Self-contained Photoelectric Sensors

PZ Series

Features
● Super-small
● IP-67-rated waterproof
● Bright powerful beam
● Easy-to-see LED indicators

Detecting Distance

Thrubeam – 0 to 7,000 mm (0 to 275.59")

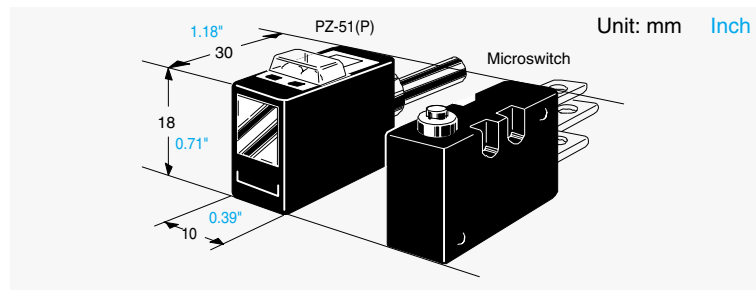Retro-reflective – 100 to 2,500 mm (3.94" to 98.43")

Diffuse-reflective – 0 to 600 mm (0 to 23.62")

Description

Super-small
Approximately the same size as a general microswitch, the PZ Series photoelectric sensors combine compactness and long-distance detection.
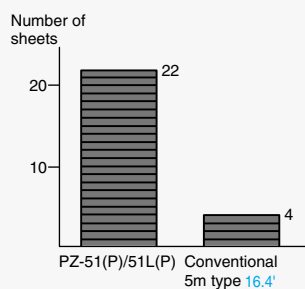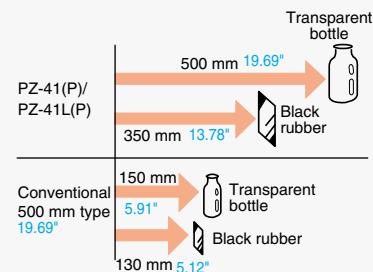

Powerful and versatile
Using a super-bright LED, the PZ Series is very powerful. The PZ-51(P) thrubeam type can penetrate even a large amount of accumulated dust or dirt with ease. The PZ-41(P) reflective type is able to detect at a distance even if the target is black or transparent.

Example:

PZ-51(P)/51I(P) penetrates up to 22 sheets of white paper (detecting distance: 100 mm 3.94").

Number of sheets

PZ-41(P)/41L(P) detects black or transparent targets from a distance.

Transparent bottle

PZ-41(P)/PZ-41L(P)
500 mm 19.69"
Black rubber
350 mm 13.78"

Conventional 500 mm type 19.69"
150 mm 5.91" Transparent bottle
Black rubber
130 mm 5.12"

PZ-51(P)/51L(P)   Conventional 5m type 16.4'

Easy-to-see LED indicators
The LED indicators provided on the top of the sensor head project slightly, making them easily visible even from a distance.
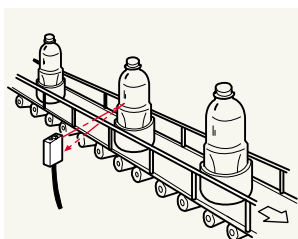
Examples:

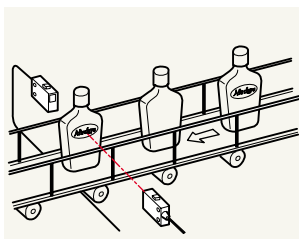Stable operation (Both red and green LEDs light when sensor is in LIGHT-ON mode.)
Unstable operation (Green LED turns off and alarm output is activated.)

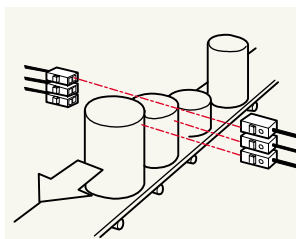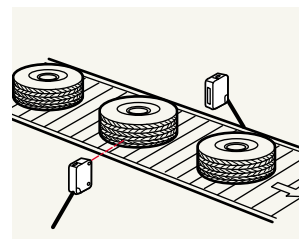**Self-contained Photoelectric Sensors PZ**

