP800-P2L**
				●						**HP800-P2D**
			●				5m			**HP800-P2L-L05**
				●						**HP800-P2D-L05**
			●				50cm			**HP800-P2L-LP5**
				●						**HP800-P2D-LP5**
			●			Preleaded connector	30cm			**HP800-P2L-CN03**
				●						**HP800-P2D-CN03**
			●				50cm			**HP800-P2L-CN05**
				●						**HP800-P2D-CN05**
			●				1m			**HP800-P2L-CN1**
				●						**HP800-P2D-CN1**
Diffuse -scan	77cm		●		●	Preleaded	2m		NPN open collector	**HP800-A1L**
				●	●					**HP800-A1D**
			●		●		5m			**HP800-A1L-L05**
				●	●					**HP800-A1D-L05**
			●		●		50cm			**HP800-A1L-LP5**
				●	●					**HP800-A1D-LP5**
			●		●	Preleaded connector	30cm			**HP800-A1L-CN03**
				●	●					**HP800-A1D-CN03**
			●		●		50cm			**HP800-A1L-CN05**
				●	●					**HP800-A1D-CN05**
			●		●		1m			**HP800-A1L-CN1**
				●	●					**HP800-A1D-CN1**
			●		●	Preleaded	2m		PNP open collector	**HP800-A2L**
				●	●					**HP800-A2D**
			●		●		5m			**HP800-A2L-L05**
				●	●					**HP800-A2D-L05**
			●		●		50cm			**HP800-A2L-LP5**
				●	●					**HP800-A2D-LP5**
			●		●	Preleaded connector	30cm			**HP800-A2L-CN03**
				●	●					**HP800-A2D-CN03**
			●		●		50cm			**HP800-A2L-CN05**
				●	●					**HP800-A2D-CN05**
			●		●		1m			**HP800-A2L-CN1**
				●	●					**HP800-A2D-CN1**

ACCESSORIES

Name	Configuration	Description	Catalog listing	Compatible model
Reflector for polarized retroreflective model		Reflector size 37mm x 56mm	**FE-RR21** (Scanning distance 5m)	**HP100-P** □
		Reflector size 47mm x 47mm	**FE-RR8** (Scanning distance 5m)	**HP100-P** □
		Reflector size 47mm x 47mm	**FE-RR17** (Scanning distance 5m)	**HP100-P** □
		Reflector size 30.8mm x 30.8mm	**FE-RR15** (Scanning distance 3.5m)	**HP100-P** □
		Reflector size 30.8mm x 30.8mm	**FE-RR18** (Scanning distance 3.5m)	**HP100-P** □
		Reflector size 8.6mm x 29.5mm	**FE-RR20** (Scanning distance 2m)	**HP100-P** □
Standard bracket		Bottom-mounting L-bracket (zinc-plated steel plate)	**HP800-B01**	All models

