No. CP-PC-2252E

azbil

# General-Purpose Self-Contained Photoelectric Sensors

# HP series

CE c UL us LISTED S* (RoHS-compliant productsavailable*)

*For details, please contact azbil sales offices or distributors.


## HP100
Reliability, plus the convenience of industry standards

## HP300
Customized to solve difficult application problems

## HP800
Designed for harsh environments

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*Specifications are subject to change without notice.*

azbil

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**Advanced Automation Company**

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URL:http://www.azbil.com/

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4th Edition: Issued in Oct.2010



(09)

General-Purpose Self-Contained Photoelectric Sensors

# HP series: a selection of 3 main models

*Customized to solve difficult application problems*

## HP300

**The HP300 is a sensor customized for the user. For problems or application needs too tough for standard HP100 functions or performance, a special HP300 product is developed using Yamatake's solutions expertise.**


*Reliability, plus the convenience of industry standards*

## HP100

**Longest scanning distance in the industry.**
**Meets global standards for photoelectric sensors.**
**Wide variety of standard functions.**

*Designed for harsh environments*

## HP800

**Doubly sealed die-cast housing, tightly sealed glass cover, rugged and oil-resistant.**

| | HP100 | | | HP300 | | | HP800 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Thru-scan | Polarized retroreflective | Diffuse-scan | Thru-scan | Polarized retroreflective | Diffuse-scan | Thru-scan | Polarized retroreflective | Diffuse-scan |
| Long scanning distance | 15 m | 5 m | 1 m | 15 m | 5 m | 1 m | 15 m | 4.5 m | 0.77 m |
| Mutual interference protection: Automatic mutual interference prevention function | | ● | ● | | ● | ● | | ● | ● |
| Mutual interference protection: Interference prevention filter | ● | | | ● | | | | | |
| Slit attachments available | ● | | | ● | | | | | |
| High resistance to coolant | | | | | | | ● | ● | ● |
| IP67 seal | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Use in cold storage warehouse to -30˚C | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Protected against inverter fluorescent light | | ● | ● | | ● | ● | | ● | ● |
| Protected against sunlight | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Light-operated indicator on front of unit | ● | | | ● | | | ● | | |
| Sensitivity adjustment | ● | ● | ● | ● | ● | ● | | | ● |
| L.O. / D.O. changeover by switch | ● | ● | ● | ● | ● | ● | | | |
| NPN / PNP dual output | | | | ▲ | ▲ | ▲ | | | |
| With M12 preleaded connector | ● | ● | ● | ▲ | ▲ | ▲ | ● | ● | ● |
| With M8 connector | ● | ● | ● | | | | | | |
| Cable length: 50 cm, 2 m and 5 m | ● | ● | ● | ▲ | ▲ | ▲ | ● | ● | ● |
| UL-listed | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| CE marking | ● | ● | ● | ● | ● | ● | ● | ● | ● |

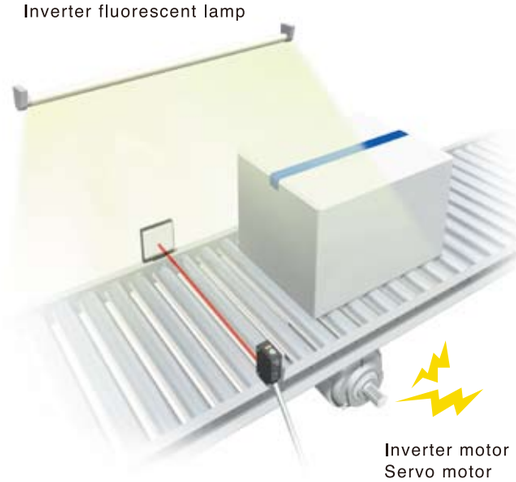
Note: ▲ indicates that some models are available. Contact Yamatake Corporation for details.

# The highest performance level in the industry

## Reliability

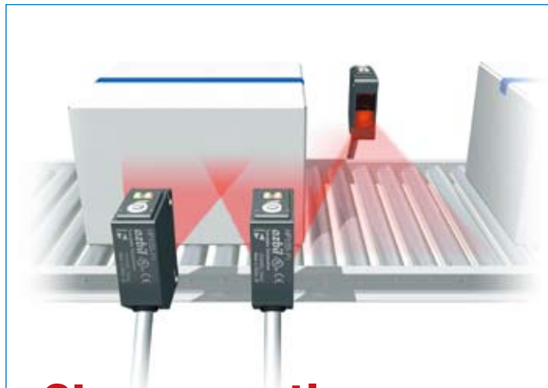
### Strong noise resistance!

**Remarkable resistance to high-frequency electrical noise from inverter/servo motors, and to high-frequency ambient light from inverter fluorescent lamps.**




### Strong resistance to interference!

**Automatic mutual interference prevention function enables close mounting of 2 units.**
**Note: For the thru-scan model, an interference prevention filter is used.**




### Strong resistance to temperature!

**Guaranteed performance in harsh environments such as cold storage warehouse (-30℃) or heat treatment equipment (+60℃).**


Cold storage warehouse


Heat treatment equipment

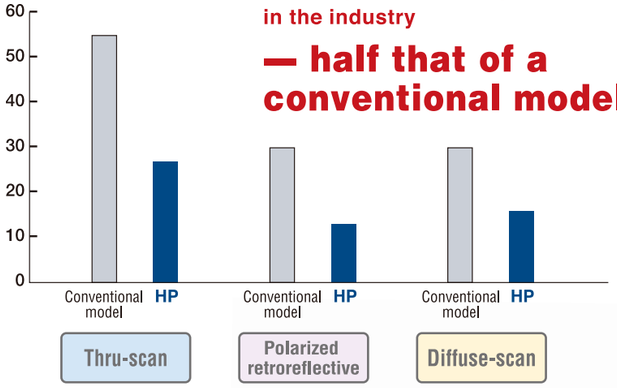


## Energy savings

### Low power consumption

**Lowest power consumption in the industry**

**— half that of a conventional model**




### Reduced wiring work

**All models have an M12 preleaded connector (and M8 connector for HP100 only) for easy wiring and maintenance.**

*62 connector-type models in total*

**M12 preleaded connector**
**HP100 / HP800**


**M8 connector**
**HP100**

## Long range

### Longest scanning distance in the industry!

**The HP100 retroreflective model has a scanning range of 5m, the longest in the industry, and it performs well in locations difficult for conventional models. Its polarization system effectively counters reflection from mirrorlike objects.**


A polarizing filter is used to eliminate reflections from mirrorlike objects. If the target object itself is highly reflective or interferes with polarization, detection might be inconsistent. For details, see handling precautions on page 29.

### Light-operated indicator in front

**The HP100 thru-scan receiver has a light-operated indicator in front, allowing a single operator to align the light axis at a distance up to 15 m from the emitter.**

General-Purpose Self-Contained Photoelectric Sensors

# HP100

CE c UL us LISTED S* (RoHS-compliant productsavailable*)

*For details, please contact azbil sales offices or distributors.

## Industrial standard compact size

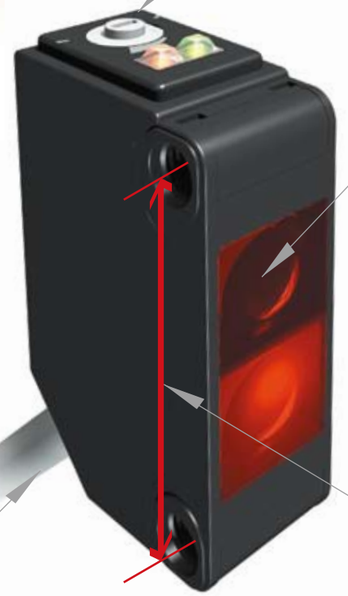
**Strong resistance to sunlight and inverter fluorescent light**

**One-piece molded housing with IP67 seal**

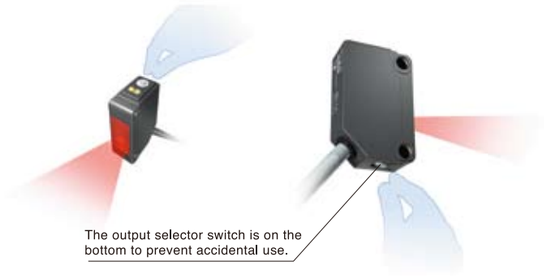
**Strong resistance to motor noise**

**Mutual interference prevention function allows close mounting**

**No damage from any wiring reversal error**

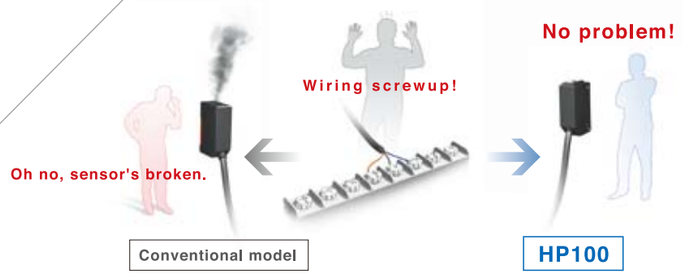


**Switch location prevents operator error.**




**Light-operated indicator in front allows operator to check sensor operation at distance of 15 m.**

**Industry standard 1-inch (25.4 mm) mounting centers**




### Choice of 3 cable lengths

50 cm
2 m
5 m

### Choice of three M12 preleaded connectors and one M8 connector

30 cm
50 cm
1 m

### 4 bracket types

- **HP100-B01** Bottom-mounting L-bracket (material: SUS)
- **HP100-B04** Rear-mounting L-bracket (material: SUS)
- **HP100-B02** Wraparound vertical mounting bracket (material: SUS)
- **HP100-B03** Wraparound horizontal mounting bracket (material: SUS)

### 6 reflector types (for polarized retroreflective)

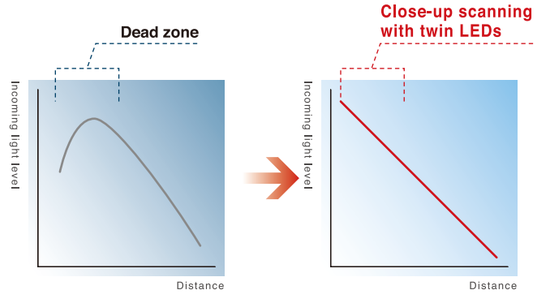
- **FE-RR21** (Scanning distance 5 m) Reflector size 37 mm x 56 mm
- **FE-RR8** (Scanning distance 5 m) Reflector size 47 mm x 47 mm
- **FE-RR17** (Scanning distance 5 m) Reflector size 47 mm x 47 mm
- **FE-RR15** (Scanning distance 3.5 m) Reflector size 30.8 mm x 30.8 mm
- **FE-RR18** (Scanning distance 3.5 m) Reflector size 30.8 mm x 30.8 mm
- **FE-RR20** (Scanning distance 2 m) Reflector size 8.6 mm x 29.5 mm