Applications

Detection of transparent bottles

Detection of labels on plastic bottles

Differentiates object height

Detection of tires

Specifications

Type		Thrubeam		Diffuse-reflective			
Model	NPN	PZ-51	PZ-51L	PZ-41	PZ-41L	PZ-42	PZ-42L
	PNP	PZ-51P	PZ-51LP	PZ-41P	PZ-41LP	PZ-42P	PZ-42LP
Detecting distance		0 to 7,000 mm 275.59"		0 to 600 mm 23.62"		0 to 80 mm 3.15"	
Detectable object		Opaque materials (8 x 8 mm 0.31" min.)		Transparent and opaque materials			
Hysteresis		—		20% max. of detecting distance			
Response time		1.5 ms max.		1 ms max. (2 ms when transmitter's LED operates on different frequency)			
Light source		Infrared LED		Infrared LED			
Sensitivity adjustment		1-turn trimmer (240°)		1-turn trimmer (240°)			
Operation mode		LIGHT-ON/DARK-ON (selectable by wiring)					
Indicators		Output: Red LED, Stable operation: Green LED, Power supply: Red LED [1]					
Control output		NPN or PNP: 100 mA (40 V) max.		NPN or PNP: 100 mA (40 V) max.			
Alarm output (NPN type only)		NPN: 50 mA (40 V) max. (with short-circuit protection circuit)					
Power supply		12 to 24 VDC ±10%		12 to 24 VDC ±10%			
Current consumption		Transmitter: 20 mA max. Receiver: 25 mA max.		30 mA max.			
Enclosure rating		IP-67		IP-67			
Ambient light		Incandescent lamp: 5,000 lux max., Sunlight: 20,000 lux max.					
Ambient temperature		-20 to +55°C		-20 to +55°C			
Housing		Glass-fiber reinforced resin		Glass-fiber reinforced resin			
Weight (including 2-m 6.6' cable)		Transmitter: approx. 60g Receiver: approx. 70g		Approx. 75 g	Approx. 75 g	Approx. 75 g	Approx. 75 g

1. The power indicator is equipped on the transmitter of the thrubeam type only.
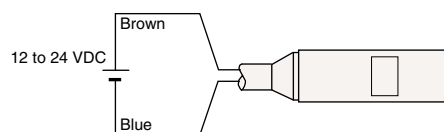
PZ Self-contained Photoelectric Sensors

Type		Retro-reflective	
Model	NPN	**PZ-61**	**PZ-61L**
	PNP	**PZ-61P**	**PZ-61LP**
Detecting distance		100 3.94" to 2,500 mm 98.43" (with R-1)	
Detectable object		Opaque materials (30 x 30 mm 1.18" min.) [1]	
Hysteresis		—	
Response time		1 ms max. (2 ms when transmitter's LED operates on different frequency)	
Light source		Infrared LED	
Sensitivity adjustment		1-turn trimmer (240°)	
Operation mode		LIGHT-ON/DARK-ON (selectable by wiring)	
Indicators		Output: Red LED Stable operation: Green LED Power supply: Red LED	
Control output		NPN or PNP: 100 mA (40 V) max.	
Alarm output (NPN type only)		NPN: 50 mA (40 V) max. (with short-circuit protection circuit)	
Power supply		12 to 24 VDC ±10%	
Current consumption		30 mA max.	
Enclosure rating		IP-67	
Ambient light		Incandescent lamp: 5,000 lux max. Sunlight: 20,000 lux max.	
Ambient temperature		-20 to +55°C	
Housing		Glass-fiber reinforced resin	
Weight (including 2-m 6.6' cable)		Approx. 75 g	Approx. 75 g

1. Objects smaller than 30 x 30 mm 1.18" can be detected depending on the sensitivity adjustment.
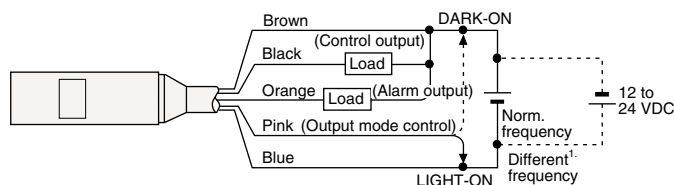
Connections

Thrubeam type (transmitter)

PZ-51(T)/51L(T)/51P(T)/51LP(T)

