General-Purpose Self-Contained Photoelectric Sensors
HP7 series

Nothing escapes his notice, no matter what the conditions.

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 sensors

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.

- Secure operating margin over a long distance

Problem 1
- Light axis is hard to adjust over long distances (thru-scan and retroreflective models)
- Inconsistent performance with black or non-reflective objects

Problem 2
- Interference between side-by-side sensors
- Need to reverse the sensor configuration or move sensors

No constraints

Thru-scan sensors using different frequencies can be installed side by side*1 without mutual interference protection filter or reversed sensor orientation. Diffuse-scan and retroreflective models are fitted with automatic interference suppression that allows two units to be used side by side.*1

*1. Subject to certain restrictions (see “Interference Suppression” in the specifications).

Problem 3
- Sensor operation affected by inverter fluorescent light

Problem 4
- Cutting oil mist near metalworking lines reduces sensor life

Improve resistance to oil

Polyallylate resin lenses offer improved resistance*2 to the effects of oils and chemicals.

*2. In tests conducted by the azbil Group.

Designed for modern lighting

New algorithms achieve major improvement in resistance*2 to external optical interference.

Cutting oil mist near metalworking lines reduces sensor life.

Problem 5

Sensor operation affected by inverter fluorescent light

Problem 6

Improved resistance to oil

Polyallylate resin lenses offer improved resistance*2 to the effects of oils and chemicals.

*2. In tests conducted by the azbil Group.
 installs thru-scan sensors using different frequencies. Multiple units can operate side by side. As previously, two diffuse-scan or retroreflective sensors can be installed side by side.

Installation of thru-scan sensors using different frequencies. Multiple units can operate side by side. As previously, two diffuse-scan or retroreflective sensors can be installed side by side.

## Suitable for a Wide Range of Applications

- Thru-scan and diffuse-scan lenses made from oil-resistant modified polyallylate

### Problem

- Plastic screw holes aren’t strong enough. Tightening the screws too hard or too quickly destroys the thread.

### Stronger mounting holes

- Threaded metal mounting holes provide improved mechanical strength.

### Low temperature use OK

- The widest operating temperature range available today—performance in freezer environments down to −30 °C is guaranteed.

- Operating temperature range is −30 to +55 °C

*3. Low temperature code is available as an option.
Features of the HP7 series

Sensing range and type setup

First determine the optimum detection distance, light source, and sensing width, in order to minimize adjustment during installation.

**Thru-scan models**

**Long range: 30 m**
For long-distance applications or dust-filled environments such as multilevel parking garages and automated warehouses

**Standard: 15 m**
For standard thru-scan sensing applications

**Short distance: 4 m**
For applications requiring sensitivity adjustment at distances of up to 1 m

**Retroreflective models**

**Standard: 5 m**
The standard type offers the longest detection range in the industry

*1. Retroreflective sensors use polarizing filters to minimize sensing error due to light reflected off a high reflective surface.

**Diffuse-scan models**

**Infrared: 1 m**
Infrared sensor with low susceptibility to color differences offering superior detection range in the industry

**Red: 0.5 m**
For near-distance applications requiring visual confirmation of the detected spot

**Wide beam diffuse-scan models**

**Wide beam: 100 mm**
For applications detecting print circuit boards and inclined objects

**Wide beam: 50 mm**
For sensing print circuit boards while minimizing interference from surrounding areas.

Interference suppression

Using a combination of standard and different-frequency sensors(for thru scan), two sensors can be installed side by side without sacrificing space or distance.

**Two thru-scan sensors (red and infrared)**
The combination of a standard sensor and a different frequency sensor prevents interference without installing an mutual interference protection filter or reversing the orientation of one of the units. Effective for up to two units side by side.*2

**Four thru-scan sensors (red)**
Using an interference mutual protection filter, it is possible to install up to four units side by side*2 without changing the orientation of any of the units.

**Diffuse-scan sensor / retroreflective sensor**
Automatic interference suppression allows two units to be installed in close proximity.*2

*2. Subject to certain restrictions (see “Interference Suppression” in the specifications)
Auto Adjust button

There are many situations where sensor systems can be installed using factory default settings. However, in some situations, further adjustment will be required. Press the button on top of the unit to automatically adjust to the optimum sensitivity.

- **Thru-scan and retroreflective models**
  Inconsistent sensor operation when objects do not block the sensor beam properly

- **Diffuse-scan models**
  Sensor operation affected by background

**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.

**Excellent resistance to sunlight**

Sensors are designed to provide a high level of resistance to sunlight (an industry-leading 40,000 lx).
How to use the Auto Adjust button

If sensor 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 sensors, the target may not block the sensor beam properly due to unwanted reflection and/or permeation of light. In some cases, diffuse-scan sensors 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 sensors: Automatically adjusts sensitivity to trigger the sensor at approximately half the intensity of the light received when there is no target object present.
- Diffuse-scan sensor: Automatically adjusts sensitivity to trigger the sensor at approximately twice the intensity of the light received when there is no target object present.

