Warning

- **Designed for general industrial use, not for safety equipment.**
- **Do not connect this device to AC power. Doing so might cause rupture or burnout.**

Handling precautions

- Tighten the mounting screws to a maximum torque of 0.8 N·m.
- Holes for mounting brackets should be 3.5 mm in diameter or less.
- After the power is turned on, the switch starts to operate in 60 ms at most (80 ms for model HP7-C).
- For outdoor use, put inside a case, etc., To prevent direct exposure to sunlight and rain water.
- Avoid locations with strong vibration or impact. They may cause optical axis misalignment.
- Shield the lens from water and oil. Water or oil on the lens can cause faulty operation.
- Do not expose to chemicals (Organic solvents, acids, alkalis).
- Use a cover or change the mounting direction to ensure correct switch 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.
- A bend in the cable immediately after it exits the device should have a radius of a least 30 mm. Also, avoid use in which the cable receives repeated bending stress. Do not apply a force of 50 N or higher (30 N or higher for low-temperature cable types).
- Do not pull the cable with excessive force (> 50 N). cable disconnection can cause burnout. Do not apply a force of 50 N or higher (30 N or higher for low-temperature cable types).
- Photoelectric switches are assembled with precision. Never strike with another object. Especially if the lens surface is scratched or cracked, switch 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 switches are used close together, mutual interference may occur. After installation, check the operation carefully before use.
- Standard cable might get hardened under 0˚C. Do not bend or apply shock / vibration under 0˚C. Low temperature cable is available.
- Switch might not reliably detect highly reflective objects or objects that disrupt polarization (ex.: Object covered with transparent film). In such a case try the following countermeasures:
  Sample countermeasures
  - Mount the switch at an angle to the target object.
  - Increase the distance between the switch and the target object.
  - Tune the switch without a workpiece.

Wiring precautions

- If a cable extension is necessary, use wire at least 0.3 mm^2 in cross-sectional area and at most 100 m long.
- If the cable of photoelectric switch are laid in the same conduit as high-voltage or power lines, inductance may cause malfunction or damage. Isolate the photoelectric switch'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 switching 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.

Adjustment method

Thru-scan model and retroreflective model

1. Move the emitter and receiver (Main body and reflector in case of a 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. Check switch operation using a target object then use the Auto Adjust button to adjust the sensitivity setting.

Diffuse-scan model

1. Mount the photoelectric switch pointing toward the desired detection position.
2. Check switch operation using a target object then use the Auto Adjust button to adjust the sensitivity setting.

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azbil

General-Purpose Self-Contained Photoelectric Switches

Model HP7-A_/C_/D_/P_/T_

Suitable for a variety of applications and conditions.

- **Wide range of configurations and specifications**
- **Improved resistance to interference (e.g., fluorescent lights)**
- **Threaded metal mounting holes for more reliable installation**
- **Different frequency thru-scan model for stress-free installation**
- **Inexpensive, to meet current market needs**
- **Auto Adjust button for situations where detection is difficult**

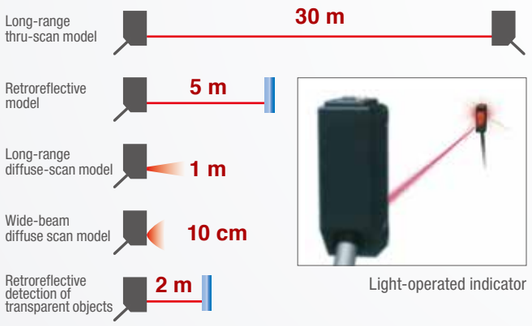
High-performance photoelectric switches suitable for a wide range of applications

Resolves installation issues!

Light axis is hard to adjust over long distances (Thru-scan and retroreflective models) **/ Unreliable detection of black (etc.) objects with low reflectance** (diffuse scan) **/ Consistent detection of transparent (etc.) objects is short-lived** (retroreflective sensor)

Simple to operate and delivers reliable detection

Long-range thru-scan models have a light-operated indicator on the front, and retroreflective models send out a visible red light beam for light axis alignment over long distances. Diffuse-scan models offer the best long-distance detection standards in the industry along with consistent detection of darker colors.



Light-operated indicator

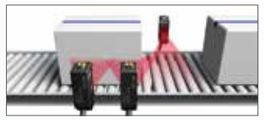
- **Interference between side-by-side switches.**
- **Need to reverse the switch configuration or move switches.**

No constraints

Thru-scan switches using different frequencies can be installed side by side without mutual interference protection filter or reversed switch orientation. (The 4 m type with its short detection range reduces malfunctions caused by mutual interference between adjacent rows of switches.) Diffuse-scan and retroreflective models are fitted with automatic interference suppression that allows two units to be used side by side.

Thru-scan models (Red, infrared): 2 switches

Thru-scan models (Red): 4 switches (Using mutual interference protection filter)



Diffuse-scan model / Retroreflective model

- **Photoelectric switches may be tripped by inverter fluorescent lights or LEDs.**
- **Reliable in various lighting**

Designed for modern lighting

New algorithms achieve major improvement in resistance to external optical interference.

*In tests conducted by the azbil Group.

- **Plastic threaded holes are not strong enough, so threads are stripped if screws are tightened too tightly or too quickly.**

Stronger mounting holes

Threaded metal mounting holes provide improved mechanical strength.
In addition to the standard brass threads, SUS304 threads are available.

SUS304 type

Designed for use in just about any environment!

- **Cutting oil mist near metalworking lines reduces switch life.**

Improved resistance to oil

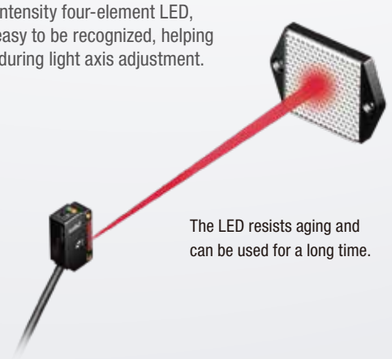
Modified polyallylate resin with excellent resistance to oil is employed (thru-scan and diffuse-scan models). Polyallylate resin lenses offer improved resistance to the effects of oils and chemicals.

*In tests conducted by the azbil Group.

- **It takes time to adjust the light axis.**
- **You can't be sure it is set correctly (it may be used for a long time).**

High-intensity red LED

Due to high-intensity four-element LED, light spot is easy to be recognized, helping to save time during light axis adjustment.



The LED resists aging and can be used for a long time.

- **Operation varies depending on who set the sensitivity.**
- **Adjusting the sensitivity takes time.**

Auto Adjust button

If there is a problem, press this button to return to stable detection.

- **Switches don't operate in freezers at –35 °C.**

Low temperature use OK

Can be used in warehouses refrigerated to -35 °C (low-temp. cord models). The operating temperature range is -35 °C to +55 °C, the widest in the industry. (low-temp. cord models)

Operation of the standard model is guaranteed down to -30 °C.

Applications

With its wide range of possible configurations, the HP7 meets a variety of detection needs.

Long-distance detection

Use to detect objects that have fallen from mobile racks or popped out of stacker cranes. The light-operated indicator on the front makes adjustment of the light axis easy.

Model HP7-T4_ Detection range: 30 m

Retroreflective models can work over long enough distances to replace thru-scan models.

Model HP7-P1_ Detection range: 5 m

High Power

Use for detection of objects passing the inlets/outlets of furnaces, where air may be thick with dust and smoke. The 30-meter detection capability makes longer service life possible.

Model HP7-T4_ Detection range: 30 m

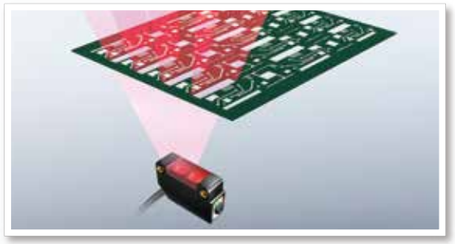
Gang-mounted switches

Use when switches need to be closely packed to judge workpiece size, etc. The combined use of standard and different-frequency switches and the mutual interference protection filter enables serial installation of multiple switches.

Model HP7-T_1 standard frequency + Model HP7-T different frequency + Model HP-U02 (Filter)

Note: This combination is for red beam models only.

Substrate detection



For use when substrate slots should not be detected. Use of a wide-beam diffuse scan model enables stable detection of substrates.