12 to 24 VDC
Brown
Blue

Thrubeam (receiver) and reflective types
NPN

PZ-51(R)/51L(R)/41/41L/42/42L/61/61L/101

Brown
Black (Control output)
Load
Orange (Alarm output)
Load
Pink (Output mode control)
Blue
DARK-ON
LIGHT-ON
Norm. frequency
Different [1] frequency
12 to 24 VDC

PNP

PZ-51P(R)/51LP(R)/41P/41LP/42P/42LP/61P/61LP/101P

Blue
Black (Control output)
Load
Purple (Output mode control)
Pink (Output mode control)
Brown
LIGHT-ON Normal frequency
DARK-ON Different [2] frequency
12 to 24 VDC

1. To operate the transmitter on a different frequency, supply 12 to 24 VDC through the blue wire and 0 V through the brown wire.
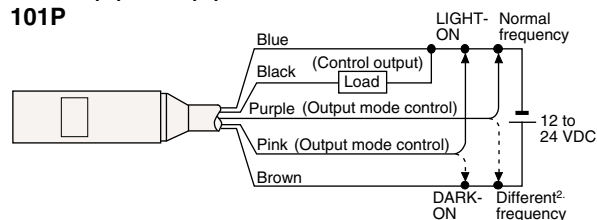
2. Provided only for diffuse reflective type and focused-beam type.

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Output Circuits

Thrubeam type: PZ-51/51L

NPN

Brown
Pink (Output mode control)
Black (Control output)
Load
Load
Orange (Alarm output)
12 to 24 VDC
Blue
Main circuit
Short-circuit protection circuit
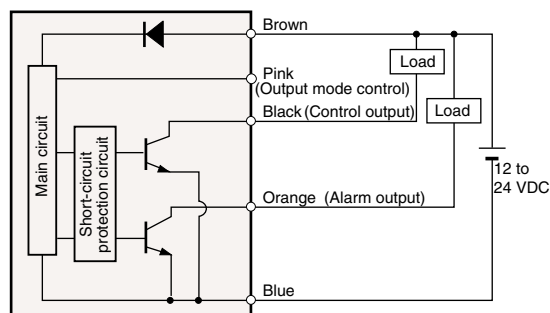
Diffuse-reflective type: PZ-41/41L/42/42L/101
Retro-reflective type: PZ-61/61L

NPN

Brown
Load
Pink (Output mode control)
Black (Control output)
Load
12 to 24 VDC
Orange (Alarm output)
Blue
Main circuit
Short-circuit protection circuit
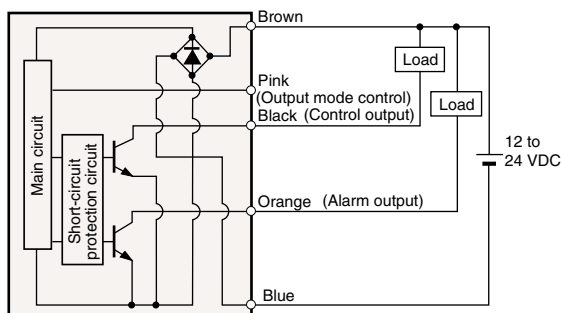
Thrubeam type: PZ-51P/51LP

PNP

Brown
Pink (Output mode control)
12 to 24 VDC
Black (Control output)
Load
Blue
Main circuit
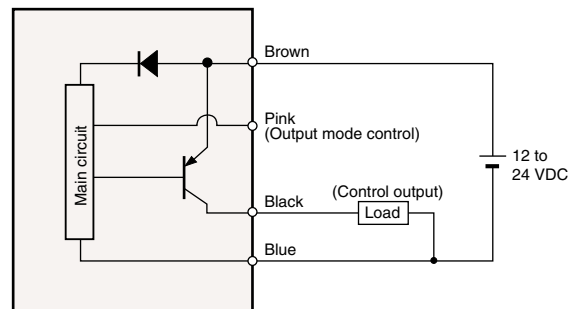
Diffuse-reflective type: PZ-41P/41LP/42P/42LP/101P
Retro-reflective type: PZ-61P/61LP

PNP

Purple (Alternet frequency control)
Brown
Black (Control output)
Load
12 to 24 VDC
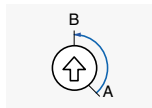Purple (Alternate frequency control)
Blue
Main circuit
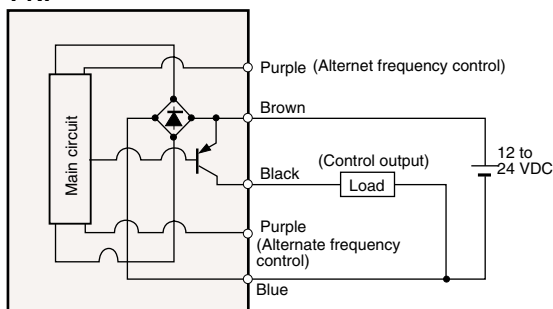
Adjustment

Reflective

LIGHT-ON mode (When DARK-ON mode is specified, refer to words in parentheses.)