SPECIFICATIONS

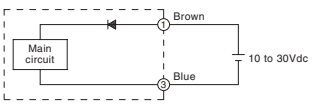
Catalog listing	HP800-P □□	HP800-T □□	HP800-A □□
Detection method	Polarized retroreflective*2	Thru-scan	Diffuse-scan
Power	10 to 30Vdc (ripple 10% max.)		
Power consumption	13mA max.	27mA max. (**HP100-E1**: 16mA max., **HP100-R**□: 11mA max.)	16mA max.
Scanning distance	0.05 to 4.5m (when used with **FE-RR8**, **FE-RR17**, or **FE-RR21** reflector)	15m	0.77m
Target object	Opaque object 80mm dia. min. (when used with **FE-RR8**, **FE-RR17**, or **FE-RR21** reflector)	Opaque object, 9mm dia. min.	——
Standard target object	——	——	300 x 300mm white paper (Kodak 90% reflective paper)
Scanning angle	Body: 0.5 to 10°. Reflector: 20° min.	2 to 20°	——
Differential travel	——	——	20% max. (at rated scanning distance)
Operation mode	**HP800-□□L**: Light-ON. **HP800-□□D**: Dark-ON.		
Output mode*1	**HP800-□1(L /D)**: NPN open collector. **HP800-□2(L /D)**: PNP open collector		
Control output	Switching current: 100mA (resistive load). Output dielectric strength: 30V. Voltage drop: 3V max. (at switching current 100mA). Short-circuit protection function.		
Response time	500μs max. for both operation and recovery		
Emitter	Red LED	Infrared LED	Infrared LED
Indicator	Indicators other than thru-scan emitter: orange when output ON, and green during stable light-ON and light-OFF. Thru-scan emitter: orange light on power supply indicator. Thru-scan receiver: light-operated red indicator on front.		
Ambient light immunity	Incandescent lamp: 10,000 lux max. Sunlight: 40,000 lux max.		
Operating temperature	–30 to +60°C (without freezing or condensation)		
Operating humidity	35 to 85% RH (without freezing or condensation)		
Insulation resistance	20MΩ min. (at 500Vdc)		
Dielectric strength	1,000Vac 50/60Hz for one minute between electrically live metal and case		
Vibration resistance	10 to 55Hz, 1.5mm peak-to-peak amplitude, 2 hours each in X, Y, and Z directions		
Shock resistance	1000m/s² 3 times each in X, Y and Z directions		
Protective structure	IP67 (JIS standard) , IP67G (JEM standard) (excluding connector)		
Wiring method	**HP800-□□□-LP5**: preleaded (0.5m), **HP800-□□□**: preleaded (2m), **HP800-□□□-L05**: preleaded (5m), **HP800-□□□-CN03**: preleaded connector (0.3m), **HP800-□□□-CN05**: preleaded connector (0.5m), **HP800-□□□-CN1**: preleaded connector (1m)		
Weight	Approx. 105g (body with 2m cable only)		
Circuit protection	Power ON malfunction prevention circuit (approx. 8ms), wiring error protection		

*1. An FET is used for output

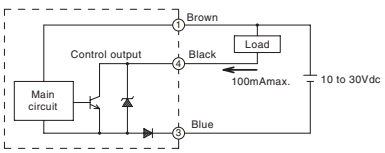
*2. If a polarized retroreflective model is used to detect highly reflective objects or objects that interfere with polarization, detection might be inconsistent. For details, see the handling precautions on page 30. When used in an environment likely to cause rust (except for cutting oil), use the **HP-PA01** spacer (sold separately) when mounting.

OUTPUT CIRCUIT DIAGRAM (Note that a FET is used for output)

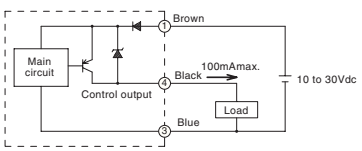
● **Thru-scan emitter**



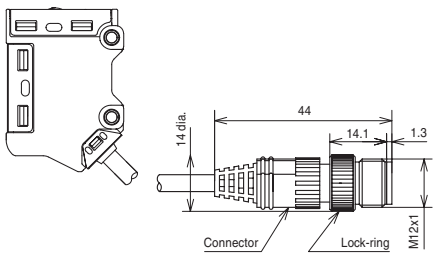
● (NPN output type)
Polarized retroreflector model
Thru-scan receiver
Diffuse-scan model

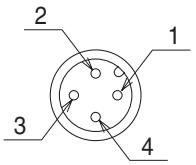


● (PNP output type)
Polarized retroreflector model
Thru-scan receiver
Diffuse-scan model



EXTERNAL DIMENSIONS/CONTACT ARRANGEMENT

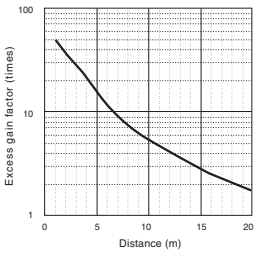




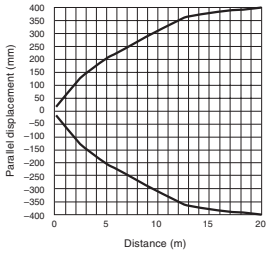
CHARACTERISTICS DIAGRAMS (typical examples)

● Thru-scan models (HP800-T□)

Excess gain
(light received over the required amount)

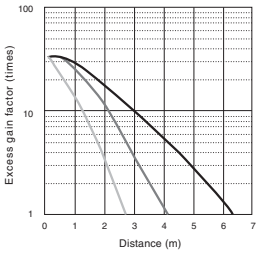


Parallel displacement

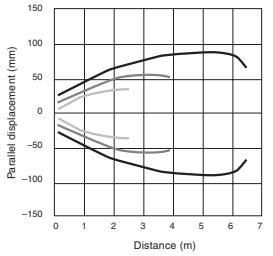


● Polarized retroreflective models (HP800-P□)