Model HP7-D2_ Detection range: 100 mm
Model HP7-D6_ Detection range: 50 mm

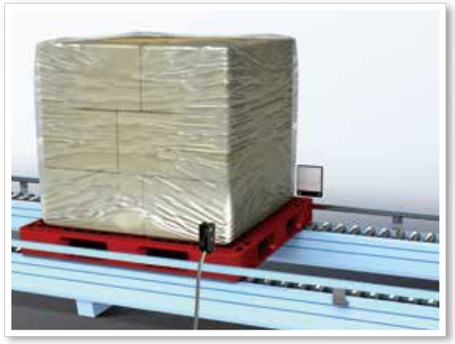
Note: Verify operation on-site with the actual target objects.

Reduction of mutual interference

Use to reduce mutual interference between adjacent lines of switches. The short detection range restricts the possibility of mutual interference.

Model HP7-T5_ Detection range: 4 m

Reduction of erroneous detection



Consistently detects film-wrapped workpieces that can fool retroreflective switches and transparent collapsible boxes that interfere with polarization.

Model HP7-P5_ Detection range: 3 m

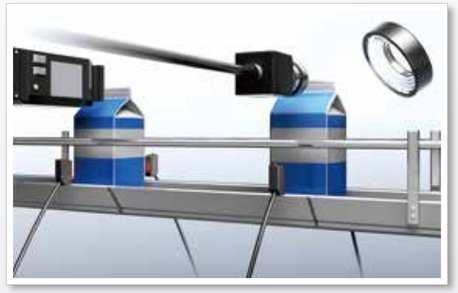
Glass detection

Use a diffuse-scan model for glass detection. Thanks to the wide beam, small inclinations do not affect detection.

Model HP7-D2_ Detection range: 100 mm

Note: Since the detection range is short in glass detection, be sure to check the detection range before use.

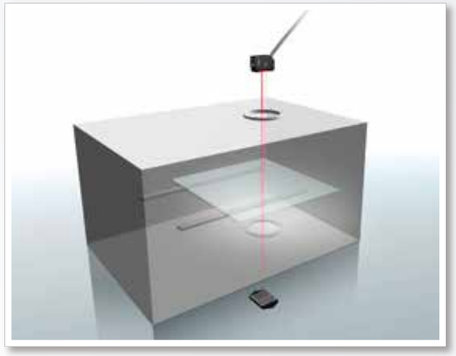
External light interference countermeasure



Use different-frequency thru-scan models to prevent false tripping of switches from image processing lighting in the printing and check processes. Different-frequency thru-scan models are especially resistant to external interference.

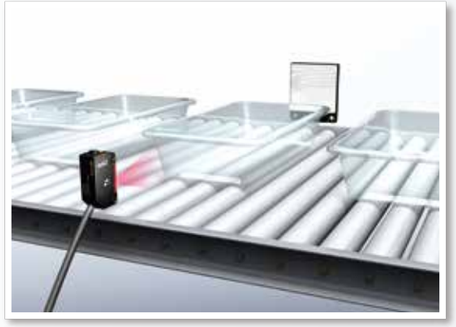
Model HP7-T__

Detection of transparent objects



Use to detect objects such as glass wafers and FPDs. Very low hysteresis ensures positive detection.

Model HP7-C3_ Detection range: 2.0 m



Use to detect transparent food containers and other transparent objects.

Model HP7-CL_ Detection range: 1 m *1
Model HP7-CN_ Detection range: 50 cm *2

*1: Installing a specially designed slit can improve consistency of detection.
*2: Model with built-in slit

Use for reliable detection of PET bottles and glass bottles. Consistent detection of any type of bottle, with or without contents.

Model HP7-CM_ Detection range: 1 m *1
Model HP7-CP_ Detection range: 50 cm *2

*1: Installing a specially designed slit can improve consistency of detection.
*2: Model with built-in slit

How to use the Auto Adjust button

If switch operation is not consistent at factory default settings, press the Auto Adjust button to adjust sensitivity automatically.

Tuning without a workpiece

In certain applications involving thru-scan and retroreflective switches, the target may not block the switch beam properly due to unwanted reflection and/or permeation of light. In some cases, diffuse-scan switches may erroneously recognize background as the target. Tuning without a workpiece is the first step in trying to resolve the problem.
Tuning without a workpiece refers to tuning with no target object present.

Thru-scan and retroreflective switches: Automatically adjusts sensitivity to trigger the switch at approximately half the intensity of the light received when there is no target object present.
Diffuse-scan switch: Automatically adjusts sensitivity to trigger the switch at approximately twice the intensity of the light received when there is no target object present.

Switch is triggered by background

Erroneously detects background as the target when operated at factory default settings (Maximum sensitivity).

Tune without a workpiece. Background information is suppressed.

Cardboard boxes are now detected consistently and reliably.

Light seeps through semi-transparent target object

Light passes through semi-transparent target objects, affecting detection consistency.

Tune without a target object.

Target is now detected correctly.

Note: For objects with high transparency, use the model HP7-C transparent object detection switch. Be sure to test it on the actual target objects.

Unwanted reflections affect detection consistency

Reflected light passes through gaps in the target object, causing detection errors.

Tune without a target object.

Palettes are now detected correctly.

Two-point tuning

Two-point tuning is used in situations where tuning without a workpiece does not achieve the required results, or where it is necessary to detect target objects at a specific location.
Sensitivity is automatically set to a value mid-way between the state when the target is present and when the target is absent.

False detection

The switch detects background objects such as the conveyor.

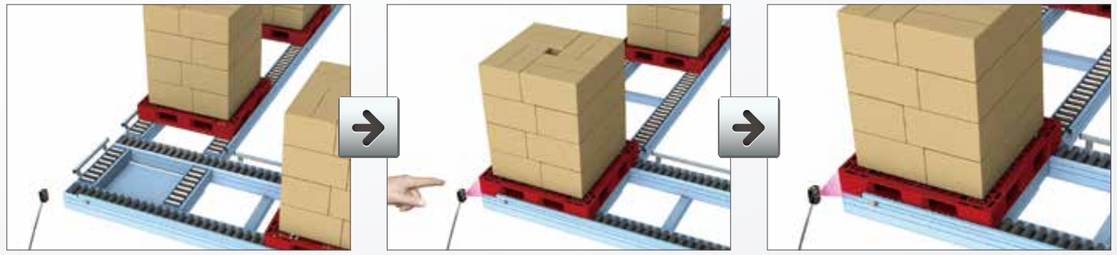
First, the switch is exposed to the no-target state.

Next, the switch is exposed to the state with a target present. The switch is now able to distinguish between the two states.

Position tuning

The switch can be adjusted to detect an object at a specific position.
The sensitivity is automatically set for detection at that position.

Detection in a specific position



The aim is to sense the target object as it reaches the designated position.

Position tuning is performed at the required position.

The switch operates around at this position. Note that the sensing distance can vary by as much as 15% from the set distance.

Catalog listings

Basic model numbers Connection: 2 m cable

Detection method / Configulation			Detection range / Light source	Catalog listing	Different-frequency model No.	Output
Thru-scan			30 m / Infrared	**HP7-T41**	**HP7-T45**	NPN
				HP7-T42	**HP7-T46**	PNP
			15 m / Red	**HP7-T11**	**HP7-T15**	NPN
				HP7-T12	**HP7-T16**	PNP
			15 m / Infrared	**HP7-T21**	**HP7-T25**	NPN
				HP7-T22	**HP7-T26**	PNP
			4 m / Red	**HP7-T51**	**HP7-T55**	NPN
				HP7-T52	**HP7-T56**	PNP
Retroreflective			5 m / Red	**HP7-P11**	–	NPN
				HP7-P12	–	PNP
			3 m / Red	**HP7-P51**	–	NPN
				HP7-P52	–	PNP
Diffuse-scan			1 m / Infrared	**HP7-A43**	–	NPN
				HP7-A44	–	PNP
			0.5 m / Red	**HP7-A13**	–	NPN
				HP7-A14	–	PNP
Wide-beam diffuse scan			100 mm / Infrared	**HP7-D23**	–	NPN
				HP7-D24	–	PNP
			50 mm / Infrared	**HP7-D63**	–	NPN
				HP7-D64	–	PNP
Retroreflective transparent object detection	Long-distance		2 m / Red	**HP7-C31S**	–	NPN
				HP7-C32S	–	PNP
	Special optics		1 m / Red	**HP7-CL1S**	–	NPN
				HP7-CL2S	–	PNP
		Improved detection	50 cm / Red	**HP7-CN1S**	–	NPN
				HP7-CN2S	–	PNP
	For PET & glass bottle detection		1 m / Infrared	**HP7-CM1S**	–	NPN
				HP7-CM2S	–	PNP
		Improved detection	50 cm / Infrared	**HP7-CP1S**	–	NPN
				HP7-CP2S	–	PNP

Note: Model HP7- T Thru-scan: Emitter model number is HP7-E and receiver model number is HP7-R.
Products with operation modes other than those specified above are also available (for example, model HP7-P13 and HP7-C33S: NPN LO).