1. With no target, turn the trimmer clockwise until the red LED indicator lights (turns off). – Point A
   If the red LED does not light (turn off) with the trimmer turned to Max., use Max. as point A.

2. With a target in place, turn the trimmer counterclockwise until the green LED turns off. – Point B
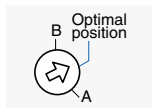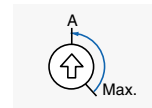
3. Set the trimmer midway between points A and B. Confirm sensor operation.
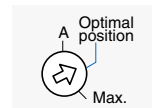
Thrubeam

DARK-ON mode

1. With no target, turn the trimmer to Max. With the receiver in place, move the transmitter up/down and right/left. Then secure the transmitter at the midpoint of the range in which the green LED indicator lights.

2. Turn the trimmer counterclockwise from Max., until the green LED turns off. – Point A
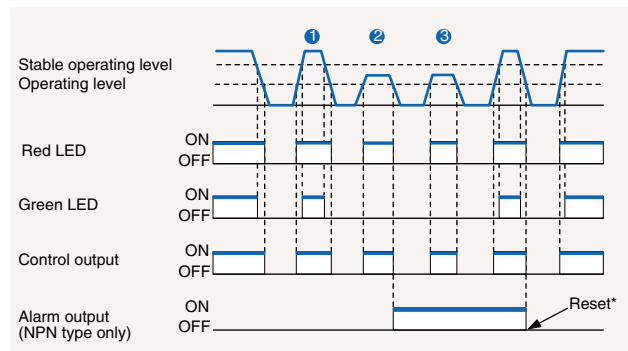
3. Set the trimmer midway between point A and Max. Confirm sensor operation.
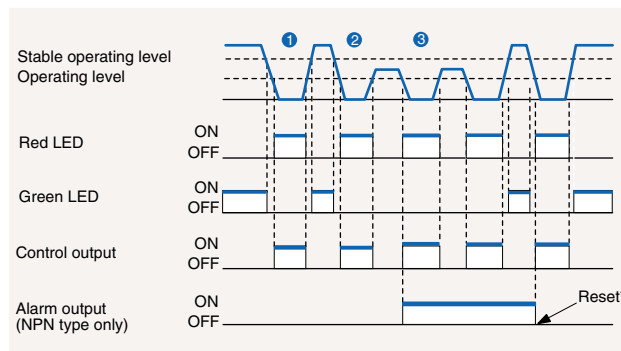
PZ Self-contained Photoelectric Sensors

Timing Chart

LIGHT-ON mode

Stable operating level
Operating level

Red LED — ON / OFF

Green LED — ON / OFF

Control output — ON / OFF

Alarm output (NPN type only) — ON / OFF   Reset*

If the light quantity received by the receiver of the sensor drops from a stable level (1) to an unstable level (2), the alarm output level is triggered.

DARK-ON mode

Stable operating level
Operating level

Red LED — ON / OFF

Green LED — ON / OFF

Control output — ON / OFF

Alarm output (NPN type only) — ON / OFF   Reset*

If the lights quantity is not restored to a stable level after detection of a target (2), the alarm output is triggered when detecting a second target (3).