Excess gain
(light received over the required amount)
Use with the **FE-RR8 / 17 / 21**, **FE-RR15 / 18**, or **FE-RR20**

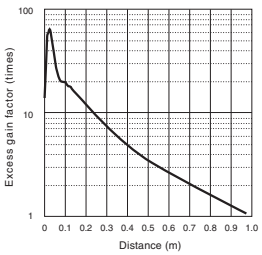


Parallel displacement
Use with **FE-RR8 / 17 / 21**, **FE-RR15 / 18**, or **FE-RR20**

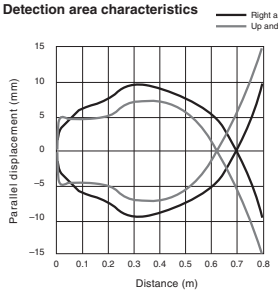


● Diffuse-scan models (HP800-A□)

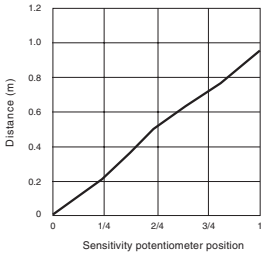
Excess gain
(light received over the required amount)



Detection area characteristics



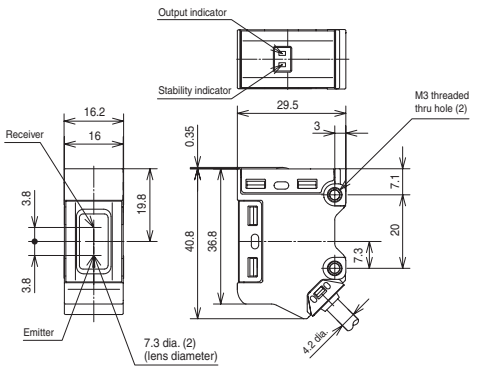
Potentiometer angle vs. scanning distance characteristics



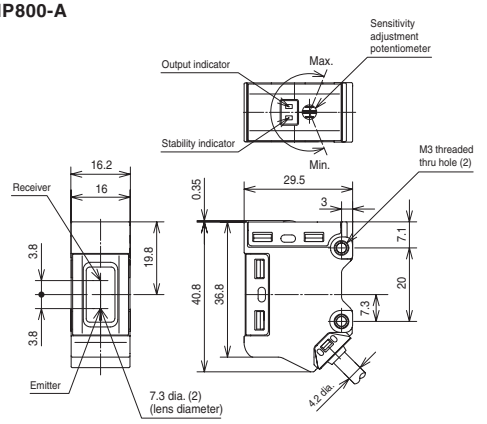
EXTERNAL DIMENSIONS

(unit: mm)