### 8 slit attachment types (for thru-scan)

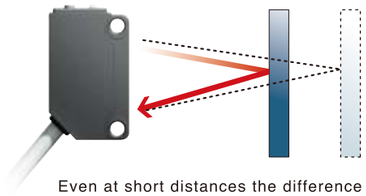
| | |
|---|---|
| **HP100-SV05/ SV10/SV15/SV20** | Vertical slit (0.5 mm/1 mm/ 1.5 mm/2 mm) |
| **HP100-SH05/ SH10/SH15/SH20** | Horizontal slit (0.5 mm/1 mm/ 1.5 mm/2 mm) |

## Close-up capabilities of diffuse scan model

**Reliable detection at short distances**



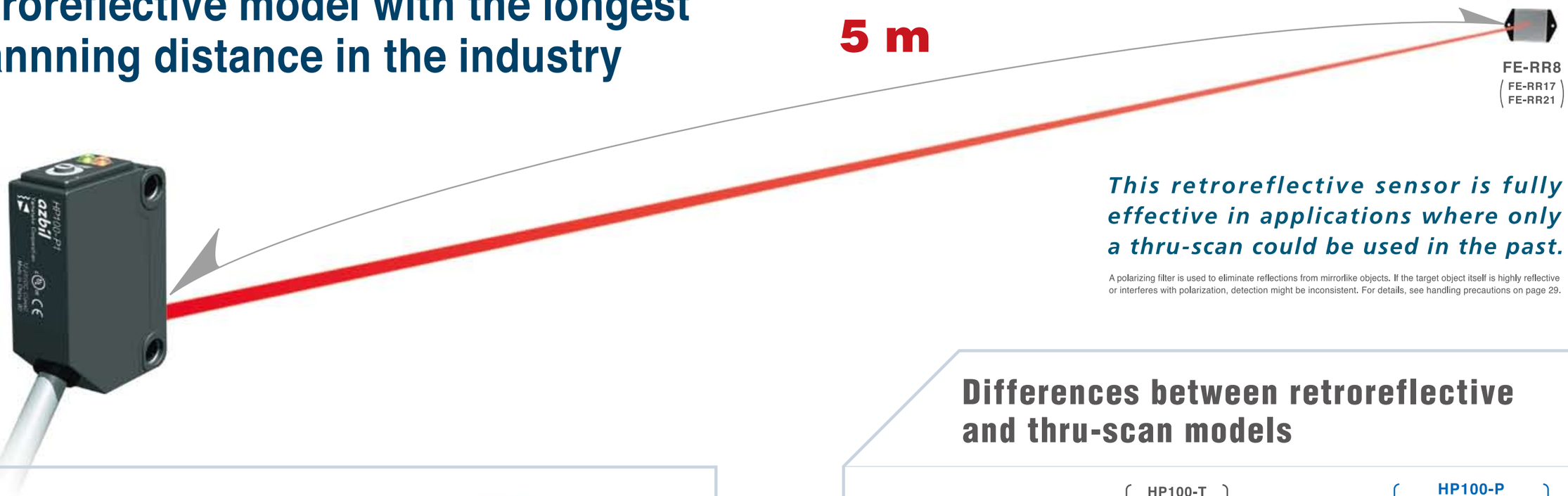

Conventional model — HP100-A



Even at short distances the difference in light level is sufficient to differentiate the positions.

**Position detection based on difference in scanning distance**

# Retroreflective model with the longest scannning distance in the industry



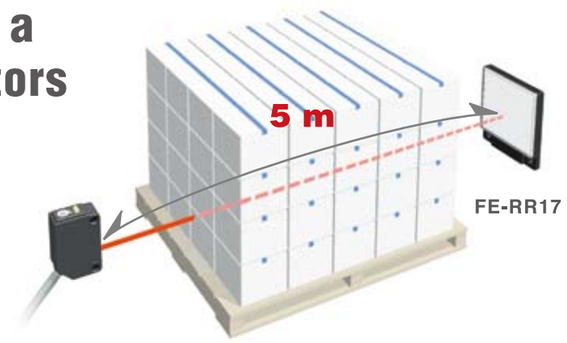

***This retroreflective sensor is fully effective in applications where only a thru-scan could be used in the past.***

A polarizing filter is used to eliminate reflections from mirrorlike objects. If the target object itself is highly reflective or interferes with polarization, detection might be inconsistent. For details, see handling precautions on page 29.

## Can be combined with a wide variety of reflectors

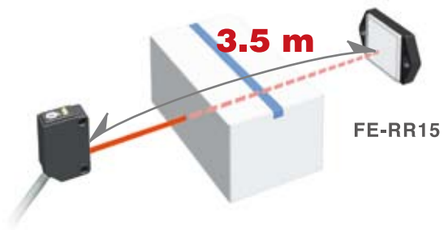
**Long distance** FE-RR8、FE-RR17、FE-RR21

Detection of a large palette or automobile



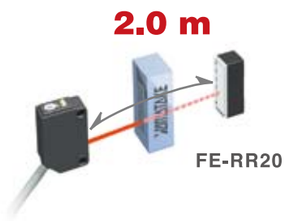

**Compact** FE-RR15、FE-RR18

Detection of a bucket or carton



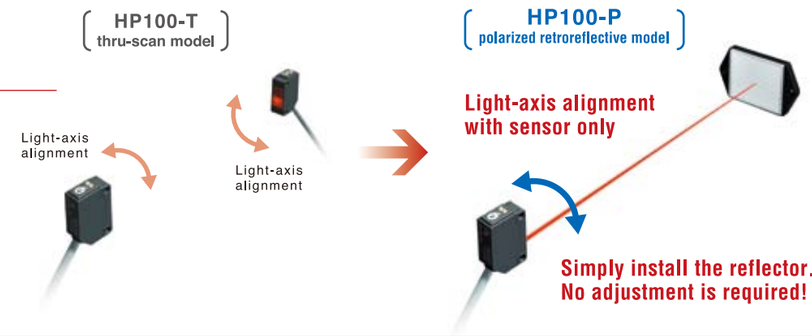

**Ultra-compact size** FE-RR20

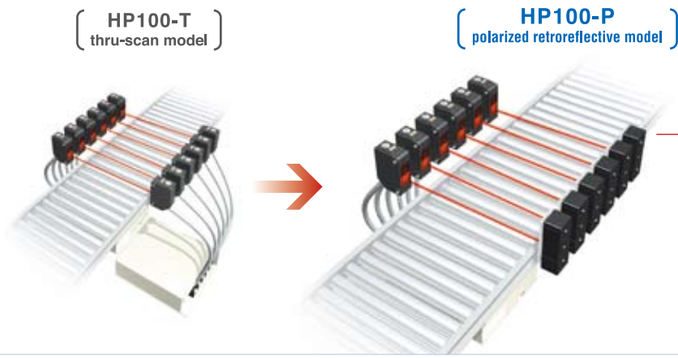
Small-object detection with a reflector the same size as the thru-scan sensor!




## Differences between retroreflective and thru-scan models

Half the light-axis alignment work




Half the wiring work

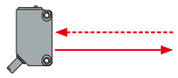
Optimal for locations where a unit on one side cannot be wired

Half the power consumption

60 W (2.5A) of electricity will power:

- **45** conventional thru-scan models
- **92** HP100 thru-scan models
- **192** HP100 retroreflective models

## Catalog listings

| Detection method | Scanning distance | Configuration | L-ON/D-ON selection | Sensitivity adjustment | Wiring method | Cable length | Power supply | Output mode | Catalog listing |
|---|---|---|---|---|---|---|---|---|---|
| Thru-scan | **15 m** |  | ● | ● | Preleaded | 2 m | 10 to 30V DC | NPN open collector | **HP100-T1** |
| | | | ● | ● | | 5 m | | | **HP100-T1-L05** |
| | | | ● | ● | | 50 cm | | | **HP100-T1-LP5** |
| | | | ● | ● | M12 preleaded connector | 30 cm | | | **HP100-T1-CN03** |
| | | | ● | ● | | 50 cm | | | **HP100-T1-CN05** |
| | | | ● | ● | | 1 m | | | **HP100-T1-CN1** |
| | | | ● | ● | M8 connector | | | | **HP100-T1-CT** |
| | | | ● | ● | Preleaded | 2 m | | PNP open collector | **HP100-T2** |
| | | | ● | ● | | 5 m | | | **HP100-T2-L05** |
| | | | ● | ● | | 50 cm | | | **HP100-T2-LP5** |
| | | | ● | ● | M12 preleaded connector | 30 cm | | | **HP100-T2-CN03** |
| | | | ● | ● | | 50 cm | | | **HP100-T2-CN05** |
| | | | ● | ● | | 1 m | | | **HP100-T2-CN1** |
| | | | ● | ● | M8 connector | | | | **HP100-T2-CT** |
| Polarized retroreflective | **5 m** (when used with **FE-RR8 or FE-RR17 or FE-RR21**) |  | ● | ● | Preleaded | 2 m | | NPN open collector | **HP100-P1** |
| | | | ● | ● | | 5 m | | | **HP100-P1-L05** |
| | | | ● | ● | | 50 cm | | | **HP100-P1-LP5** |
| | | | ● | ● | M12 preleaded connector | 30 cm | | | **HP100-P1-CN03** |
| | | | ● | ● | | 50 cm | | | **HP100-P1-CN05** |
| | | | ● | ● | | 1 m | | | **HP100-P1-CN1** |
| | | | ● | ● | M8 connector | | | | **HP100-P1-CT** |
| | | | ● | ● | Preleaded | 2 m | | PNP open collector | **HP100-P2** |
| | | | ● | ● | | 5 m | | | **HP100-P2-L05** |
| | | | ● | ● | | 50 cm | | | **HP100-P2-LP5** |
| | | | ● | ● | M12 preleaded connector | 30 cm | | | **HP100-P2-CN03** |
| | | | ● | ● | | 50 cm | | | **HP100-P2-CN05** |
| | | | ● | ● | | 1 m | | | **HP100-P2-CN1** |
| | | | ● | ● | M8 connector | | | | **HP100-P2-CT** |
| Diffuse -scan | **1 m** |  | ● | ● | Preleaded | 2 m | | NPN open collector | **HP100-A1** |
| | | | ● | ● | | 5 m | | | **HP100-A1-L05** |
| | | | ● | ● | | 50 cm | | | **HP100-A1-LP5** |
| | | | ● | ● | M12 preleaded connector | 30 cm | | | **HP100-A1-CN03** |
| | | | ● | ● | | 50 cm | | | **HP100-A1-CN05** |
| | | | ● | ● | | 1 m | | | **HP100-A1-CN1** |
| | | | ● | ● | M8 connector | | | | **HP100-A1-CT** |
| | | | ● | ● | Preleaded | 2 m | | PNP open collector | **HP100-A2** |
| | | | ● | ● | | 5 m | | | **HP100-A2-L05** |
| | | | ● | ● | | 50 cm | | | **HP100-A2-LP5** |
| | | | ● | ● | M12 preleaded connector | 30 cm | | | **HP100-A2-CN03** |
| | | | ● | ● | | 50 cm | | | **HP100-A2-CN05** |
| | | | ● | ● | | 1 m | | | **HP100-A2-CN1** |
| | | | ● | ● | M8 connector | | | | **HP100-A2-CT** |