*   If the alarm output is triggered, clean the lens surface and/or realign the optical axis so that the stable operation indicator lights again. Operating the sensor with the green LED lit resets the alarm output.
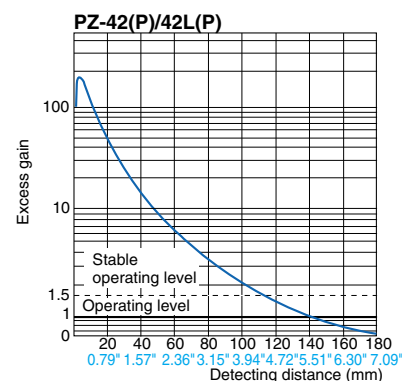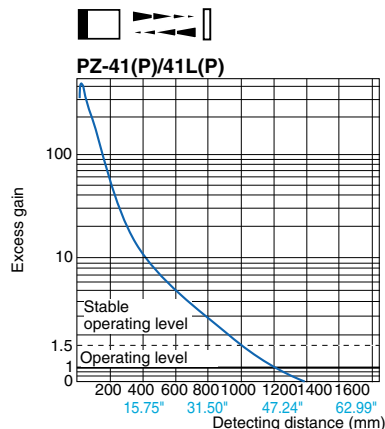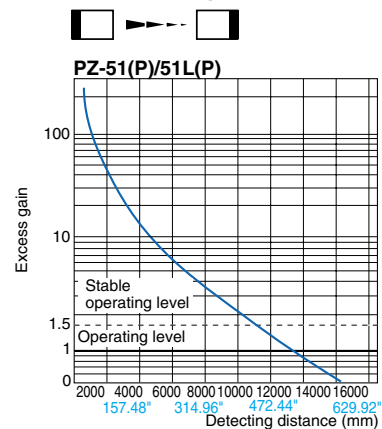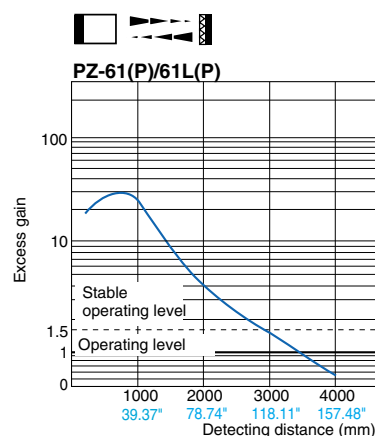
Characteristics

Receiver excess gain vs. distance (Typical)

PZ-51(P)/51L(P)

Excess gain

Stable operating level
Operating level

Detecting distance (mm)
2000 4000 6000 8000 10000 12000 14000 16000
157.48"   314.96"   472.44"   629.92"

PZ-41(P)/41L(P)

Excess gain

Stable operating level
Operating level

Detecting distance (mm)
200 400 600 800 1000 1200 1400 1600
15.75"   31.50"   47.24"   62.99"

PZ-42(P)/42L(P)

Excess gain

Stable operating level
Operating level

Detecting distance (mm)
20 40 60 80 100 120 140 160 180
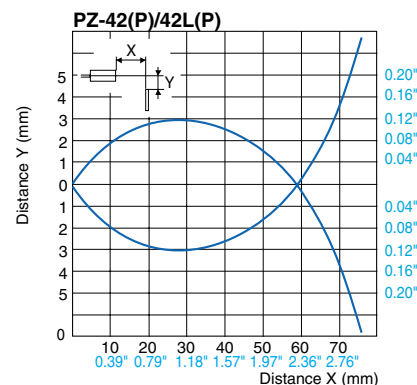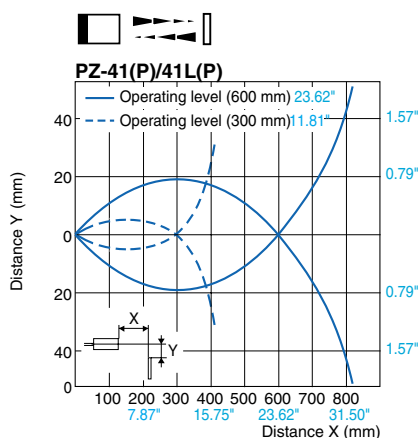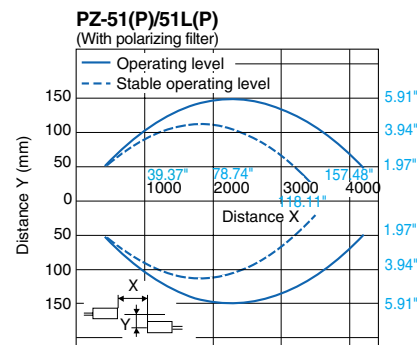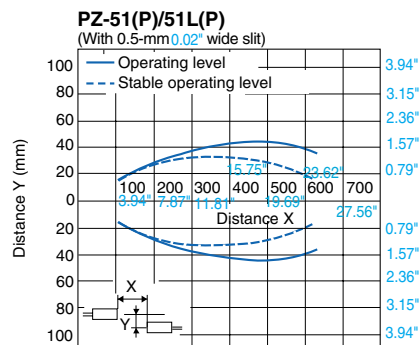0.79" 1.57" 2.36" 3.15" 3.94" 4.72" 5.51" 6.30" 7.09"