Connection options

Model HP7 can handle cable connections.
* Model HP7-C is incompatible with low-temperature cables.

Connection Type	Model No. Suffix
0.5 m Cable	**-L005**
5 m Cable	**-L050**
M12 Preleaded Connector 30 cm Cable	**-C003**
M12 Preleaded Connector 50 cm Cable	**-C005**
M12 Preleaded Connector 1 m Cable	**-C010**
Quick Lock Preleaded Connector, 30 cm Cable	**-S003**
Quick Lock Preleaded Connector, 1m Cable	**-S010**
M8 Connector	**-T**
Low-temperature Cable 2 m	**-D**
Low-temperature Cable 5 m	**-D050**

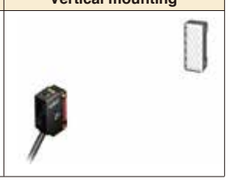
Reflector

Name	Configuration	Catalog listing	Description	Detection range by photoelectric switch (mm) (reference value) HP7-P1_	HP7-P5_	HP7-C3_S	HP7-CL_S	HP7-CM_S	HP7-CN_S	HP7-CL_S
Reflector		**FE-RR8**	47 x 47 mm	50 to 5,000	50 to 3,000	50 to 2,000	50 to 1,000	50 to 1,000	50 to 500	50 to 500
		FE-RR15	30.8 x 30.8 mm	50 to 3,300	50 to 1,600	50 to 1,000	50 to 700	50 to 750	80 to 300	20 to 450
		FE-RR17	47 x 47 mm	50 to 5,000	50 to 3,000	50 to 2,000	50 to 1,000	50 to 1,000	50 to 500	50 to 500
		FE-RR18	30.8 x 30.8 mm	50 to 3,300	50 to 1,600	50 to 1,000	50 to 700	50 to 750	80 to 300	20 to 450
		FE-RR21	37 x 56 mm	50 to 4,800	50 to 2,700	50 to 1,500	50 to 800	50 to 750	80 to 600	50 to 600
		FE-RR22	47 x 47 mm	50 to 5,000	500 to 2,000	–	–	–	–	–
		FE-RR23 *1	8.6 x 29.5 mm	Horizontal: 50 to 1,800 Vertical: 50 to 1,300	100 to 400	Horizontal: 20 to 450 Vertical: 20 to 700	Horizontal: 20 to 100 Vertical: 20 to 400	Horizontal: 20 to 100 Vertical: 20 to 400	Horizontal: 50 to 200 Vertical: 60 to 100	Horizontal: 20 to 150 Vertical: 20 to 250
		FE-RR24	22.5 x 39.2 mm	50 to 2,500	50 to 1,400	20 to 1,000	20 to 400	20 to 350	90 to 360	20 to 450
		FE-RR25	30.8 x 30.8 mm	50 to 3,300	50 to 1,600	50 to 700	50 to 550	50 to 600	80 to 480	20 to 600
		FE-RR26	30.8 x 30.8 mm	50 to 3,300	50 to 1,600	50 to 700	50 to 550	50 to 600	80 to 480	20 to 600
	Metal threads	**FE-RR27**	22.5 x 39.2 mm	50 to 2,500	50 to 1,400	20 to 1,000	20 to 400	20 to 350	90 to 360	20 to 450
	Metal threads	**FE-RR28**	30.8 x 30.8 mm	50 to 3,300	50 to 1,600	50 to 700	50 to 550	50 to 600	80 to 480	20 to 600
Reflective sheet	Use at 70 % or less of the max. detection range.	**FE-RRS01**	35 x 40 mm	100 to 1,350	150 to 1,000	80 to 1,000	180 to 600	260 to 600	–	–
		FE-RRS02	70 x 80 mm	100 to 1,500	150 to 1,100	80 to 1,400	180 to 1,100	260 to 1,100	–	–
		FE-RRSF1	200 x 305 mm (Cut to any size)	Depends on the size after cutting.						

Accessories

Name	Configuration	Catalog listing	Description	Compatible model
Standard bracket		**HP-B08**	Bottom-mounting L-bracket	**All models**
		HP-B09	Bottom-mounting L-bracket	**All models**
		HP-B10	Rear-mounting L-bracket	**All models**
Wraparound mounting bracket		**HP-B11**	Wraparound vertical mounting bracket	**All models**
		HP-B12	Wraparound horizontal mounting bracket	**All models**
Slit for thru-scan model		**HP-SV05** *2 **HP-SV10** **HP-SV20**	Vertical slit	**HP7-T_**
		HP-SH05 *2 **HP-SH10** **HP-SH20**	Horizontal slit	**HP7-T_**
Mutual interference protection filter for thru-scan model		**HP-U02** *3	Mutual interference can beprevented by changing the polarizing direction of 2 adjacent emitter-receiver pairs	**HP7-T1_/T5_**
Reflector slit for transparent object detection		**HP-SC01**	Slit for improving detection consistency	**HP7-CL_S/CM_S**

*1.

Horizontal mounting	Vertical mounting
	

*2. Scanning distance of thru-scan switch with slit.

		Catalog listing of compatible switches	
		HP7-T1_ / HP7-T2_	HP7-T5_
Slit width	Catalog listing	Scanning distance	Scanning distance
0.5 × 6.4 mm	**HP-S_05**	1.2 m	0.4 m
1.0 × 6.4 mm	**HP-S_10**	3 m	0.7 m
2.0 × 6.4 mm	**HP-S_20**	5 m	1.5 m

*3. Scanning distance of thru-scan switch with mutual interference protection filter.

	Catalog listing of compatible switches	
	HP7-T1_	HP7-T5_
Catalog listing	Scanning distance	Scanning distance
HP-U02	7 m	1.8 m