## Accessories

| Name | Configuration | Description | Catalog listing | Compatible model |
|---|---|---|---|---|
| Reflector for polarized retroreflective model |  | Reflector size 37 mm x 56 mm | **FE-RR21** (Scanning distance 5 m) | **HP100-P□** |
| |  | Reflector size 47 mm x 47 mm | **FE-RR8** (Scanning distance 5 m) | **HP100-P□** |
| |  | Reflector size 47 mm x 47 mm | **FE-RR17** (Scanning distance 5 m) | **HP100-P□** |
| |  | Reflector size 30.8 mm x 30.8 mm | **FE-RR15** (Scanning distance 3.5 m) | **HP100-P□** |
| |  | Reflector size 30.8 mm x 30.8 mm | **FE-RR18** (Scanning distance 3.5 m) | **HP100-P□** |
| |  | Reflector size 8.6 mm x 29.5 mm | **FE-RR20** (Scanning distance 2 m) | **HP100-P□** |
| Standard bracket |  | For **HP100/HP300** Bottom-mounting L-bracket (material: SUS) | **HP100-B01** | All models |
| |  | For **HP100/HP300** Rear-mounting L-bracket (material: SUS) | **HP100-B04** | All models |
| |  | For **HP100/HP300** Bottom-mounting L-bracket (8 mm mounting holes, SUS, angle adjustable by 10°) | **HP100-B07** | All models |
| |  | For **HP100/HP300** Rear-mounting L-bracket (8 mm mounting holes, SUS, angle adjustable by 10°) | **HP100-B06** | All models |
| Wraparound mounting bracket |  | For **HP100/HP300** Wraparound vertical mounting bracket (material: SUS) | **HP100-B02** | All models |
| |  | For **HP100/HP300** Wraparound horizontal mounting bracket (material: SUS) | **HP100-B03** | All models |
| Slit for thru-scan model |  | For **HP100/HP300** Vertical slit (0.5 mm/1 mm/ 1.5 mm/2 mm) | **HP100-SV05 / SV10 / SV15 / SV20** | **HP100-T□** |
| |  | For **HP100/HP300** Horizontal slit (0.5 mm/1 mm/ 1.5 mm/2 mm) | **HP100-SH05 / SH10 / SH15 / SH20** | **HP100-T□** |
| Mutual interference protection filter for thru-scan model |  | For **HP100/HP300** Mutual interference can beprevented by changing thepolarizing direction of 2 adjacent emitter-receiver pairs | **HP100-U01** | **HP100-T□** |

## Specifications

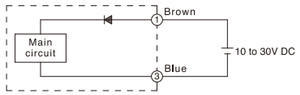
| | | | | | | |
|---|---|---|---|---|---|---|
| Catalog listing | **HP100-P1** | **HP100-P2** | **HP100-T1** | **HP100-T2** | **HP100-A1** | **HP100-A2** |
| Detection method | Polarized retroreflective*2 | | Thru-scan | | Diffuse-scan | |
| Power supply | 10 to 30V DC (ripple 10% max.) | | | | | |
| Power consumption | 13 mA max. | | **HP100-E1**: 16 mA max., **HP100-R□**: 11 mA max. | | 16 mA max. | |
| Scanning distance | 0.05 to 5 m (with **FE-RR8**, **FE-RR17**, or **FE-RR21** reflector) | | 15 m | | 1 m | |
| Target object | Opaque object 80 mm dia. min (with **FE-RR8**, **FE-RR17**, or **FE-RR21** reflector) | | Opaque object 9 mm dia. min. | | —— | |
| Standard target object | —— | | —— | | 300 x 300 mm white paper (Kodak 90% reflective paper) | |
| Scanning angle | Body: 0.5 to 10°. Reflector: 30° min. | | 2 to 20° | | —— | |
| Differential travel | —— | | —— | | 20% max. (at rated scanning distance) | |
| Operation mode | Light-ON / Dark-ON selectable by switch | | | | | |
| Output mode*1 | **HP100-□1**: NPN open collector , **HP100-□2**: PNP open collector | | | | | |
| Control output | Switching current: 100 mA (resistive load). Output dielectric strength: 30V. Voltage drop: 3V max. (at 100 mA switching current). Short-circuit protection. | | | | | |
| Response time | 500 μs max. for both operation and recovery | | | | | |
| Emitter | Red LED | | Red LED | | Infrared LED | |
| Indicator | Indicators other than thru-scan emitter: orange when output ON, and green at stable light-ON and light-OFF. Thru-scan emitter: orange light on power supply indicator. Thru-scan receiver: light-operated red indicator on front of unit. | | | | | |
| 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) | | | | | |
| Storage temperature | -40 to +70°C (without freezing or condensation) | | | | | |
| Insulation resistance | 20 MΩ min. (at 500V DC) | | | | | |
| Dielectric strength | 1,000Vac 50/60Hz for one minute between electrically live metal and case | | | | | |
| Vibration resistance | 10 to 55 Hz, 1.5 mm peak-to-peak amplitude, 2 hours each in X, Y, and Z directions | | | | | |
| Shock resistance | 500 m/s² 10 times each in X, Y and Z directions | | | | | |
| Protective structure | IP67 (IEC standard) | | | | | |
| Wiring method | **HP100-□□-LP5**: preleaded (0.5 m), **HP100-□□**: preleaded (2 m), **HP100-□□-L05**: preleaded (5 m), **HP100-□□-CN03**: M12 preleaded connector (0.3 m), **HP100-□□-CN05**: M12 preleaded connector (0.5 m), **HP100-□□-CN1**: M12 preleaded connector (1 m), **HP100-□□-CT**: M8 connector | | | | | |
| Weight | Approx. 55 g (body with 2 m cable only) | | | | | |
| Circuit protection | Power ON malfunction prevention circuit (approx. 8 ms), wiring error protection | | | | | |

*1. An FET is used for output

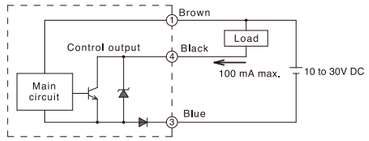
*2. If a polarized retroreflective model is used to detect highly reflective objects or objects that interfere with polarization, detection might be inconsistent. For details, see the handling precautions on page 30.

## Output circuit diagram (Note that a FET is used for output)

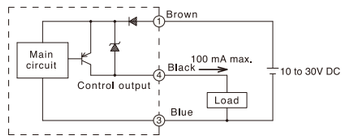
### ●Thru-scan emitter




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

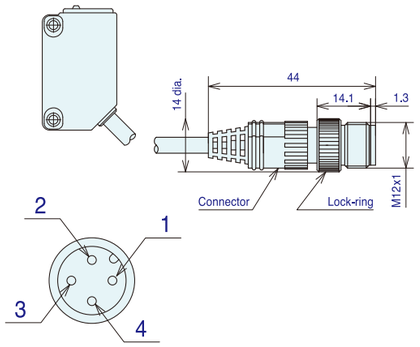



### ● (PNP output type)
**Polarized retroreflector model**
**Thru-scan receiver**
**Diffuse-scan model**

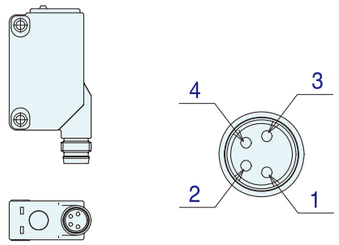



## External dimensions/Contact arrangement

### ●M12 preleaded connector




### ●M8 connector

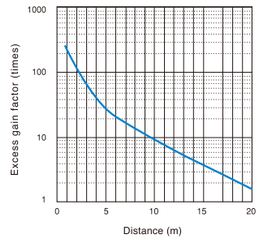




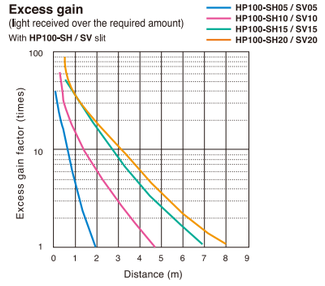

## Characteristics diagrams (typical examples)

### ■Thru-scan models (HP100-T□)

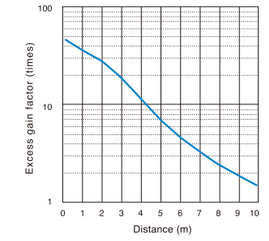
**Excess gain**
(light received over the required amount)