Receiver excess gain vs. distance (Typical)

PZ-61(P)/61L(P)

Excess gain

Stable operating level
Operating level

Detecting distance (mm)
1000 2000 3000 4000
39.37"   78.74"   118.11"   157.48"

Operating distance vs. detecting distance (Typical)

PZ-41(P)/41L(P)

— Operating level (600 mm) 23.62"
- - - Operating level (300 mm) 11.81"

Distance Y (mm)
40   1.57"
20   0.79"
0
20   0.79"
40   1.57"

Distance X (mm)
100 200 300 400 500 600 700 800
7.87"   15.75"   23.62"   31.50"

PZ-42(P)/42L(P)

Distance Y (mm)
5   0.20"
4   0.16"
3   0.12"
2   0.08"
1   0.04"
0
1   0.04"
2   0.08"
3   0.12"
4   0.16"
5   0.20"

Distance X (mm)
10 20 30 40 50 60 70
0.39" 0.79" 1.18" 1.57" 1.97" 2.36" 2.76"

Self-contained Photoelectric Sensors **PZ**

Parallel displacement of optical axis (Typical)

PZ-51(P)/51L(P)
(Without slit)

- Operating level
- Stable operating level

Distance Y (mm) / Distance X

PZ-51(P)/51L(P)
(With 0.5-mm 0.02" wide slit)

- Operating level
- Stable operating level

PZ-51(P)/51L(P)
(With polarizing filter)

- Operating level
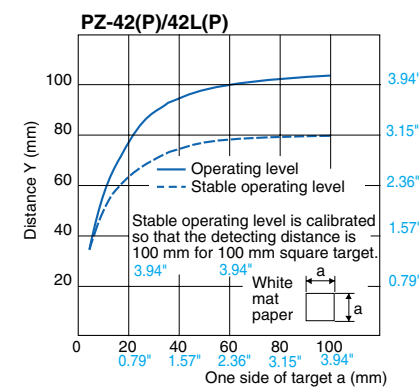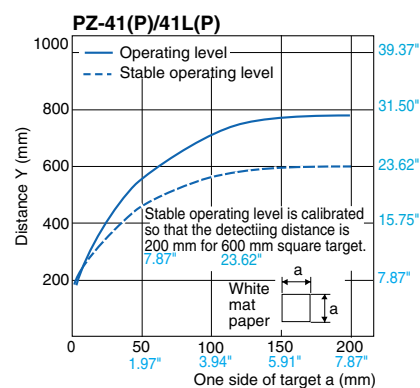- Stable operating level

Parallel displacement of optical axis (Typical)

PZ-51(P)/51L(P)
(With 0.5-mm 0.02" wide slit and polarizing filter)

- Operating level
- Stable operating level

PZ-61(P)/61L(P)

- Operating level
- Stable operating level

Residual voltage (All models)

Residual voltage (All models)

Alarm output | Control output

Residual voltage (V) / Load current (mA)

Detecting distance vs. object size (Typical)

PZ-41(P)/41L(P)

- Operating level
- Stable operating level

Stable operating level is calibrated so that the detecting distance is 200 mm for 600 mm square target.

White mat paper

Distance Y (mm) / One side of target a (mm)

PZ-42(P)/42L(P)

- Operating level
- Stable operating level

Stable operating level is calibrated so that the detecting distance is 100 mm for 100 mm square target.