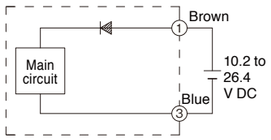
Specification

Catalog listing	NPN	HP7-P51	HP7-P11	HP7-T51	HP7-T11 (Red) HP7-T21 (Infrared)	HP7-T41	HP7-A13	HP7-A43	HP7-D23	HP7-D63	HP7-C31S	HP7-CL1S	HP7-CM1S	HP7-CN1S	HP7-CP1S
	PNP	HP7-P52	HP7-P12	HP7-T52	HP7-T12 (Red) HP7-T22 (Infrared)	HP7-T42	HP7-A14	HP7-A44	HP7-D24	HP7-D64	HP7-C32S	HP7-CL2S	HP7-CM2S	HP7-CN2S	HP7-CP2S
Detection method		Retroreflective *2		Thru-scan			Diffuse-scan				Retroreflective transparent object detection				
Power supply		10.2 to 26.4V DC (Ripple 10% max.)													
Power consumption		14 mA max.		22 mA max.	25 mA max. (Red) 30 mA max. (Infrared)	32 mA max.	14 mA max.	17 mA max.	17 mA max.		15 mA max.				
Scanning distance		3 m *7	5 m *7	4 m	15 m	30 m	0.5 m	1 m	100 mm	50 mm	0.05 to 2.0 m *7	0.05 to 1.0 m *7		0.05 to 0.5 m *7	
Target object		Opaque object 80 mm dia. min *7		Opaque object 12 mm dia. min.			Standard target object: 200 × 200 mm paper, 90 % reflectivity				Less than 85% transmittance more than 50 x 50 mm				
Differential travel		—		—			20% max. (at rated scanning distance)				—				
Operation mode		Light-operate / Dark-operate selectable by operation button													
Output mode*1		NPN open collector / PNP open collector													
Control output		Switching current: preleaded. Preleaded connector type 100 mA (Resistance load) M8 connector type and low-temperature cable type 50 mA (Resistance load) Output withstand voltage: 30 V Residual voltage: 2 V or lower (at switching current of 100 mA/50 mA), 1.1 V or less (at switching current below 10 mA)									Switching current: 50 mA or lower (Resistive load) Output withstand voltage: 30 V Residual voltage: 1 V or less				
Response time*3		1 msec		1 msec (Different frequency model: 3 ms)			1 msec				1 msec				
Light source		Red, 4 elements (Wavelength approx. 645 nm)		Red, 4 elements (Wavelength approx. 645 nm)	Red, 4 elements (Wavelength approx. 645 nm) Infrared (Wavelength approx. 860 nm)	Infrared (Wavelength approx. 860 nm)	Red, 4 elements (Wavelength approx. 645 nm)	Infrared (Wavelength approx. 860 nm)			Red, 4 elements (Wavelength approx. 645 nm)	Infrared (wavelength approx. 950 nm)	Red, 4 elements (wavelength approx. 645 nm)	Infrared (wavelength approx. 950 nm)	
Scanning angle		0.5 to 10°		2 to 20°			-				Switch: 0.5° to 10°				
Indicator		Output ON: orange indicator ON. At stable light and stable dark: green indicator Thru-scan emitter: power indicator, 30 m thru-scan receiver: light-operated indicator on front													
Ambient light immunity		Incandescent lamp: 10,000 lux max. Sunlight: 40,000 lux max. Model HP7-T_, HP7-P_, HP7-C_: Minimum angle of incidence of surrounding light = 5° Model HP7-A_: Minimum angle of incidence of surrounding light = 15° Model HP7-D_:Figures apply to indirect illumination.													
Operating temperature		-30 to + 55˚C (without freezing or condensation) *6									-10 to + 55˚C (without freezing or condensation) *6				
Storage temperature		-40 to + 70˚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, 1.5 mm peak-to-peak amplitude, 2 hours each in X, Y, and Z directions													
Shock resistance		500m/s² 10 times each in X, Y and Z directions													
Sensitivity adjustment		Operation button													
Protective structure		IP67 (IEC standard)													
Wiring method		Model HP7-_ _: preleaded 2 m, Model HP7-_-L050: preleaded 5 m, Model HP7-_-C003: M12 preleaded connector 30 cm, Model HP7-_-T: M8 connector													
Circuit protection		Error prevention circuit at power on (max. 60 ms) Full wiring error protection									Error prevention circuit at power on (max. 100 ms) Power supply reverse polarity protection, output short-circuit protection				
Interference suppression*5		Diffuse-scan, retroreflective, retroreflective transparent object detection models up to 2 units. Thru-scan models with different frequencies, up to 2 units. Thru-scan models with mutual interference prevention filter*4 (for red), up to 2 units. Different frequency models + mutual interference prevention filters (for red), up to 4 units.													

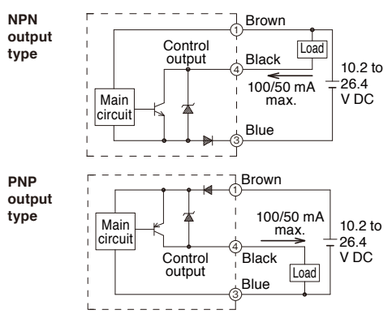
*1. An FET is used for output *2. Retroreflective switches feature polarizing filters; however, performance may be affected by highly reflective objects and objects that interfere with polarization. *3. Response time may be longer if affected by light from other switches. *4. Mutual interference protection filters are for red light source. *5. Avoid operating diffuse-scan switches head-on when using gang mounting. *6. In a low-temperature environment (0° or below), the standard cable will harden. Low temperature cables are available. Contact our branch or sales office to order. (Not available for model HP7-C__S.) *7. When used with model FE-RR17 reflector.

Output circuit diagram Note: An FET is used for output

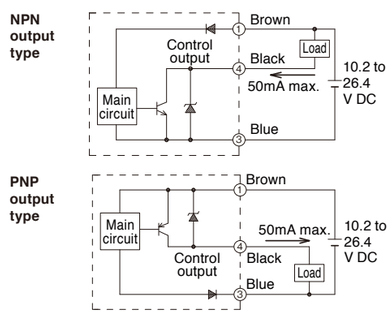
Thru-scan emitter



Polarized retroreflector model, Thru-scan receiver, Diffuse-scan mode



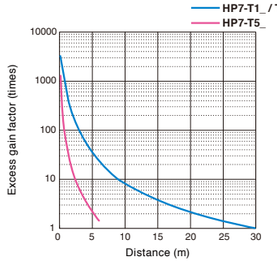
Retroreflective transparent object detection

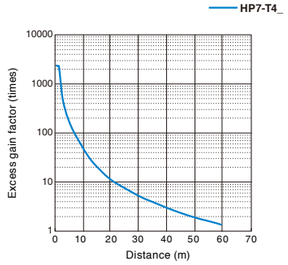


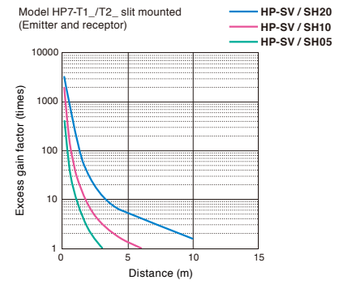
Characteristics diagrams (Typical examples)

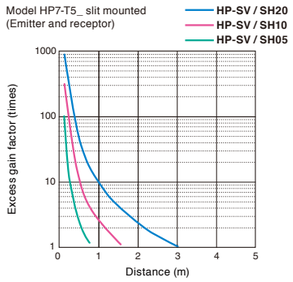
Thru-scan models (Model HP7-T1_ / T2_ / T5_)

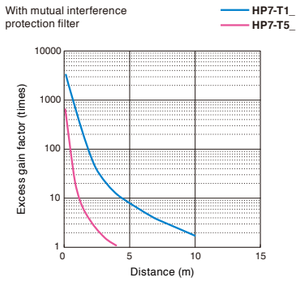
Excess gain (Light received over the required amount)



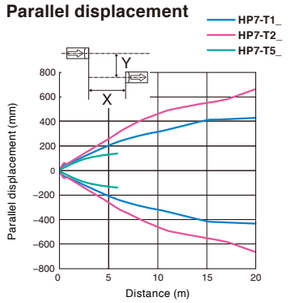


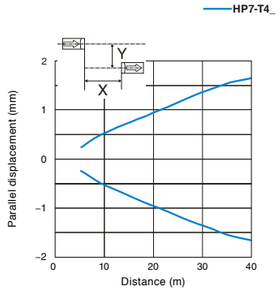


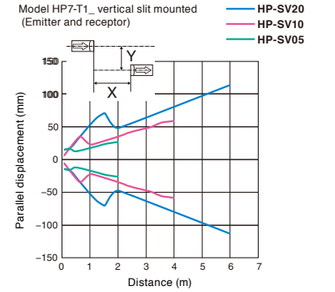


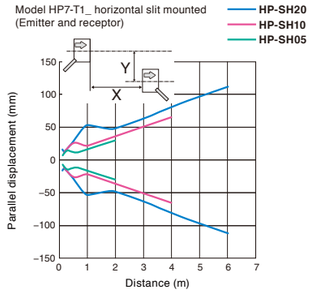


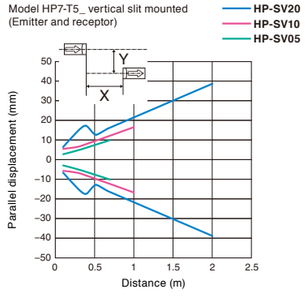
Parallel displacement

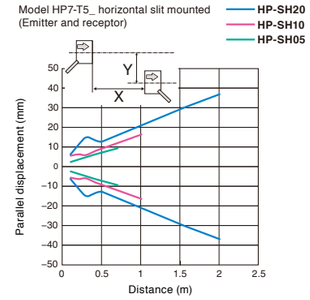


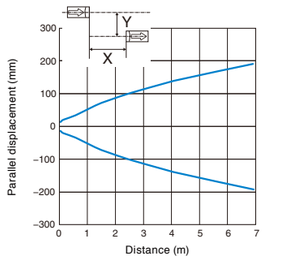


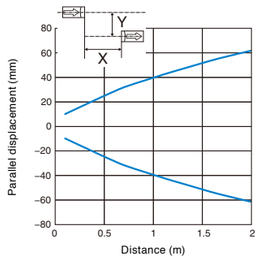










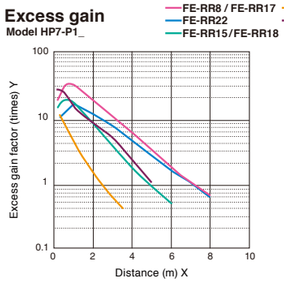


Note: The above summary of key characteristics should not be construed as a performance guarantee. Always test first under actual conditions and allow leeway as appropriate.