Sensor 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: Highly transparent objects cannot be detected. Check with actual target objects before running a machine.

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 sensor detects background objects such as the conveyor. First, the sensor is exposed to the no-target state. Next, the sensor is exposed to the state with a target present. The sensor is now able to distinguish between the two states.

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 sensor operates around at this position. Note that the sensing distance can vary by as much as 15% from the set distance.
## Catalog listings

### Base model number

<table>
<thead>
<tr>
<th>Detection method / Configuration</th>
<th>Detection range &amp; light source</th>
<th>Catalog listing</th>
<th>Out put</th>
<th>Wiring method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thru-scan</td>
<td>30m/Infrared</td>
<td>HP7-T41</td>
<td>NPN</td>
<td>cable 2m</td>
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<tr>
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<td>HP7-T42</td>
<td>PNP</td>
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<tr>
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<td>15m/Red</td>
<td>HP7-T11</td>
<td>NPN</td>
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<td>HP7-T22</td>
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<td></td>
<td>4m/Red</td>
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<td>NPN</td>
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<td>HP7-T52</td>
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<td>Retroreflective</td>
<td>5m/Red</td>
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<td>NPN</td>
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<tr>
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<td>0.5m/Red</td>
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<tr>
<td>Wide-beam diffuse scan</td>
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### Thru-scan sensors different frequencies

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<td>HP7-T26</td>
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<td>HP7-T51 type</td>
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### Connection options

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<th>HP7-P11-L050</th>
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<td>0.5m Red</td>
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<td>Thru-scan sensors, different frequencies</td>
<td>30 m Infrared sensors, different frequencies</td>
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<td>4 m Red sensors, different frequencies</td>
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<td>HP7-T56</td>
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✓: available  ○: Always in stock; for other products, ask for delivery time.
1. Interchangeable with Omron Smart Click.
2. Cord length is 300 mm.
<table>
<thead>
<tr>
<th>Name</th>
<th>Configuration</th>
<th>Description</th>
<th>Catalog listing</th>
<th>Compatible model</th>
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<tbody>
<tr>
<td>Reflector for retroreflective model</td>
<td></td>
<td>Reflector size 47 x 47 mm (Scanning distance 0.05 to 5 m)</td>
<td>FE-RR22</td>
<td>HP7-P-</td>
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<tr>
<td></td>
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<td>Reflector size 30.8 x 30.8 mm (Scanning distance 0.05 to 3.3 m)</td>
<td>FE-RR18</td>
<td>HP7-P-</td>
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<td>Reflector size 37 x 56 mm</td>
<td>FE-RR21</td>
<td>HP7-P-</td>
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<tr>
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<td>Scanning distance: horiz. mounting 0.05 to 5 m, vertical mounting 0.05 to 4.8 m²</td>
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<td></td>
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<td>Reflector size 47 x 47 mm (Scanning distance 0.05 to 5 m)</td>
<td>FE-RR8</td>
<td>HP7-P-</td>
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<td>Reflector size 30.8 x 30.8 mm (Scanning distance 0.05 to 3.3 m)</td>
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<td>HP7-P-</td>
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<td>Reflector size 8.6 x 29.5 mm</td>
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<td>Scanning distance: horiz. mounting 0.05 to 1.8 m, vertical mounting 0.05 to 1.3 m²</td>
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<tr>
<td>Standard bracket</td>
<td>Bottom-mounting L-bracket</td>
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<td>HP-B08</td>
<td>All models</td>
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<tr>
<td></td>
<td>Bottom-mounting L-bracket</td>
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<td>HP-B09</td>
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<td>Rear-mounting L-bracket</td>
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<td>Wraparound vertical mounting bracket</td>
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<td>All models</td>
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<td>Wraparound horizontal mounting bracket</td>
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<td>HP-B12</td>
<td>All models</td>
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<tr>
<td>Slit for thru-scan model</td>
<td>Vertical slit</td>
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<td>HP-SV05</td>
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<td>Horizontal slit</td>
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<td>HP-U02</td>
<td>HP7-T1_/T5-</td>
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<tr>
<td>Mutual interference protection filter for thru-scan model</td>
<td>Mutual interference can be prevented by changing the polarizing direction of 2 adjacent emitter-receiver pairs</td>
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</table>