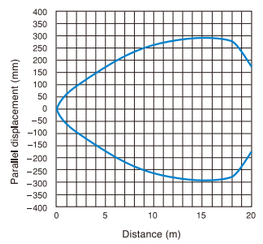

**Excess gain**
(light received over the required amount)
With **HP100-SH / SV** slit




**Excess gain**
(light received over the required amount)
With **HP-100-U01** mutual interference prevention filter

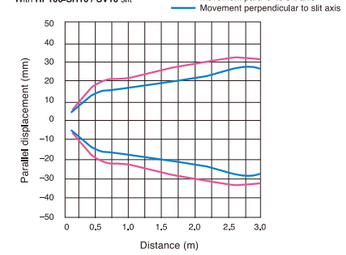



**Parallel displacement**

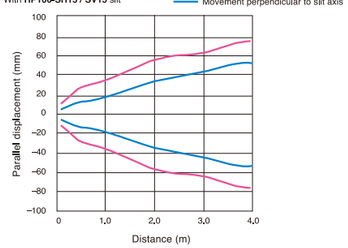



**Parallel displacement**
With **HP100-SH05 / SV05** slit

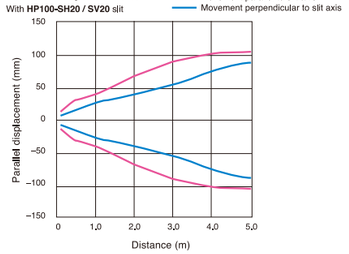

**Parallel displacement**
With **HP100-SH10 / SV10** slit



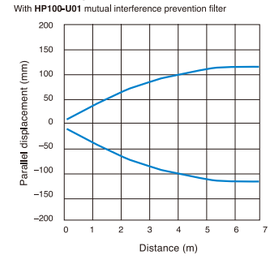

**Parallel displacement**
With **HP100-SH15 / SV15** slit




**Parallel displacement**
With **HP100-SH20 / SV20** slit

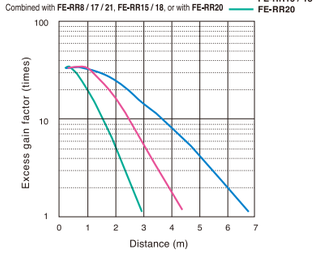



**Parallel displacement**
With **HP100-U01** mutual interference prevention filter

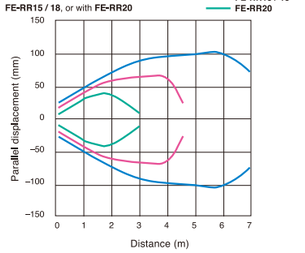



### ■Polarized retroreflective models (HP100-P□)

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

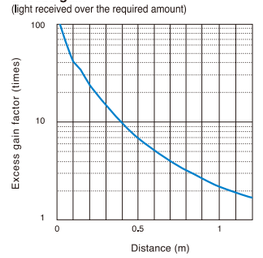



**Parallel displacement**
Combined with **FE-RR8 / 17 / 21**, **FE-RR15 / 18**, or with **FE-RR20**

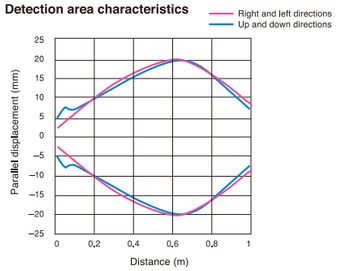



### ■Diffuse-scan models (HP100-A□)

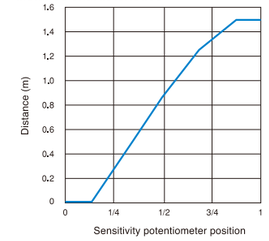
**Excess gain**
(light received over the required amount)




**Detection area characteristics**



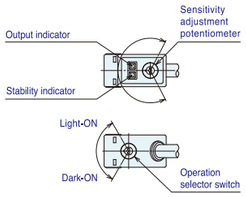

**Potentiometer angle vs. scanning distance characteristics**

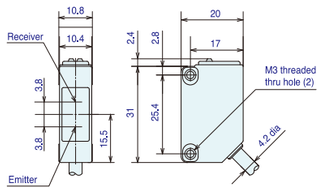


## External Dimensions (Unit: mm)

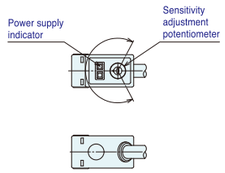
### ■Preleaded and M12 preleaded connector types

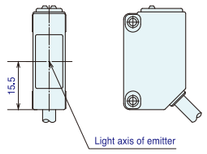
#### ●HP100-P/HP100-A



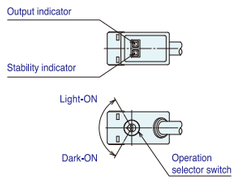



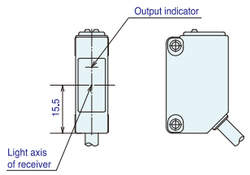

#### ●HP100-T (emitter: HP100-E1)



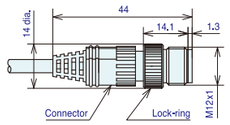




#### ●HP100-T (receiver: HP100-R)



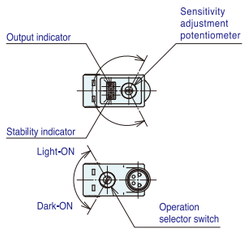



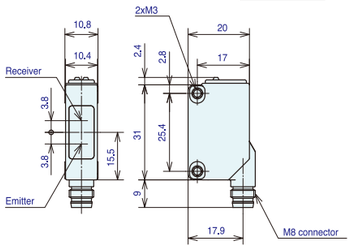

#### ●Connector (common)



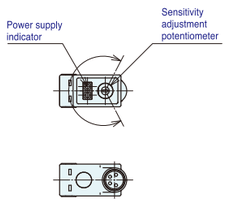

### ■M8 connector types

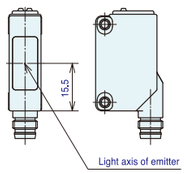
#### ●HP100-P□-CT/HP100-A□-CT



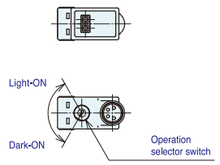



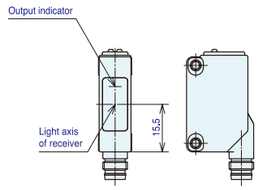

#### ●HP100-T□-CT (emitter: HP100-E1-CT)



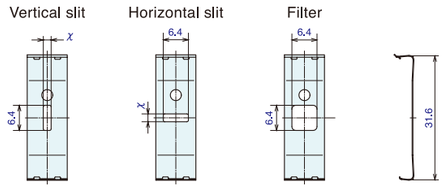




#### ●HP100-T□-CT (receiver: HP100-R□-CT)




### ■Slit and filter




**Scanning distance with slit on thru-scan model**

| Slit width | Type | Catalog listings | Scanning distance | Catalog listing of a model used with |
|---|---|---|---|---|
| 0.5x6.4 mm | Vertical | **HP100-SV05** | 1.2 m | **HP100-T□** |
| | Horizontal | **HP100-SH05** | | |
| 1.0x6.4 mm | Vertical | **HP100-SV10** | 3 m | |
| | Horizontal | **HP100-SH10** | | |
| 1.5x6.4 mm | Vertical | **HP100-SV15** | 4 m | |
| | Horizontal | **HP100-SH15** | | |
| 2.0x6.4 mm | Vertical | **HP100-SV20** | 5 m | |
| | Horizontal | **HP100-SH20** | | |

Note: Data assumes slit is mounted on both emitter and receiver.

**Scanning distance when mutual interference prevention filter is mounted on thru-scan model**

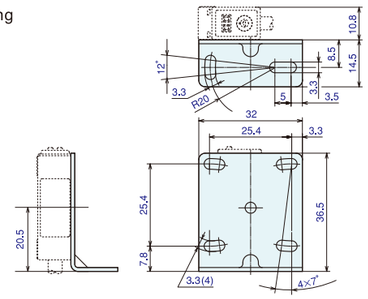
| Catalog listings | Scanning distance | Catalog listing ofa model used with |
|---|---|---|
| **HP100-U01** | 7 m | **HP100-T□** |



### ■Bracket (sold separately)

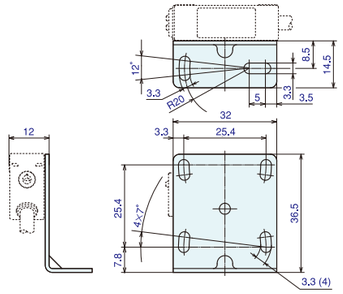
Bottom-mounting L-bracket (**HP100-B01**)

material: 1,2 mm thick SUS



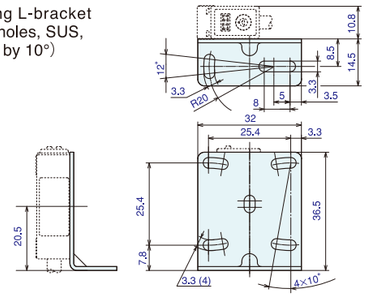

Rear-mounting L-bracket (**HP100-B04**)

material: 1,2 mm thick SUS



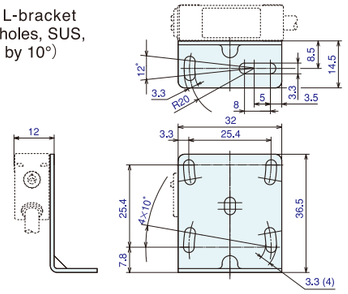

Bottom-mounting L-bracket (8mm mounting holes, SUS, angle adjustable by 10°) (**HP100-B07**)

material: 1,2 mm thick SUS



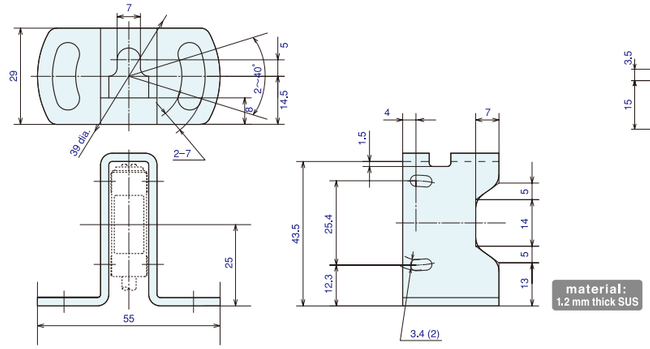

Rear-mounting L-bracket (8mm mounting holes, SUS, angle adjustable by 10°) (**HP100-B06**)

material: 1,2 mm thick SUS



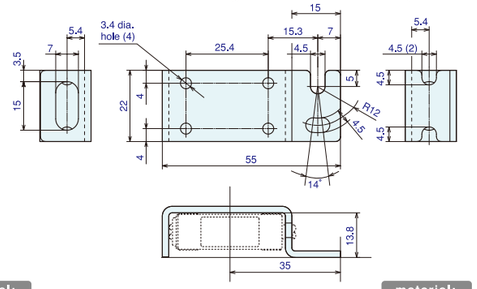

Wraparound vertical mounting bracket (**HP100-B02**)

material: 1.2 mm thick SUS



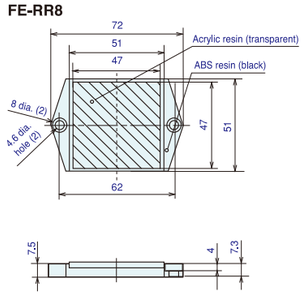

Wraparound horizontal mounting bracket (**HP100-B03**)