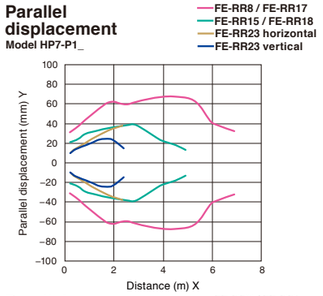
Characteristics diagrams (Typical examples)

Retroreflective models (Model HP7-P1_ / P5_)

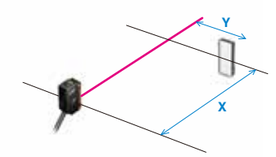
Excess gain
Model HP7-P1_



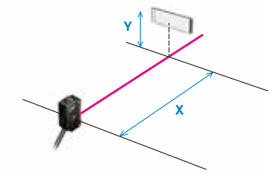
Parallel displacement
Model HP7-P1_



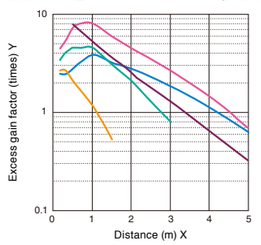
Vertically placed reflector



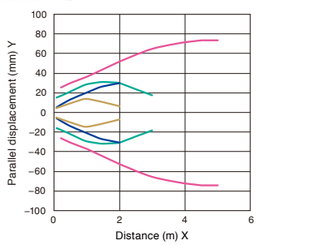
Horizontally placed reflector



Excess gain
Model HP7-P5_

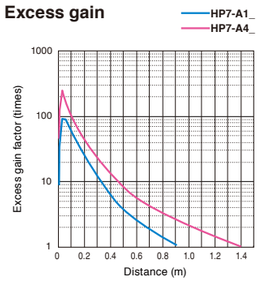


Parallel displacement
Model HP7-P5_



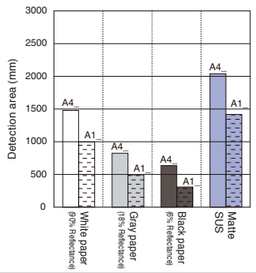
Diffuse-scan models (Model HP7-A1_ / A4_)

Excess gain

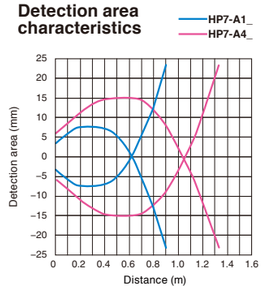


Target specifications
Model HP7-A1_ / HP7-A4_

With highly reflective backgrounds, tilting the switch may improve background suppression.

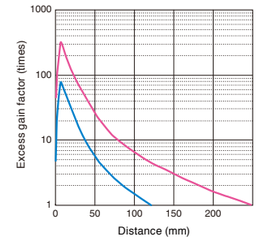


Detection area characteristics



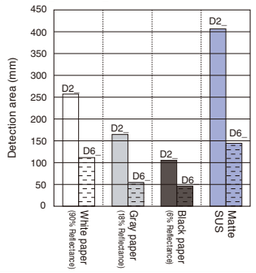
Wide-beam diffuse scan model (Model HP7-D2_ / D6_)

Wide-beam diffuse scan model

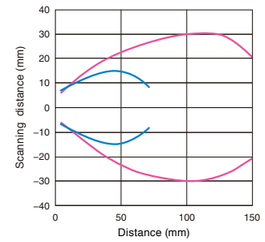


Target specifications
Model HP7-D6_ / HP7-D2_

With highly reflective backgrounds, tilting the switch may improve background suppression.

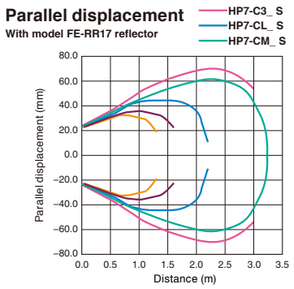


Detection area characteristics



Retroreflective transparent object detection model (Model HP7-C3_S / CL_S / CM_S)

Parallel displacement
With model FE-RR17 reflector

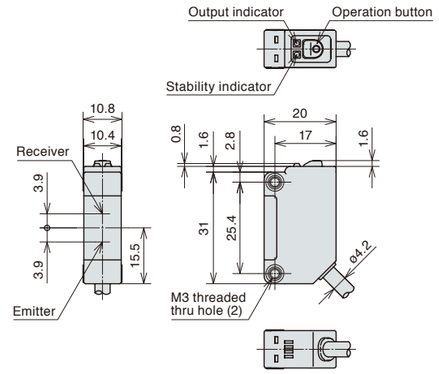


Note: The above summary of key characteristics should not be construed as a performance guarantee. Always test first under actual conditions and allow leeway as appropriate.

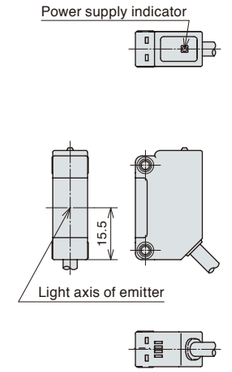
External Dimensions (Unit: mm)

Preleaded and M12 preleaded connector types

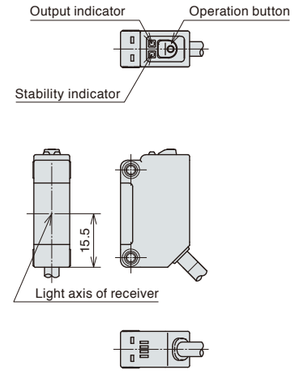
Retroreflective / Retroreflective transparent object detection model / Diffuse-scan



Thru-scan emitter

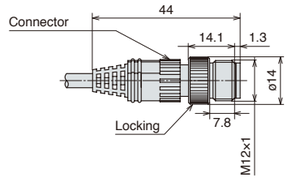


Thru-scan receiver

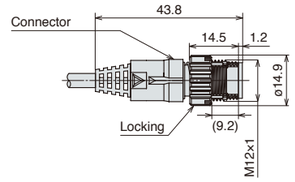


Connector part

Model HP7-_ _ _-C_ _ _
(M12 preleaded connector)

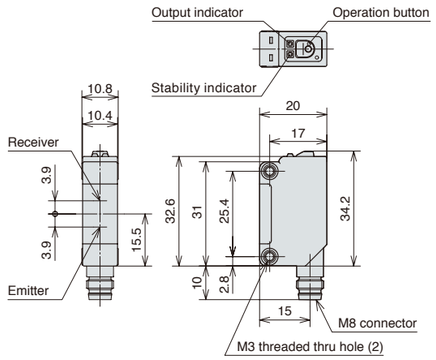


Model HP7-_ _ _-S_ _ _
(Quick Lock preleaded connector)

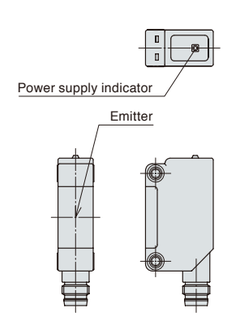


M8 connector types

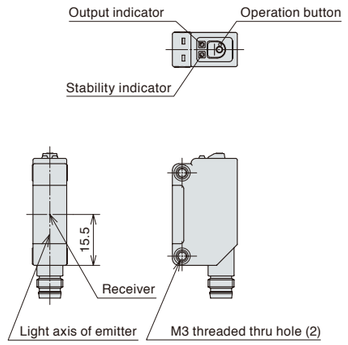
Retroreflective / Retroreflective transparent object detection model / Diffuse-scan