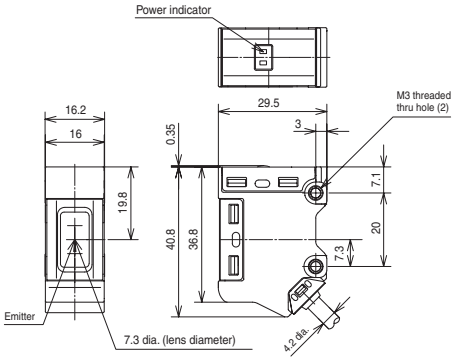
● **HP800-P**



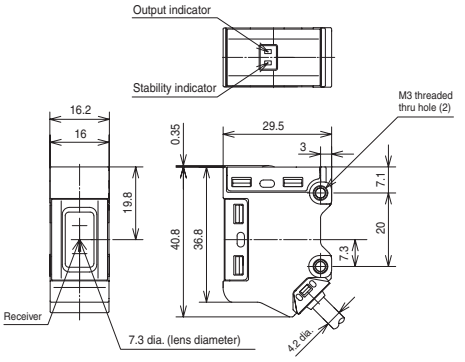
● **HP800-A**



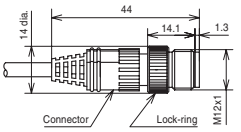
● **HP800-T (emitter: HP800-E1)**



● **HP800-T (receiver: HP800-R)**

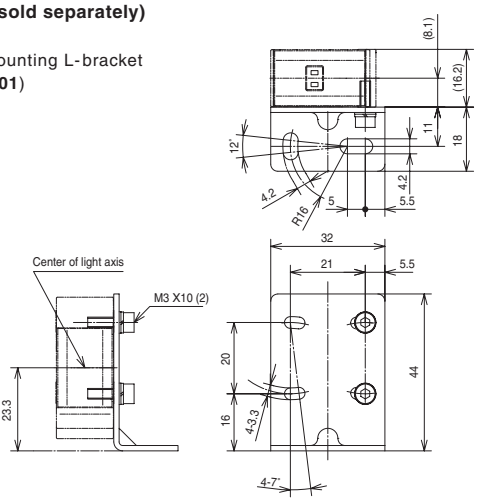


● **Connector (common)**



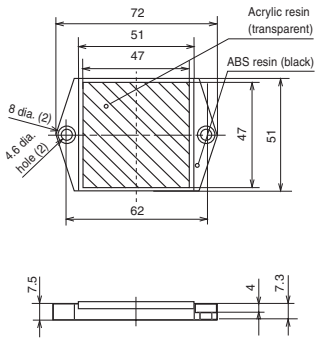
● **Bracket (sold separately)**

Bottom-mounting L-bracket (**HP800-B01**)

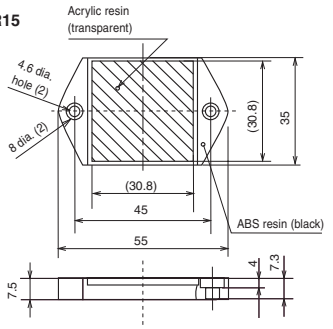


●Reflector (sold separately)

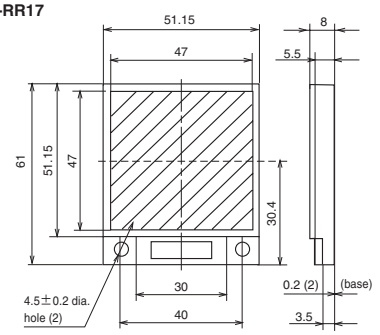
FE-RR8



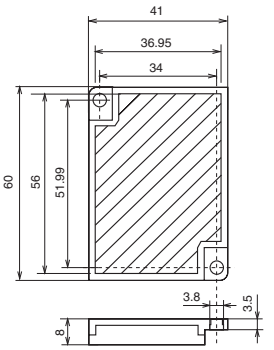
FE-RR15



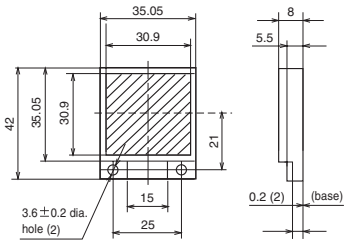
FE-RR17



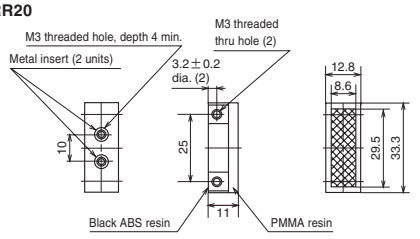
FE-RR21



FE-RR18



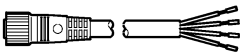
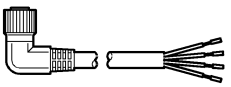
FE-RR20

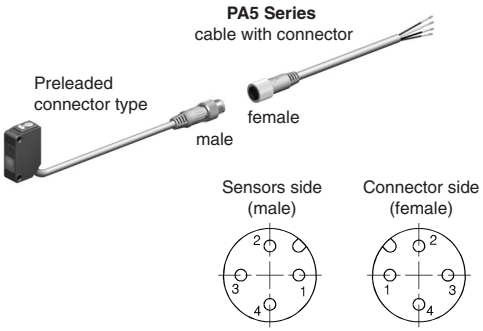


CABLE WITH CONNECTOR

Be sure to use a **PA5** Series cable with connector when connecting a preleaded connector or connector-type sensor.

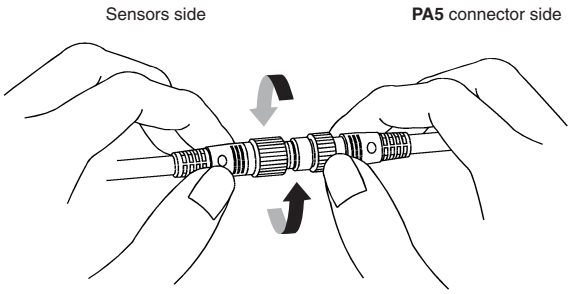
● PA5 Series cable with connector

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.