material: 1.2 mm thick SUS

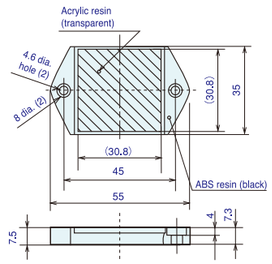



### ■Reflector (sold separately)

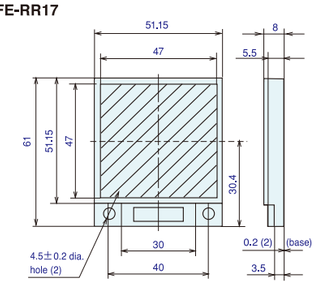
**FE-RR8**



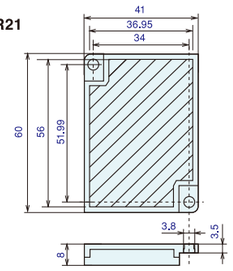

**FE-RR15**



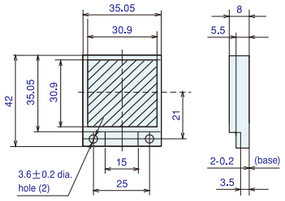

**FE-RR17**



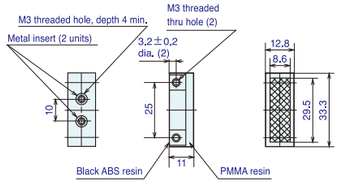

**FE-RR21**




**FE-RR18**




**FE-RR20**



Photoelectric Sensors Customized for Problem Solution

# HP300

CE c UL us LISTED (S) (RoHS-compliant productsavailable*)

*For details, please contact azbil sales offices or distributors.

## Customized to solve difficult application problems

**HP300** Series sensors are customized to users' needs,
for problems too tough or unusual for the **HP100** Series.
Developed to meet your application needs,
using Yamatake's solutions expertise.


**Contact Yamatake Corporation in case of applications where the HP100 Series cannot be used.**

## The HP300 Series:

**Yamatake delivers solutions by developing customized products for particular work site issues, based on the HP100 Series of general-purpose self-contained photoelectric sensors.**

### *Are you faced with any of these problems?*

- Tightly mounted thru-scan sensors interfere with each other, and a filter doesn't help.
- An advance operation check is needed to prevent error due to dust or dirt.
- Chattering may occur during detection, depending on the target object condition.
- A diffuse-scan model sometimes fails to detect a target object that has a hole or notch.
- A diffuse-scan sensor is needed but is unreliable if the scanning distance is too short.
- The use of both NPN and PNP models requires too much troublesome maintenance.
- Seasonal fogging of the lens surface causes operational error.
- Cables become disconnected from sensors mounted on moving units.

### *The HP300 Series can solve your application problems!*

**Yamatake's HP300 Series engineers listen to users' issues and discuss possible customized product solutions.**

**Models listed below are now available.**

LINEUP

| Type | Scanning distance | Configuration | L-ON/D-ON selection | Sensitivity adjustment | Wiring method | Cable length | Power supply | Output mode | Catalog listing |
|---|---|---|---|---|---|---|---|---|---|
| Short-range diffuse-scan | 200 mm | | ● | ● | Preleaded | 2 m | 10 to 30V DC | NPN open collector | HP300-S1 |
| | | | ● | ● | | | | PNP open collector | HP300-S2 |
| Thru-scan and remote emitter control | 15 m | | ● | ● | | | | NPN open collector | HP300-T1-003 |
| Wide-beam diffuse-scan | 100 mm | | ● | ● | | | | NPN open collector | HP300-D1 |
| | | | ● | ● | | | | PNP open collector | HP300-D2 |
| Wide-beam diffuse-scan | 50 mm | | ● | ● | | | | NPN open collector | HP300-DA1 |
| | | | | | | | | PNP open collector | HP300-DA2 |
| NPN-PNP dual output thru-scan | 15 m | | ● | ● | Preleaded connector | 30 cm | 10 to 26.4V DC | NPN-PNP dual output | HP300-T3-CN03 |
| NPN-PNP dual output polarized retroreflective | 0.05 to 5 m | | ● | ● | | | | | HP300-P3-CN03 |
| NPN-PNP dual output diffuse-scan | 1 m | | ● | ● | | | | | HP300-A3-CN03 |
| Background suppression | 20 to 200 mm | | | ● | Preleaded | 2 m | 10 to 30V DC | NPN open collector | HP350-G1L |
| | | | | ● | | | | PNP open collector | HP350-G2L |

Note: Brochures by model number are available. Contact Yamatake Corporation for more information.

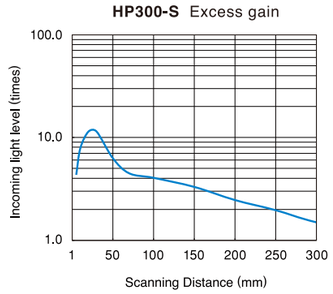
# HP300 Series Product introduction

## Short-range diffuse-scan HP300-S1/HP300-S2

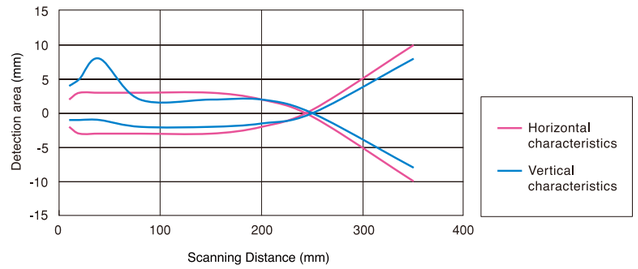
- Twin emitter LEDs enable stable detection at close sensing range.
- Mutual interference prevention function allows side-by-side installation.

### Characteristics diagram (typical examples)

● Excess gain




● Detection area characteristics



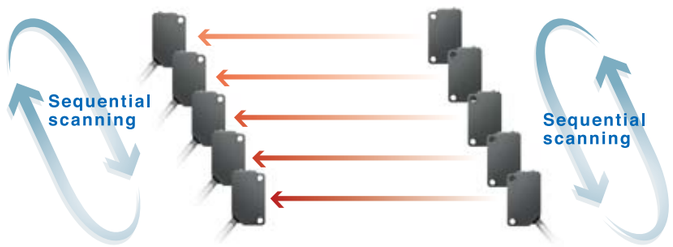

## Thru-scan emitter control input function HP300-T1-003

- Long range sensing—up to 15m
- Emitter on-off control by remote input
- Light-operated indicator in front allows a single operator to align the light axis.

### Application

● Mutual interference prevention for gang mounting of multiple sensors

Mounting multiple thru-scan sensors in a small area might create mutual interference. Using emitter control input to operate one emitter at a time, and checking the output status of the corresponding receiver, enables close mounting without interference and with no limit on the number of units.




● External diagnostics by remote input

When operation begins, the operator can check the condition of the sensors by using emitter control input and checking the output of the receivers.

● For interlock signal transmitter (1 bit optical transmitter)

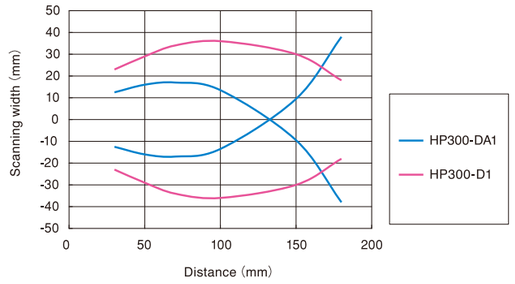
By using emitter control input, the HP300-T1-003 can be used as a 1-bit optical transmitter between AGV and station.

## Extra wide-beam diffuse-scan (for PCB detection) HP300-D1/HP300-D2
## Wide-beam diffuse scan (for PCB detection) HP300-DA1/HP300-DA2

- The beam of the HP300-D is 7 times wider than a regular diffuse scan beam, allowing detection of targets of various shapes.
- High gain enables detection of low-reflectivity objects.

### Characteristics diagram (typical examples)

● Detection area characteristics (Horizontal characteristics)




### Application

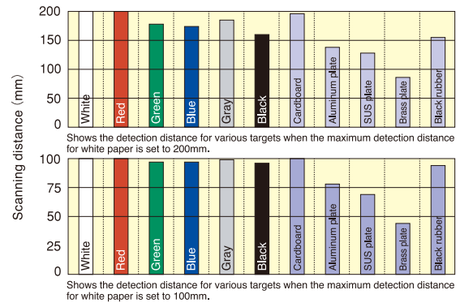
● Detection of PCBs having holes or slots

## Background suppression HP350-G Series

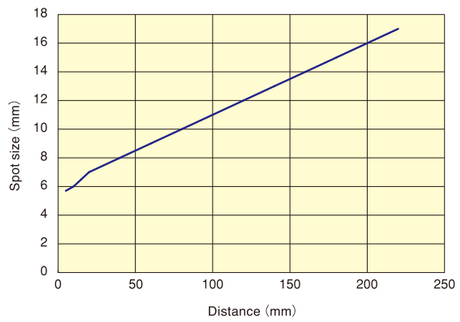
- Distance-based detection
- Reduced influence from background metal such as aluminum or stainless steel
- Reduced influence from color variation of target objects
- Visible red light for easier alignment
- Smaller hysteresis for detecting differences in thickness
- Click-action potentiometer turns 6 full revolutions for high-resolution setting

### Characteristics diagram (typical examples)

Detection distance for various target object types




Spot lens size vs. distance



Photoelectric Sensors for Harsh Environments

# HP800

CE c UL us LISTED

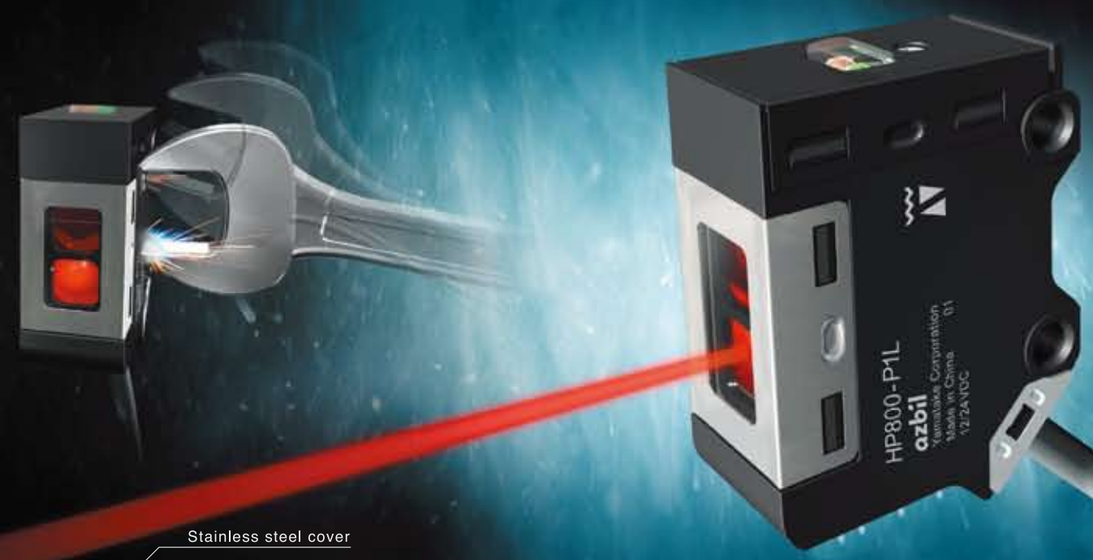
RoHS-compliant productsavailable*

*For details, please contact azbil sales offices or distributors.