Thru-scan emitter



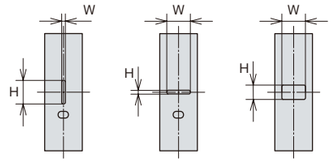
Thru-scan receiver



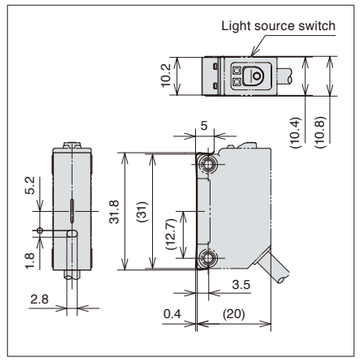
External Dimensions (Unit: mm)

Slit

Model HP-SV_ _ / **Model HP-SH_ _** / **Model HP-SC01**



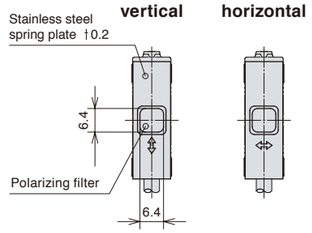
Catalog listing	Width (mm)	Height (mm)
HP-SV05	0.5	6.4
HP-SV10	1.0	6.4
HP-SV20	2.0	6.4
HP-SH05	6.4	0.5
HP-SH10	6.4	1.0
HP-SH20	6.4	2.0
HP-SC01	6.4	3.9



Filter

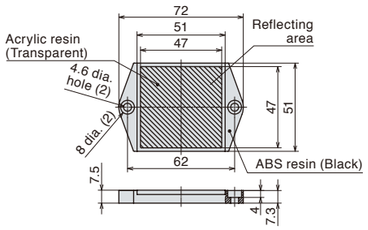
Model HP-U02

Polarizing direction: vertical / **Polarizing direction: horizontal**

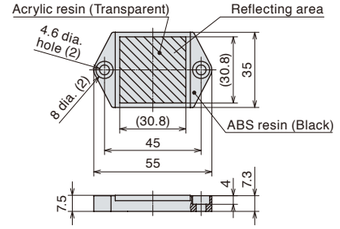


Reflector (Sold separately)

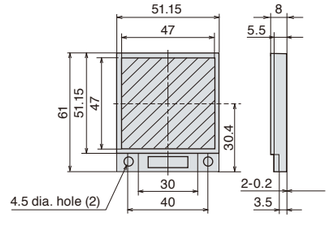
Model FE-RR8



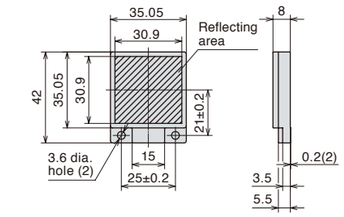
Model FE-RR15



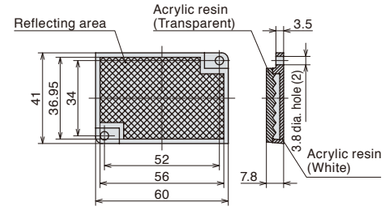
Model FE-RR17



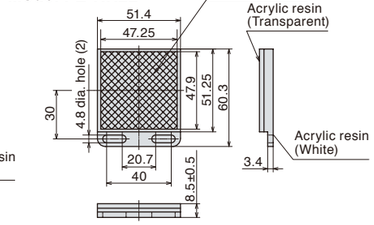
Model FE-RR18



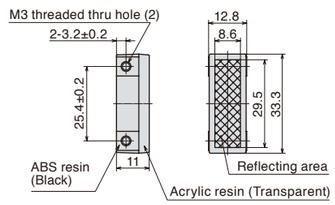
Model FE-RR21



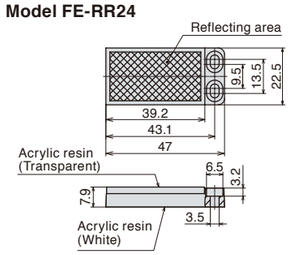
Model FE-RR22



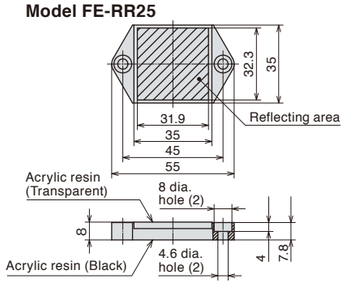
Model FE-RR23



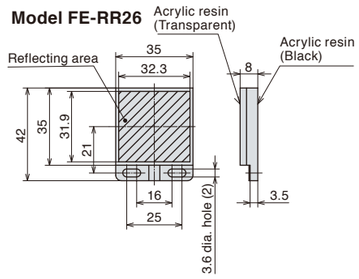
Model FE-RR24



Model FE-RR25

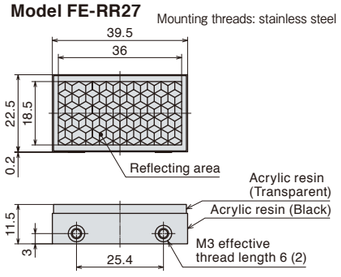


Model FE-RR26



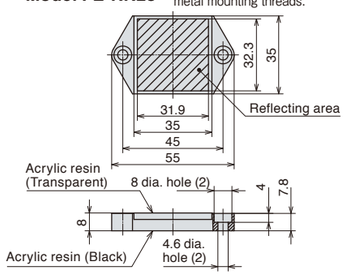
Model FE-RR27

Mounting threads: stainless steel



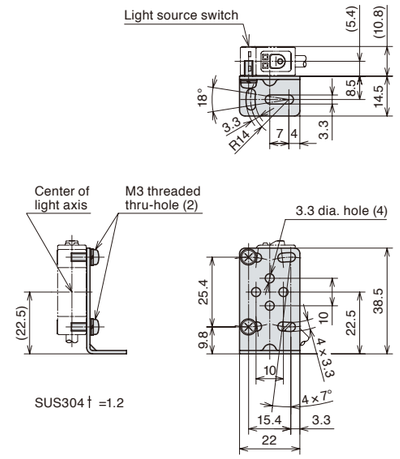
Model FE-RR28

* Identical to Model FE-RR25, but with metal mounting threads.

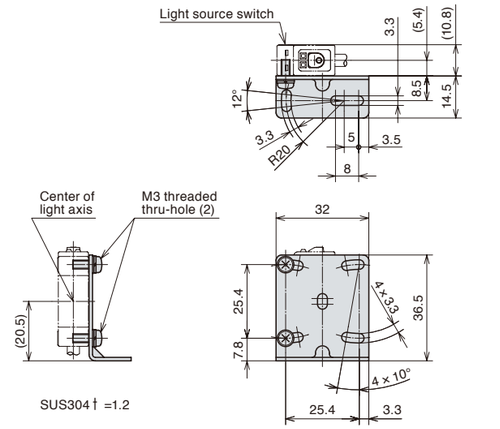


Bracket (Sold separately)

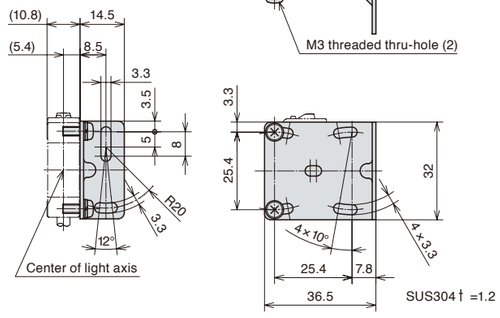
Button-mounting L-bracket (Model HP-B08)



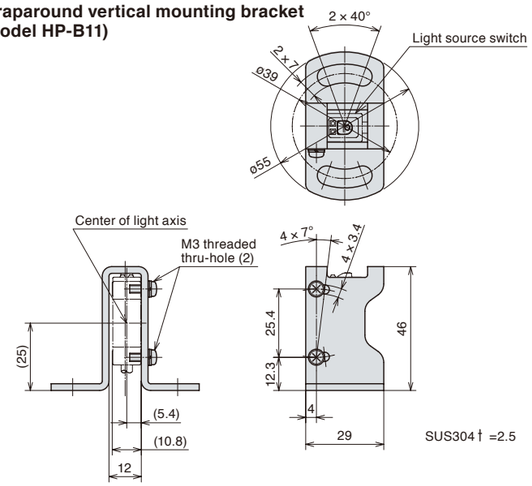
Button-mounting L-bracket (Model HP-B09)



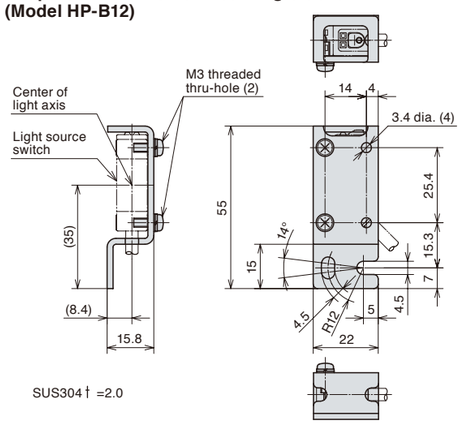
Rear-mounting L-bracket (Model HP-B10)



Wraparound vertical mounting bracket (Model HP-B11)



Wraparound horizontal mounting bracket (Model HP-B12)



The operation method

Tuning without a workpiece (recommended)

After light axis adjustment, if target objects cannot be reliably detected at the factory default sensitivity (maximum sensitivity), adjust according to the instructions below.