White mat paper

Distance Y (mm) / One side of target a (mm)

Interference area

PZ-51(P)/51L(P)
(Without slit)

Operating area
Interference area

Distance Y (mm) / Distance X (mm)

PZ-51(P)/51L(P)
(With 0.5-mm 0.02" wide slit)

Operating area
Interference area

Distance Y (mm) / Distance X (mm)

PZ-51(P)/51L(P)
(With polarizing filter)

Operating area
Interference area

Distance Y (mm) / Distance X (mm)

PZ-51(P)/51L(P)
(With slit and polarizing filter)

Operating area
Interference area

Distance Y (mm) / Distance X (mm)

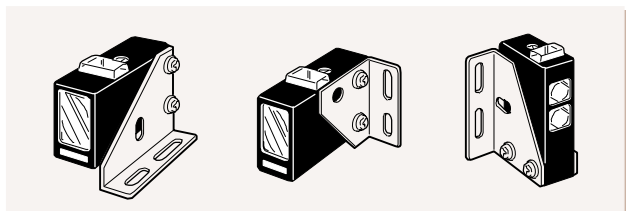# PZ Self-contained Photoelectric Sensors

Hints on Correct Use

Wiring
- Limit the length of extension to within 100 m 328.1'.

Mounting
- Use the attached mounting bracket to install and mount the sensor. The sensor can be mounted in various ways depending on the installation site or type of sensor.

Examples:

- Mount the sensor at a tightening torque of 0.5 N•m max.

- Two diffuse-reflective or two retro-reflective type sensors can be mounted side-by-side. Refer to Connections for wiring.

[Note]
Only two sensors can be mounted side-by-side.
To mount three or more sensors, provide enough distance between the first and third sensors so that they do not interfere with each other. If the sensor is used at an alternate frequency, the response speed will be 2 ms.


Separate to prevent interference.
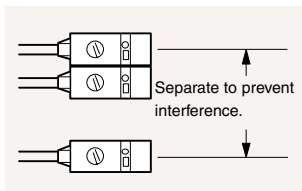
- To install two or more thrubeam type sensors side-by-side, alternate the transmitter and receiver. This limits the range of interference and stabilizes detection.
  If the detecting distance is short (within 50 cm 19.69"), interference can also be eliminated by using a slit plate.

T: Transmitter R: Receiver
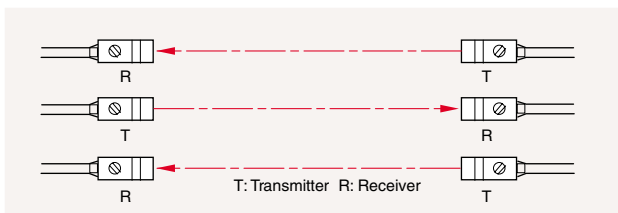
Stable operation indicator and output
The stable operation indicator (green LED) of the sensor lights when the quantity of light the receiver has received reaches or exceeds 150% of the operating level.
This indicator is used as an alarm for detection failure.
The indicator turns off when the received light quantity falls below 150% of the operating level due to soiled lens surface or misalignment of the optical axis. If this happens, the alarm output is activated and, the OUT indicator lights simultaneously.
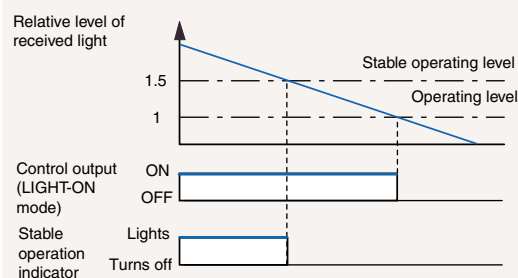

[Note]
If the alarm output is triggered, clean the lens surface and/or realign the optical axis so that the stable operation indicator lights again.

Slit plate
An optional slit plate is available for the thrubeam type sensors [models PZ-51 (P) and PZ-51L (P)].
It is used to detect or position thin or small objects.
Use the polarizing filter to prevent interference when sensors are installed side-by-side.
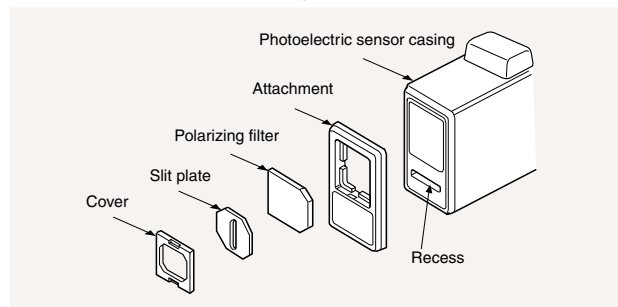
Slit plate (A-1)