## Designed for harsh environments

**Rugged:** Die-cast housing

**Rugged:** Shock resistant to 1000 m/s²





**Oil resistant:** Glass lens cover

**Oil resistant:** Stainless steel cover

**Oil resistant:** Fluorine coating

**Oil resistant:** special sealing, IP67g

**Oil resistant:** special cable

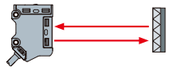
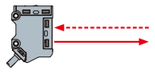

## About oil resistance

- 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 (mm²/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) |

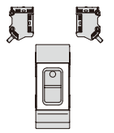
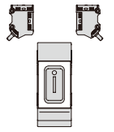
Note: The three types of cutting oil are made by Yushiro Chemical Industry Co., Ltd.

## 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 | **15 m** |  | ● | | | Preleaded | 2 m | 10 to 30V DC | NPN open collector | **HP800-T1L** |
| | | | | ● | | | | | | **HP800-T1D** |
| | | | ● | | | | 5 m | | | **HP800-T1L-L05** |
| | | | | ● | | | | | | **HP800-T1D-L05** |
| | | | ● | | | | 50 cm | | | **HP800-T1L-LP5** |
| | | | | ● | | | | | | **HP800-T1D-LP5** |
| | | | ● | | | Preleaded connector | 30 cm | | | **HP800-T1L-CN03** |
| | | | | ● | | | | | | **HP800-T1D-CN03** |
| | | | ● | | | | 50 cm | | | **HP800-T1L-CN05** |
| | | | | ● | | | | | | **HP800-T1D-CN05** |
| | | | ● | | | | 1 m | | | **HP800-T1L-CN1** |
| | | | | ● | | | | | | **HP800-T1D-CN1** |
| | | | ● | | | Preleaded | 2 m | | PNP open collector | **HP800-T2L** |
| | | | | ● | | | | | | **HP800-T2D** |
| | | | ● | | | | 5 m | | | **HP800-T2L-L05** |
| | | | | ● | | | | | | **HP800-T2D-L05** |
| | | | ● | | | | 50 cm | | | **HP800-T2L-LP5** |
| | | | | ● | | | | | | **HP800-T2D-LP5** |
| | | | ● | | | Preleaded connector | 30 cm | | | **HP800-T2L-CN03** |
| | | | | ● | | | | | | **HP800-T2D-CN03** |
| | | | ● | | | | 50 cm | | | **HP800-T2L-CN05** |
| | | | | ● | | | | | | **HP800-T2D-CN05** |
| | | | ● | | | | 1 m | | | **HP800-T2L-CN1** |
| | | | | ● | | | | | | **HP800-T2D-CN1** |
| Polarized retroreflective | **4.5 m** (when used with **FE-RR8** or **FE-RR17** or **FE-RR21**) |  | ● | | | Preleaded | 2 m | | NPN open collector | **HP800-P1L** |
| | | | | ● | | | | | | **HP800-P1D** |
| | | | ● | | | | 5 m | | | **HP800-P1L-L05** |
| | | | | ● | | | | | | **HP800-P1D-L05** |
| | | | ● | | | | 50 cm | | | **HP800-P1L-LP5** |
| | | | | ● | | | | | | **HP800-P1D-LP5** |
| | | | ● | | | Preleaded connector | 30 cm | | | **HP800-P1L-CN03** |
| | | | | ● | | | | | | **HP800-P1D-CN03** |
| | | | ● | | | | 50 cm | | | **HP800-P1L-CN05** |
| | | | | ● | | | | | | **HP800-P1D-CN05** |
| | | | ● | | | | 1 m | | | **HP800-P1L-CN1** |
| | | | | ● | | | | | | **HP800-P1D-CN1** |
| | | | ● | | | Preleaded | 2 m | | PNP open collector | **HP800-P2L** |
| | | | | ● | | | | | | **HP800-P2D** |
| | | | ● | | | | 5 m | | | **HP800-P2L-L05** |
| | | | | ● | | | | | | **HP800-P2D-L05** |
| | | | ● | | | | 50 cm | | | **HP800-P2L-LP5** |
| | | | | ● | | | | | | **HP800-P2D-LP5** |
| | | | ● | | | Preleaded connector | 30 cm | | | **HP800-P2L-CN03** |
| | | | | ● | | | | | | **HP800-P2D-CN03** |
| | | | ● | | | | 50 cm | | | **HP800-P2L-CN05** |
| | | | | ● | | | | | | **HP800-P2D-CN05** |
| | | | ● | | | | 1 m | | | **HP800-P2L-CN1** |
| | | | | ● | | | | | | **HP800-P2D-CN1** |
| Diffuse -scan | **770 mm** |  | ● | | ● | Preleaded | 2 m | | NPN open collector | **HP800-A1L** |
| | | | | ● | ● | | | | | **HP800-A1D** |
| | | | ● | | ● | | 5 m | | | **HP800-A1L-L05** |
| | | | | ● | ● | | | | | **HP800-A1D-L05** |
| | | | ● | | ● | | 50 cm | | | **HP800-A1L-LP5** |
| | | | | ● | ● | | | | | **HP800-A1D-LP5** |
| | | | ● | | ● | Preleaded connector | 30 cm | | | **HP800-A1L-CN03** |
| | | | | ● | ● | | | | | **HP800-A1D-CN03** |
| | | | ● | | ● | | 50 cm | | | **HP800-A1L-CN05** |
| | | | | ● | ● | | | | | **HP800-A1D-CN05** |
| | | | ● | | ● | | 1 m | | | **HP800-A1L-CN1** |
| | | | | ● | ● | | | | | **HP800-A1D-CN1** |
| | | | ● | | ● | Preleaded | 2 m | | PNP open collector | **HP800-A2L** |
| | | | | ● | ● | | | | | **HP800-A2D** |
| | | | ● | | ● | | 5 m | | | **HP800-A2L-L05** |
| | | | | ● | ● | | | | | **HP800-A2D-L05** |
| | | | ● | | ● | | 50 cm | | | **HP800-A2L-LP5** |
| | | | | ● | ● | | | | | **HP800-A2D-LP5** |
| | | | ● | | ● | Preleaded connector | 30 cm | | | **HP800-A2L-CN03** |
| | | | | ● | ● | | | | | **HP800-A2D-CN03** |
| | | | ● | | ● | | 50 cm | | | **HP800-A2L-CN05** |
| | | | | ● | ● | | | | | **HP800-A2D-CN05** |
| | | | ● | | ● | | 1 m | | | **HP800-A2L-CN1** |
| | | | | ● | ● | | | | | **HP800-A2D-CN1** |

## Accessories

| Name | Configuration | Description | Catalog listing | Compatible model |
|---|---|---|---|---|
| Reflector for polarized retroreflective model |  | Reflector size 37 mm x 56 mm | **FE-RR21** (Scanning distance 5 m) | **HP100-P□** |
| |  | Reflector size 47 mm x 47 mm | **FE-RR8** (Scanning distance 5 m) | **HP100-P□** |
| |  | Reflector size 47 mm x 47 mm | **FE-RR17** (Scanning distance 5 m) | **HP100-P□** |
| |  | Reflector size 30.8 mm x 30.8 mm | **FE-RR15** (Scanning distance 3.5 m) | **HP100-P□** |
| |  | Reflector size 30.8 mm x 30.8 mm | **FE-RR18** (Scanning distance 3.5 m) | **HP100-P□** |
| |  | Reflector size 8.6 mm x 29.5 mm | **FE-RR20** (Scanning distance 2 m) | **HP100-P□** |
| Standard bracket |  | Bottom-mounting L-bracket (zinc-plated steel plate) | **HP800-B01** | All models |
| Wraparound bracket |  | Horizontal mounting wraparound bracket (zinc-plated steel plate) | **HP800-B02** | All models |

| Detection method | Configuration | Wiring method | Cable length | Power supply | Scsnning distance | Slit width | Output mode | Catalog listing |
|---|---|---|---|---|---|---|---|---|
| Thru-scan with horizontal slit |  | Preleaded | **2 m** | **10 to 30V DC** | **1 m** | **1 mm** | **NPN**,Dark ON | **HP800-T1D-014** |
| | | | | | | | **PNP**,Dark ON | **HP800-T2D-014** |
| | | | | | **2 m** | **2 mm** | **NPN**,Dark ON | **HP800-T1D-015** |
| | | | | | | | **PNP**,Dark ON | **HP800-T2D-015** |
| | | Preleaded connector | **30 cm** | | **1 m** | **1 mm** | **NPN**,Dark ON | **HP800-T1D-016** |
| | | | | | | | **PNP**,Dark ON | **HP800-T2D-016** |
| | | | | | **2 m** | **2 mm** | **NPN**,Dark ON | **HP800-T1D-018** |
| | | | | | | | **PNP**,Dark ON | **HP800-T2D-018** |
| Thru-scan with vertical slit |  | Preleaded | **2 m** | | **1 m** | **1 mm** | **NPN**,Dark ON | **HP800-T1D-019** |
| | | | | | | | **PNP**,Dark ON | **HP800-T2D-019** |
| | | | | | **2 m** | **2 mm** | **NPN**,Dark ON | **HP800-T1D-020** |
| | | | | | | | **PNP**,Dark ON | **HP800-T2D-020** |
| | | Preleaded connector | **30 cm** | | **1 m** | **1 mm** | **NPN**,Dark ON | **HP800-T1D-021** |
| | | | | | | | **PNP**,Dark ON | **HP800-T2D-021** |
| | | | | | **2 m** | **2 mm** | **NPN**,Dark ON | **HP800-T1D-022** |
| | | | | | | | **PNP**,Dark ON | **HP800-T2D-022** |