●Thru-scan models and retroreflective models

Adjust in the following cases. Switch sensitivity will be set automatically so that it operates at about half the light intensity as when there is no target object.

- The objects are transparent or translucent
- The objects have holes or notches
- Not enough light is blocked by target objects because light reaches the switch from the surroundings.

Model
Note: For thru-scan models, if the set scanning distance is shorter than the following amounts, light intensity may be too strong, causing the switch to enter the state described in "Indicator lamp flashes repeatedly."

Model HP7-T1_ _ _ and HP7-T2_ _ _: 1 m. Model HP7-T5_ _ _: 0.3 m.

●Diffuse-scan models

Adjust in the following cases. Switch sensitivity will be set automatically so that it operates at about twice the light intensity as when there is no target object.

- Because of light from the surroundings, the switch receives light even when there is no target object.

●Retroreflective transparent object detection models

Before adjusting, allow 3 minutes for warm-up after turning the power on.

Hold down the button for about 2 seconds until the orange indicator lamp starts flashing rapidly (at about 10 Hz), then release.

Switches to sensitivity adjustment mode.

Without a workpiece, give the button a short press. Both LEDs turn OFF.

Measures the light intensity without a target object and sets sensitivity as required.

Setup is complete
Normal operation will be restored automatically.[*1]

*1. If the indicator lamp flashes repeatedly, repeat the procedure as described under Indicator lamp flashes repeatedly.

2-point tuning

If target objects cannot be reliably detected even after tuning without a workpiece, adjust as shown below.

●Thru-scan models and retroreflective models

As a result of tuning without a workpiece, target objects do not block enough light.

●Diffuse-scan models

As a result of tuning without a workpiece, the switch does not receive enough light from target objects.

The switch will be set automatically so that it operates at a light intensity that is between the intensity with a target object and the intensity without a target object.

Hold down the button for about 2 seconds until the orange indicator lamp starts flashing rapidly (at about 10 Hz), then release.

Switches to sensitivity adjustment mode.

Without a workpiece, hold down the button until both[*2] LEDs start blinking (about 2 seconds), and release it.

Measures light intensity without a target object.

With a workpiece in place, give the button a short press.[*3]

Measures light intensity with target present and sets sensitivity.

Setup is complete
Normal operation will be restored automatically. (in about 2 seconds).[*3]

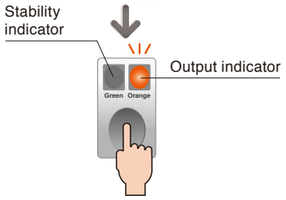
*2. It is OK to reverse the order of the two states (target present / target absent). (Excluding the model HP7-C_)
*3. If the indicator lamp flashes repeatedly, repeat the procedure as described under Indicator lamp flashes repeatedly.

LO/DO Changeover

The operating mode is set to default at the factory, but can be changed as outlined below. Light-operate changes to Dark-operate, and Dark-operate changes to Light-operate.

From Dark-operate to Light-operate	From Light-operate to Dark-operate
Normal operation	Normal operation

×5 Press the button 5 times consecutively.



Only Orange LED blinks qrapidly (about 10 Hz).

Set to Light-operate

Only Green LED blinks rapidly (about 10 Hz).

Set to Dark-operate

Setup is complete
Normal operation will be restored automatically. (in about 2 seconds).[*2]

Position tuning

For diffuse-scan detection at any desired specific position, use position tuning. (Positioning accuracy is a maximum of 15 % of the set distance.)

Model HP7-A1_: Distance between 200 mm and 500 mm
Model HP7-A4_: Distance between 200 mm and 1,000 mm

Hold down the button for about 2 seconds until the orange indicator lamp starts flashing rapidly (at about 10 Hz), then release.

Switches to sensitivity adjustment mode.

With the target in position, hold down the button for about 2 seconds until both indicator lamps start flashing rapidly (at about 10 Hz), then release.

Now press the button again briefly. Both indicator lamps will flash slowly (at about 1 Hz).[*4]

Press the button briefly.

Setup is complete
Normal operation will be restored automatically. (in about 2 seconds).

*4. If the orange light continues to flash slowly (at about 1 Hz), repeat the procedure as described under Indicator lamp flashes repeatedly.

Checking LO/DO

Use the procedure shown below to check the current operating mode.

Normal operation

×3 Press the button 3 times consecutively.

Orange LED only blinks rapidly (about 10 Hz).

Indicates Light-operate status.

Green LED only blinks rapidly (about 10 Hz).

Indicates Dark-operate status.

Checking is complete
Normal operation will be restored automatically. (in about 2 seconds).

When confused, or to restore the default setting (max. sensitivity)

If you wish to restore the factory default sensitivity, or if you lose track of your progress while making adjustments, do the following to restore the factory default from any flashing status.

Hold down the button until the green LED starts blinking (about 7 seconds).

Sensitivity is restored to the factory default setting.

Setup is complete
Normal operation will be restored automatically. (in about 2 seconds).

Indicator lamp flashes repeatedly

The table below lists the various states indicated by repeated flashing together with suggested responses. If the problem is not resolved, it may be necessary to try a different model of switch.

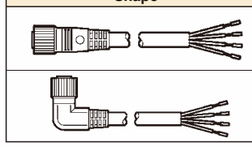
LED indicators	Status	Solution
Orange indicator flashes rapidly or both indicators flash rapidly (at about 10 Hz)	**Tuning in progress**	Hold down the button until the green indicator flashes rapidly (about 7 seconds) to restore the factory default setting (Maximum sensitivity).
Orange LED only blinks slowly. (at about 1 Hz)	**Tuning Without a tuning workpiece** Tuning failed - insufficient light	**Thru-scan and retroreflective models** Press the button once to revert to normal operation at the pre-tuning sensitivity. Adjust the light axis and then repeat the tuning procedure.
	2-point tuning Tuning failed - insufficient light at both points	Press the button once to revert to normal operation at the pre-tuning sensitivity. **Thru-scan and retroreflective models** Adjust the light axis and then repeat the tuning procedure. **Diffuse-scan models** Move the switch closer to the target to boost the reflected light intensity and then repeat the tuning procedure.
	2-point tuning Tuning failed - too much light at both points	**Thru-scan models** Press the button once to revert to normal operation at the pre-tuning sensitivity. Reduce the amount of light by using slits or tilting the optical axis, and then repeat the tuning procedure.
Both LEDs blink slowly at the same time. (at about 1 Hz)	**Tuning without workpiece** Setup is done but light intensity is too high. Stability Indicator may not light up.	Press the button once to revert to normal operation based on the tuning results. Use a workpiece to verify that the switch works properly. **Thru-scan models** Reduce the amount of light by mounting slits or tilting the optical axis, and then repeat the tuning procedure. **Diffuse-scan models** Minimize the reflected light by painting the background black, and then repeat the tuning procedure.
	Tuning without workpiece Setup is done but light intensity is too low. The switch may not operate.	**Thru-scan and retroreflective models** Press the button once to revert to normal operation based on the tuning results. Adjust the light axis and then repeat the tuning procedure.
	2-point tuning After 2-point tuning, the difference in light intensity between the two points is too small. The switch may not operate.	**Thru-scan, retroreflective, and diffuse-scan models** Press the button once to revert to normal operation based on the tuning results. Check operation before use.