Slit width	Detecting distance	Smallest detectable object
0.5 mm 0.02"	500 mm 19.69"	0.5 x 5 mm opaque 0.02" x 0.20"
1 mm 0.04"	800 mm 31.50"	1.0 x 5 mm opaque 0.04" x 0.20"
2 mm 0.08"	1500 mm 59.06"	2.0 x 5 mm opaque 0.08" x 0.20"

Polarizing filter (A-2)

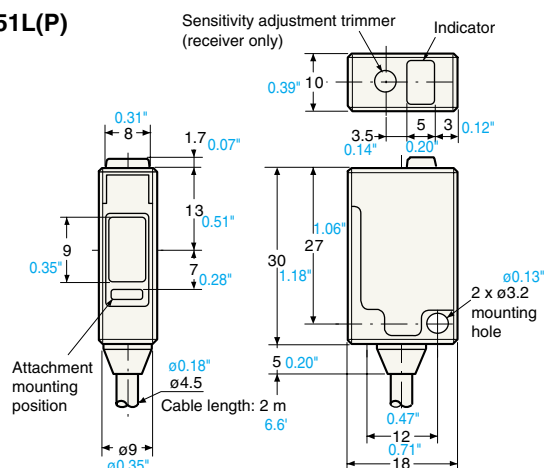| Detecting distance	Smallest detectable object
2.5 m 8.2'	6 x 6 mm 0.24" x 0.24" opaque

When both slit plate and polarizing filter are attached.

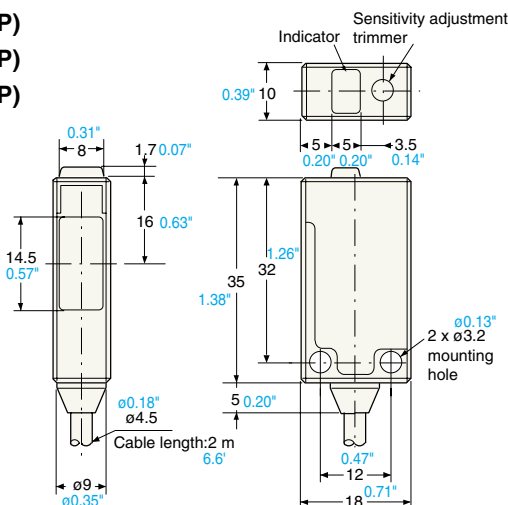| Slit width	Detecting distance	Smallest detectable object
0.5 mm 0.02"	200 mm 7.87"	0.5 x 5 mm opaque 0.02" x 0.20"
1 mm 0.04"	400 mm 15.75"	1.0 x 5 mm opaque 0.04" x 0.20"
2 mm 0.08"	700 mm 27.56"	2.0 x 5 mm opaque 0.08" x 0.20"

Self-contained Photoelectric Sensors PZ

Dimensions

▶ **CAD**

Unit: mm   Inch

Thrubeam type
PZ-51(P)

PZ-51L(P)

Diffuse-reflective, and retro-reflective types
PZ-41(P)
PZ-42(P)
PZ-61(P)
PZ-101(P)

PZ-41L(P)
PZ-42L(P)
PZ-61L(P)

Reflector
(standard for PZ-61(P)/61L(P))

R-1

Mounting bracket (standard)

Reflective tape (optional)
OP-92070
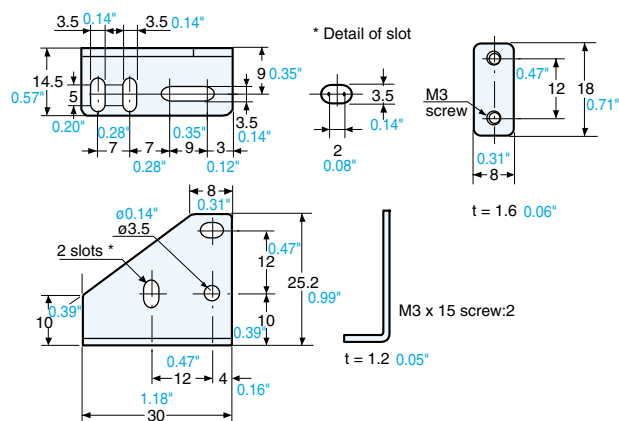
*   The thrubeam type (PZ-51/51L) also comes with a plane-symmetrical type bracket (not shown).