## Specifications

| | | | |
|---|---|---|---|
| Catalog listing | **HP800-P**□□ | **HP800-T**□□ | **HP800-A**□□ |
| Detection method | Polarized retroreflective*2 | Thru-scan | Diffuse-scan |
| Power | 10 to 30V DC (ripple 10% max.) | | |
| Power consumption | 13 mA max. | 27 mA max. (**HP100-E1**: 16 mA max., **HP100-R**□: 11 mA max.) | 16 mA max. |
| Scanning distance | 0.05 to 4.5 m (when used with **FE-RR8**, **FE-RR17**, or **FE-RR21** reflector) | 15 m | 0.77 m |
| Target object | Opaque object 80 mm dia. min. (when used with **FE-RR8**, **FE-RR17**, or **FE-RR21** reflector) | Opaque object, 9 mm dia. min. | —— |
| Standard target object | —— | —— | 300 x 300 mm 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: 100 mA (resistive load). Output dielectric strength: 30V. Voltage drop: 3V max. (at switching current 100 mA). Short-circuit protection function. | | |
| Response time | 500 μs 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 | 20 MΩ min. (at 500V DC) | | |
| Dielectric strength | 1,000V AC 50/60 Hz for one minute between electrically live metal and case | | |
| Vibration resistance | 10 to 55 Hz, 1.5 mm peak-to-peak amplitude, 2 hours each in X, Y, and Z directions | | |
| Shock resistance | 1000 m/s² 10 times each in X, Y and Z directions | | |
| Protective structure | IP67 (JIS standard) , IP67G (JEM standard) (excluding connector) | | |
| Wiring method | **HP800-**□□□**-LP5**: preleaded (0.5 m), **HP800-**□□□: preleaded (2 m), **HP800-**□□□**-L05**: preleaded (5 m), **HP800-**□□□**-CN03**: preleaded connector (0.3 m), **HP800-**□□□**-CN05**: preleaded connector (0.5 m), **HP800-**□□□**-CN1**: preleaded connector (1 m) | | |
| Weight | Approx. 105g (body with 2 m cable only) | | |
| Circuit protection | Power ON malfunction prevention circuit (approx. 8 ms), wiring error protection | | |

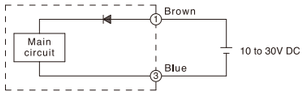
*1. An FET is used for output
*2. If a polarized retroreflective model is used to detect highly reflective objects or objects that interfere with polarization, detection might be inconsistent. For details, see the handling precautions on page 29.
When used in an environment likely to cause rust (except for cutting oil), use the **HP-PA01** spacer (sold separately) when mounting.

| | **HP800-T**□□**-014/-016** | **HP800-T**□□**-019/-021** | **HP800-T**□□**-015/-018** | **HP800-T**□□**-020/-022** |
|---|---|---|---|---|
| Catalog listing<br>Detection method | Thru-scan with horizontal 1 mm slit | Thru-scan with vertical 1 mm slit | Thru-scan with horizontal 2 mm slit | Thru-scan with vertical 2 mm slit |
| Power | DC10～30V(ripple10%max.) | | | |
| Power consumption | 27 mA max. (**HP100-E1**:16 mA max., **HP100-R**□: 11 mA max.) | | | |
| Scanning distance | 1 m | 1 m | 2 m | 2 m |
| Target object | Opaque, min. 2 mm vert. × 9 mm horiz. *2 | Opaque, min. 9 mm vert. × 2 mm horiz.*2 | Opaque, min. 3 mm vert. × 9 mm horiz.*2 | Opaque, min. 9 mm vert. × 3 mm horiz.*2 |
| Scanning angle | 1–20° for both emitter and receiver | | | |
| Operation mode | **HP800-T**□**D** : Dark-ON | | | |
| Output mode*1 | **HP800-T1**□**-0**＊＊: NPN open collector. | | | |
| Control output | Switching current: 100 mA (resistive load). Output dielectric strength: 30V. Voltage drop: 3V max. (at switching current 100 mA). Short-circuit protection function. | | | |
| Response time | 500 μs max.for both operation and recovery | | | |
| Emitter | Red LED | | | |
| Indicator | Receiver: orange when output ON, and green during stable light-ON and light-OFF. | | | |
| Ambient light immunity | Incandescent lamp: 10,000 lux max. Sunlight: 40,000 lux max. | | | |
| Operating temperature | —30～+60°C (without freezing or condensation) | | | |
| Operating humidity | 35 to 85%RH (without freezing or condensation) | | | |
| Insulation resistance | 20 MΩ min. (at 500V DC) | | | |
| Dielectric strength | 1,000V AC 50／60 Hz for one minute between electrically live metal and case | | | |
| Shock resistance | 10 to 55 Hz, 1.5 mm peak-to-peak amplitude, 2 hour each in X, Y and Z directions | | | |
| Protective structure | 1000 m/s² 10 times each in X, Y and Z directions | | | |
| weight | Approx. 210 g (body with 2 m cable only) | | | |
| Circuit protection | Power ON malfunction prevention circuit (approx. 8 ms), wiring error protection | | | |
| Standards | The EMC Directive (2004/108/EC) | | | |

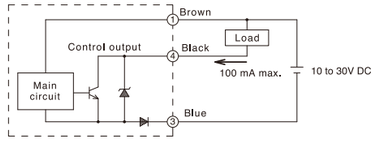
*1. An FET is used for output
*2. Mounting the emitter or receiver on an angle affects the ability to detect an object of a certain size.

## Output circuit diagram (Note that a FET is used for output)

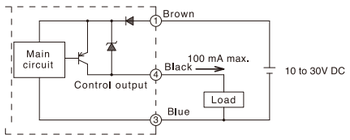
**● Thru-scan emitter**



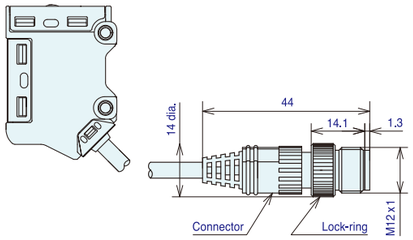

**● (NPN output type)**
**Polarized retroreflector model**
**Thru-scan receiver**
**Diffuse-scan model**

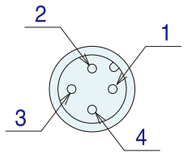



**● (PNP output type)**
**Polarized retroreflector model**
**Thru-scan receiver**
**Diffuse-scan model**




## Preleaded connector (External dimensions/Contact arrangement)

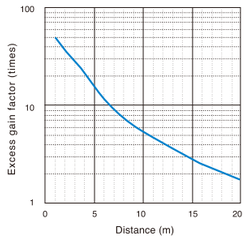


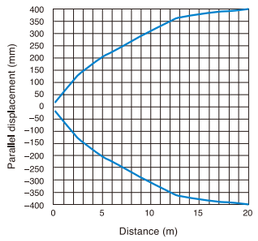
## Characteristics diagrams (typical examples)

### ■Thru-scan models (HP800-T□)

**Excess gain**
(light received over the required amount)

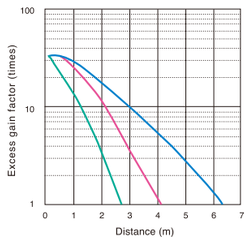



**Parallel displacement**

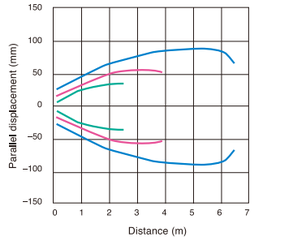



### ■Polarized retroreflective models (HP800-P□)

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

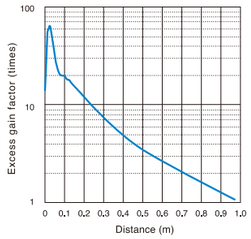



**Parallel displacement**
Use with **FE-RR8 / 17 / 21**, **FE-RR15 / 18**, or **FE-RR20**

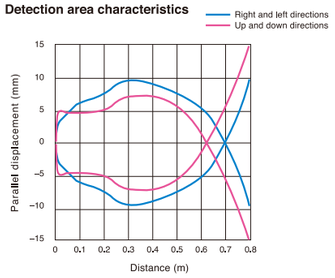



### ■Diffuse-scan models (HP800-A□)

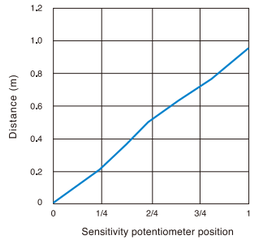
**Excess gain**
(light received over the required amount)