HANDLING

1. Handling precautions

- Tighten the mounting screws to a torque of less than 0.5N•m.
- Output is disabled upon power-up for 50ms max. until the unit stabilizes.
- When used outdoors, use a case to ensure that the unit is not exposed to direct sunlight or rain.
- Applications involving strong vibration or shock should be avoided due to potential for misalignment of the optical axis.
- Water or oil splashed on the lens surface may cause incorrect opertion. Shield it to prevent direct splashes.
- Do not use where exposed to chemicals (organic solvents, acids, alkalis, etc.).
- Use a cover or change the mounting direction to ensure correct sensor operation if there is heavy interference from ambient light.
- When used in a very dusty environment, be sure to take countermeasures to keep dust away from the lens surface by using a sealed case or air purging.
- Even when oil-resistant cable is used, do not use in a location subject to continuous splashing by water or oil, or where the unit is immersed in liquid. Ensure that the end of the cable is not subject to splashing by water or oil.
- Do not bend the part of the cable nearest to the main body beyond the bend radius of 30mm. Avoid continuous bending stress.
- Pulling with excessive force may break the cable. Do not apply a force of more than 50N.
- Photoelectric sensors are assembled with precision. Never strike with another object. Especially if the lens surface is scratched or cracked, sensor performance may decline. Handle with care.
- To clean the lens or reflector, wipe lightly with a soft, clean cloth or cloth moistened with water. Do not use an organic solvent such as alcohol, benzene, acetone, or thinner.
- When multiple photoelectric sensors are used close together, mutual interference may occur. After installation., check the operation carefully before use.
- When a polarized retroreflective model is used to detect highly reflective object or objects that disturb polarization, detection might be inconsistent. In such case, take the following countermeasures:

Examples of target object that might cause faulty operation:	·–––	● Target object covered with a transparent film ● Semi-transparent target object (semi-transparent case, etc.) ● Mirror or highly reflective mirrorlike object
Countermeasures:	–––––	● Mount the sensor at a slight angle to the target object. ● Increase the distance between the sensor and the target object. ● Lower the sensitivity setting of the sensor.

2. Wiring precautions

- If a cable extension is necessary, use wire at least 0.3mm^2 in cross-sectional area and at most 100m long.
- If the wires of photoelectric sensor are laid in the same conduit as high-voltage or power lines, inductance may cause malfunction or damage. Isolate the photoelectric sensor's cable or lay it in a separate conduit.
- When using a commercially available switching regulator, ground the frame ground and ground terminals. If used without grounding, switching noise may cause faulty operation.
- When using a load which generates an inrush current above the switiching capacity, such as a capacitive load or incandescent lamp, connect a current-limiting resistor between the load and the output terminals. Otherwise, the output short-circuit protection function may be activated.

3. Adjustment method

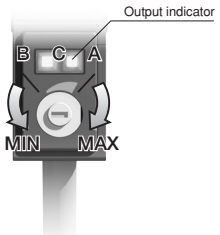
When there are many target objects or detection position changes, check the sensor's operation check during trial run adjustment. Be sure to check that there is no effect from light reflected from surrounding objects.

Thru-scan model and polarized retroreflective model

1. Move the emitter and receiver (main body and reflector in case of a polarized retroreflective model) up, down, right, and left, and then align them in the center of the area where the green stable-operation indicator lights up.
2. Finally, with the target object in position, be sure to check that the sensor correctly operates.

Diffuse-scan model

1. Mount the photoelectric sensor pointing toward the desired detection position.
2. With no target object present, slowly turn the light quantity adjustment potentiometer from MAX position toward MIN position, and find the position (called position A) where the output indicator (orange) goes off (or lights up). If the output indicator is off (on) even with the knob at MAX position, MAX position is position A.
3. With a target object in place, slowly turn the light quantity adjustment potentiometer from MIN position toward MAX position, and find the position (position B) where the output indicator (orange) lights up (or goes off).
4. Put the light quantity potentiometer in the center between A and B.



Note: The above adjustment method is primarily for light-ON operation. For dark-ON operation, apply the text in parentheses.