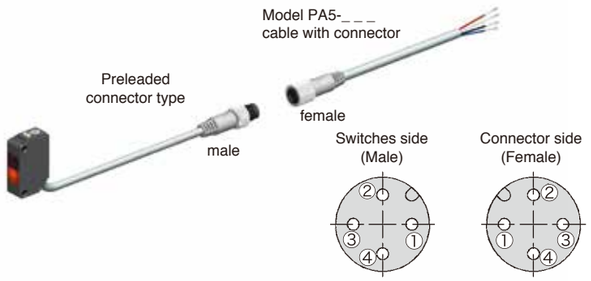
Cable with connector

Model PA5-_ _ _ cable

Be sure to use a model PA5-_ _ _ cable with connector when connecting a preleaded connector or connector-type switch.

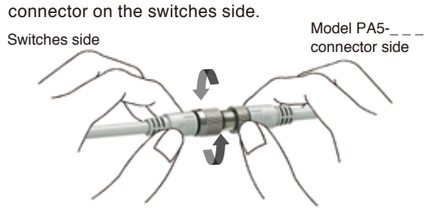
● Model PA5-_ _ _ cable with connector

Shape	Power supply	Cable properties	Cable length	Catalog	Lead colors
	DC	Vinyl-insulated cable with high resistance to oil and vibration (UL/NFPA79 CM, CL3)	2 m	**PA5-4ISX2SK**	1: brown, 2: white, 3: blue, 4: black
			5 m	**PA5-4ISX5SK**	1: brown, 2: white, 3: blue, 4: black
			2 m	**PA5-4ILX2SK**	1: brown, 2: white, 3: blue, 4: black
			5 m	**PA5-4ILX5SK**	1: brown, 2: white, 3: blue, 4: black



● Tightening the connector

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

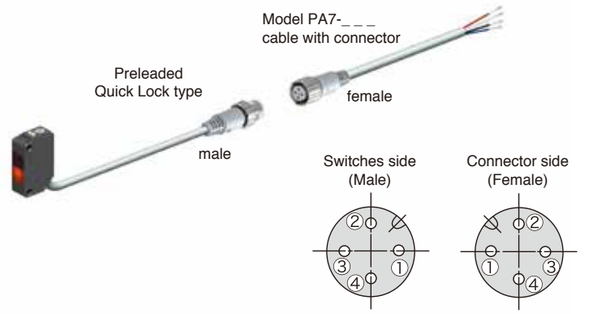


Model PA7-_ _ _ cable

Be sure to use a model PA7-_ _ _ cable with connector when connecting Preleaded Quick Lock type switch.

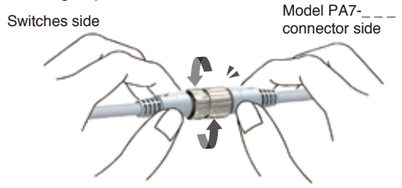
● Model PA7-_ _ _ cable with connector

Shape	Power supply	Cable properties	Cable length	Catalog	Lead colors
	DC	Vinyl-insulated cable with high resistance to oil and vibration (UL/NFPA79 CM)	2 m	**PA7-4ISX2SK**	1: brown, 2: white, 3: blue, 4: black
			5 m	**PA7-4ISX5SK**	1: brown, 2: white, 3: blue, 4: black



● Tightening the connector

Align the triangle mark and mate the male and female connector then rotate 45 degree to match the keys on the rings by hand.



Interchangeable with Smartclick made by OMRON Corporation.

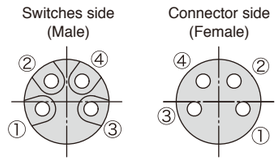
Smartclick Smartclick is trademark of OMRON Corporation.

Model PA8-_ _ _ cable

Be sure to use a model PA8 cable with connector when connecting a M8 preleaded connector or M8 connector type switch.

● Model PA8-_ _ _ cable with connectors.

Shape	Power supply	Cable properties	Cable length	Catalog	Lead colors
	DC	Vinyl-insulated cable with high resistance to oil and vibration	2 m	**PA8-4ISX2MK**	1: brown, 2: white, 3: blue, 4: black
			5 m	**PA8-4ISX5MK**	1: brown, 2: white, 3: blue, 4: black



● Tightening the connector

Align the grooves and rotate the fastening nut on the model PA8-_ _ _ connector by hand until it fits tightly with the connector on the switches side.

Retroreflective transparent object detection

Tips for using the model HP7-C retroreflective transparent object detection model

The extensive model HP7-C lineup can handle a variety of target objects and customer applications.

● Model HP7-C lineup

Sample model	Detection range *1	Beam	Overview	Features	Recommended targets
HP7-C31S	2 m	Red	Standard long-distance model	Long-distance detection capability allows flexible usage by eliminating restrictions on installation.	FPD glass substrate and transparent film
HP7-CL1S *1	1 m	Red	Special optical system	Consistent detection by significantly reducing external interference	Transparent containers (FOUP and food containers) and transparent film
HP7-CN1S	50 cm		Special optical system Improved detection	Interference due to refraction from target is greatly reduced.	
HP7-CM1S *1	1 m	Infrared	For PET & glass bottle detection	Can consistently detect any type of bottle, with or without contents	PET/glass bottles (with or without contents)
HP7-CP1S	50 cm		For PET/glass bottles Improved detection	Interference due to refraction from target is greatly reduced.	

*1 If detection is not consistent due to the shape of target objects, specially designed slits are available to improve performance.
(Model No. of special slits for HP7-CL_S and HP7-CM_S: HP-SC01)

● Recommended models for various target objects

Target	HP7-C3	HP7-CL	HP7-CM	HP7-CN	HP7-CP
Empty PET bottle	×	△	△	◎	◎
Full PET bottle	×	×	◎	×	◎
Empty glass bottle	×	△	△	◎	◎
Full glass bottle	×	×	◎	×	◎
Food container	×	○	△	◎	○
FOUP	△	◎	○	△	△
Transparent film	○	◎	○	○	○
FPD glass	◎	○	○	△	△

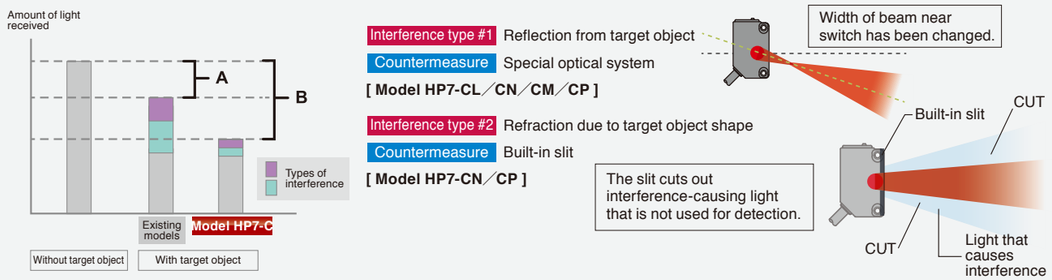
◎: Recommended product
○: Acceptable but "◎" product is better.
△: Test carefully before use.
× : Not recommended

Notes for reliable detection

- Wait 3 minutes after power on before tuning or using the switch. This allows the internal temperature to stabilize.
- If the ambient temperature varies after tuning and detection becomes unreliable, retune the switch.
- Over the course of long-term use, variations in light intensity may be caused by factors such as dirt on the switch/reflector or light axis misalignment due to vibration. Regular maintenance and cleaning will prevent such problems.

New models with improved detection: Model HP7-CL/CN/CM/CP

To detect target objects with diverse shapes and materials, HP7-C models are equipped with a special optical system and built-in slit, and users can select the optimum light source for the target object. The model HP7-C provides both top performance and ease of use.



Category	Model No.	Reflection countermeasures (special optical system)	Refraction countermeasures	Condenser lens effect countermeasures
For transparent containers	**HP7-CL**	○	× Note 1	×
	HP7-CN	○	○	×
For PET/glass bottles	**HP7-CM**	○	× Note 1	○
	HP7-CP	○	○	○

Models for PET/glass bottle detection

A PET or glass bottle filled with liquid can act as a condenser lens. As a countermeasure, these models are equipped with an LED that emits near-infrared light, which attenuates in water at a high rate. The result is attenuation of interfering light at a rate more than twice as high as with previous models.

Note 1: If detection is inconsistent due to the particular shape of the target object, specially designed slits are available to improve performance (model No. of special slits for HP7-CL_S and HP7-CM_S: HP-SC01).