**Detection area characteristics**

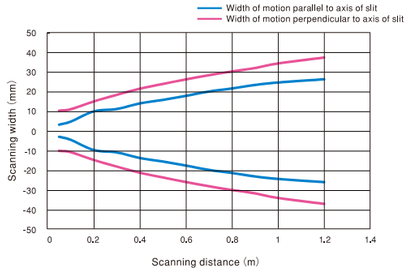



**Potentiometer angle vs. scanning distance characteristics**

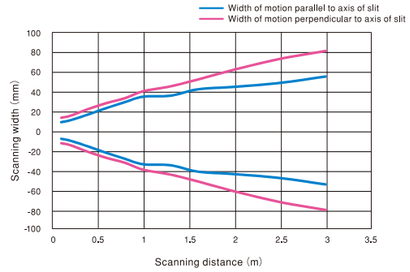



### ■Thru-scan with a slit (HP800-T□)

**Detection area characteristics for HP800 thru-scan sensor with 1mm slit**



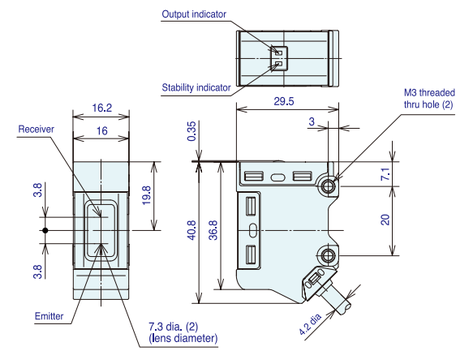

**Detection area characteristics for HP800 thru-scan sensor with 2mm slit**



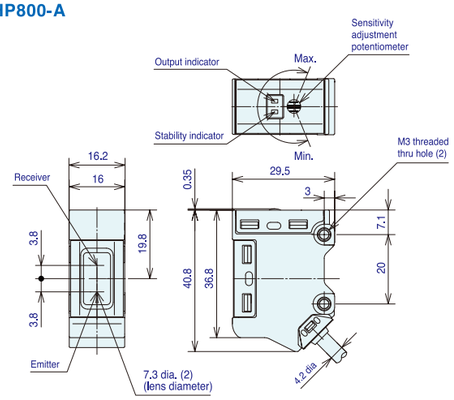



## External Dimensions (Unit: mm)

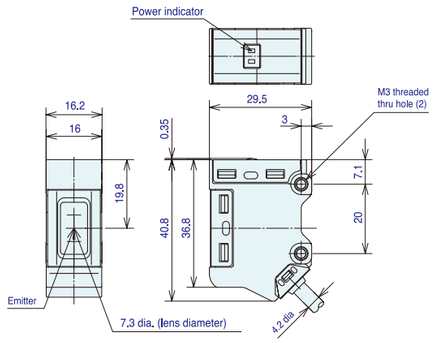
### ●HP800-P



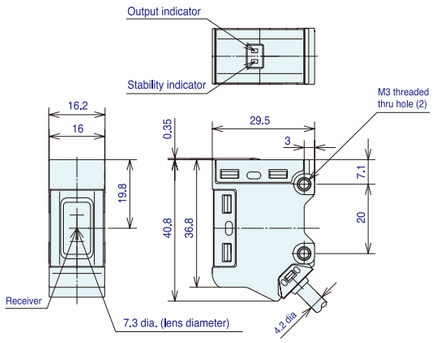

### ●HP800-A



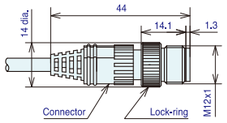

### ●HP800-T (emitter: HP800-E1)




### ●HP800-T (receiver: HP800-R)

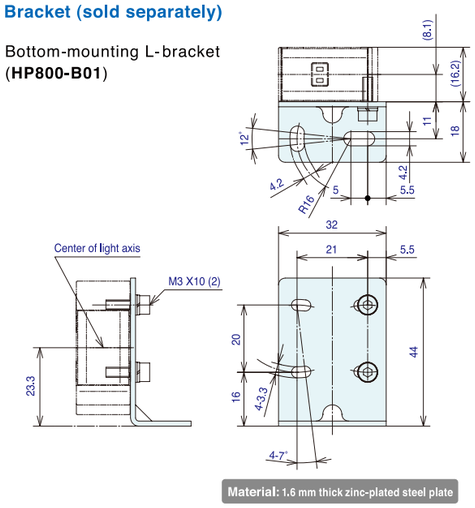



### ●Connector (common)



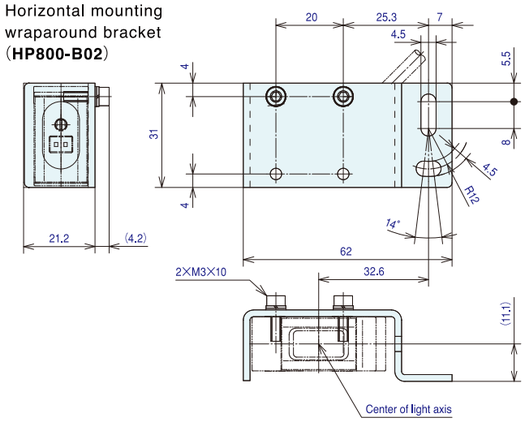

### ●Bracket (sold separately)

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




**Material:** 1.6 mm thick zinc-plated steel plate

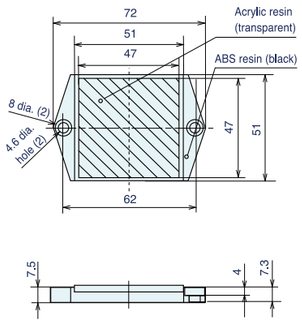
Horizontal mounting wraparound bracket (**HP800-B02**)



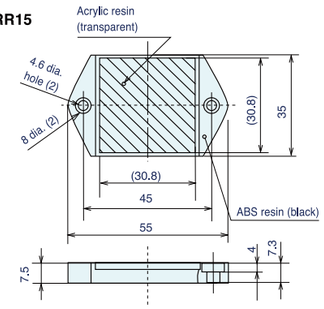

**Material:** 2.0 mm thick zinc-plated steel plate

## ●Reflector (sold separately)

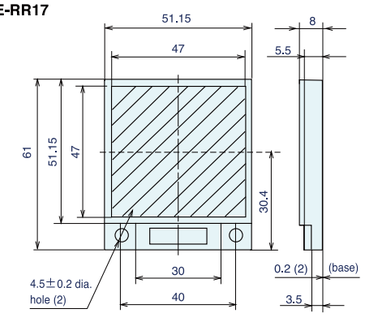
**FE-RR8**



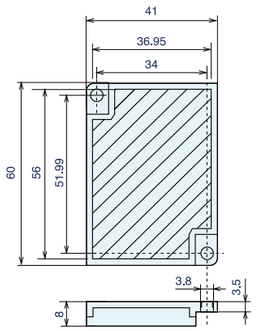

**FE-RR15**



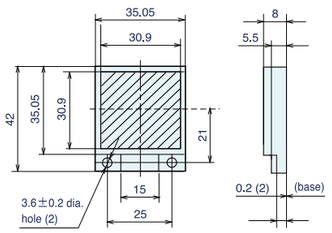

**FE-RR17**



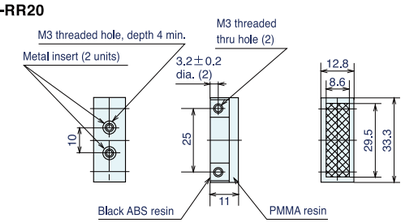

**FE-RR21**




**FE-RR18**




**FE-RR20**






# HP series Precautions for Use

## European standards (EN standards)

### About CE Marking (CE:conformité Européenne = European conformity)

In order to make the best use of the advantages obtained by European unification, the European Union (EU) Commission adjusted the safety regulations in the EU area to produce unified regulations by product category, such as machinery, toys, and medical devices. This was done in the European Communities Directive (= EC Directive) officially announced in 1989. Documents such as the Machine Directive, EMC Directive (regulations on the compatibility of electromagnetic waves generated by electrical products), Low Voltage Directive, and Medical Device Directive were issued. At the same time, the system of granting CE marking by product category began. The EC Directive most directly relevant for Yamatake's products is the Low Voltage Directive. The Machinery Directive is also relevant indirectly.

### About EN standards (EN: European Norm = European standard)

EC directives like those mentioned above are laws that must be observed. However, they contain only basic requirements written in general terms, resulting in difficulty in concrete understanding. Therefore, many manufacturers now design products based on what are known as EN standards. In parallel with unifying the regulations (EC directives) in the EU area, the industrial standards and safety standards of each country are also being unified. This unification of standards is being carried out by CEN (Comitunified standards, the letters EN are used at the head of each standards number.

EN standards assist in concrete product design by giving numerical values and drawings pertaining to the safety requirements of EC directives. Whether the EN standards should be adopted or not is left up to the manufacturer. In other words, it is theoretically possible not to adopt the EN standards. However, in such a case, much effort is required to demonstrate objectively, using relevant data and documents, that the adopted method satisfies the EC directives. Also, explaining the reason for not using the EN standards is difficult. Since the easiest way to receive EC marking and satisfy the EC directives is to gather all the EN standards related to the directives and then to develop products that meet the standards, almost all manufactures follow this method. In this case the CE marking can be used only after the EN standards are met and all the relevant EC directives are satisfied.

## UL standards

UL standards are used mostly in the USA. However, due to mutual relations with CSA, joint certification in the U.S. and Canada is often possible. (Canada-only certification is also possible.) Since the **HP100 Series** is certified for both USA (UL) and Canada (C-UL), it is accepted as a CSA-certified product.


### Meaning of "Listed"

Listing is the kind of UL certification that applies to equipment or devices designed to be used as a final product, without regard to application. Unlike a "Recognized" component, even if a Listed device is changed for maintenance, the overall product is still considered as "Listed." Therefore, if UL-listed products are used, reapplication for UL-certification after changes can be eliminated or reduced.

# Handling

## 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.

## Wiring precautions

- If a cable extension is necessary, use wire at least 0.3mm² 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.

## 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

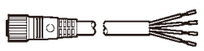
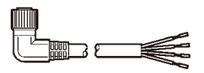
1. Mount the photoelectric sensor pointing toward the desired detection position.
2. With no target object present, slowly turn the light quantity adjustment potentiometer from MAX position toward MIN position, and find the position (called position A) where the output indicator (orange) goes off (or 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.

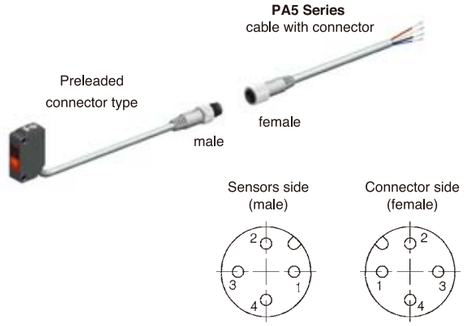

Note: The above adjustment method is primarily for light-ON operation. For dark-ON operation, apply the text in parentheses.

# CABLE WITH CONNECTOR

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

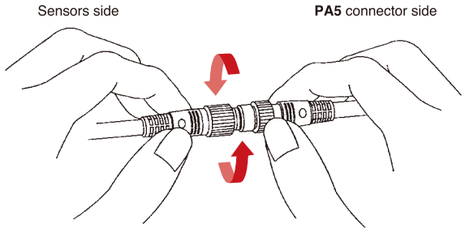
**● PA5 Series cable with connector**

| Shape | Power supply | Cable properties | Cable length | Catalog listing | Lead colors |
|---|---|---|---|---|---|
|  | DC | Vinyl-insulated cable with high resistance to oil and vibration (UL/NFPA79 CM, CL3) | 2 m | **PA5-4I SX2SK** | 1: brown, 2: white, 3: blue, 4: black |
| | | | 5 m | **PA5-4I SX5SK** | 1: brown, 2: white, 3: blue, 4: black |
|  | | | 2 m | **PA5-4I LX2SK** | 1: brown, 2: white, 3: blue, 4: black |
| | | | 5 m | **PA5-4I LX5SK** | 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.




Memo