*2 horiz. mounting  vertical mounting
**Specification**

<table>
<thead>
<tr>
<th>Catalog listing</th>
<th>NPN</th>
<th>HP7-P11</th>
<th>HP7-T51</th>
<th>HP7-T11(Infrared)</th>
<th>HP7-T21(Red)</th>
<th>HP7-T41</th>
<th>HP7-A13</th>
<th>HP7-A43</th>
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<td>HP7-P12</td>
<td>HP7-T52</td>
<td>HP7-T12(Infrared)</td>
<td>HP7-T22(Red)</td>
<td>HP7-T42</td>
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<td>Diffuse-scan</td>
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<td>10.2 to 26.4V DC (ripple 10% max.)</td>
<td>10.2 to 26.4V DC (ripple 10% max.)</td>
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<td>22 mA max.</td>
<td>25 mA max. (Infrared)</td>
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<td>32 mA max.</td>
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<td>Scanning distance</td>
<td>5 m (with FE-RR8 reflector)</td>
<td>4 m</td>
<td>15 m</td>
<td>30 m</td>
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<td>1 m</td>
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<td>-</td>
<td>Standard target object: 200 × 200 mm paper, 90 % reflectivity</td>
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<td>Differential travel</td>
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<td>20% max. (at rated scanning distance)</td>
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<tr>
<td>Output mode*1</td>
<td>NPN or PNP open collector</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control output</td>
<td>Switching current: 100 mA (resistive load). Output dielectric strength: 30V, Voltage drop: 3V max. (at 100 mA switching current). 1.1V max. (less than 10mA).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>1ms (different frequency model: 3ms)</td>
<td>1ms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light source</td>
<td>Red, 4 elements (wavelength approx. 645 nm)</td>
<td>Red, 4 elements (wavelength approx. 645 nm)</td>
<td>Red, 4 elements (wavelength approx. 645 nm)</td>
<td>Infrared (wavelength approx. 860 nm)</td>
<td>Red, 4 elements (wavelength approx. 860 nm)</td>
<td>Infrared (wavelength approx. 860 nm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scanning angle</td>
<td>0.5 to 10°</td>
<td>2 to 20°</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indicator</td>
<td>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</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient light immunity</td>
<td>Incandescent lamp: 10,000 lux max. Sunlight: 40,000 lux max. HP7-T_ , HP7-P_: Minimum angle of incidence of surrounding light = 5° HP7-A_: Minimum angle of incidence of surrounding light = 15°</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-30 to +55 ºC (without freezing or condensation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating humidity</td>
<td>35 to 85% RH (without freezing or condensation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 to +70 ºC (without freezing or condensation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>20MΩ min. (at 500Vdc)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dielectric strength</td>
<td>1,000Vac 50/60Hz for one minute between electrically live metal and case</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55Hz, 1.5 mm peak-to-peak amplitude, 2 hours each in X, Y, and Z directions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock resistance</td>
<td>500m/s*10 times each in X, Y, and Z directions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity adjustment</td>
<td>Operation button</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protective structure</td>
<td>IP67 (IEC standard)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wiring method</td>
<td>HP7-_ : preleaded 2 m , HP7-_L050 preleaded 5 m , HP7-_C003: M12 preleaded connector 30 cm, HP7-_T : M8 preleaded connector</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit protection</td>
<td>Error prevention circuit at power on (max. 60 ms) Full wiring error protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interference suppression*5</td>
<td>Up to two diffuse-scan and retroreflective sensors, or two thru-scan sensors when operating at different frequencies or using mutual interference protection filters*4 (red), or up to four thru-scan sensors when using different frequencies together with mutual interference protection filters (red)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1. An FET is used for output 
*2. Retroreflective sensors 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 sensors. 
*4. Mutual interference protection filters are for red light source. 
*5. Interference suppression used in combination with different frequencies on thru-scan sensors is effective under the following conditions. Avoid head-on detection with close contacted mounting of diffuse-scan sensors. 

<table>
<thead>
<tr>
<th>Catalog listing</th>
<th>HP7-T5_</th>
<th>HP7-T1_/HP7-T2_</th>
<th>HP7-T4_</th>
<th>HP7-T1_ + HP-U02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set distance</td>
<td>1.3 m max.</td>
<td>5 m max.</td>
<td>10 m max.</td>
<td>2 m max.</td>
</tr>
<tr>
<td>Sensitivity setting</td>
<td>Maximum sensitivity (with light axis adjustment)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*6. Standard cord might get hardened under 0 ºC. Low temperature cord is available as an option.

---

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

**Thru-scan emitter**

- **Main circuit**
  - Brown
  - Blue
  - 10.2 to 26.4 V DC

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

- **Main circuit**
  - Control output
  - Load
  - 10.2 to 26.4 V DC
  - Brown
  - 100 mA max.
  - Blue

---

**PNP output type**

- **Main circuit**
  - Control output
  - Load
  - 10.2 to 26.4 V DC
  - Brown
  - 100 mA max.
  - Blue
Characteristics diagrams (typical examples)

■ Thru-scan models (HP7-T1_/T2_/T5_)

*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.

Excess gain
(light received over the required amount)

Excess gain
(light received over the required amount) With mutual interference protection filter

Parallel displacement

Parallel displacement
With mutual interference protection filter
**Retroreflective models (HP7-P1_)**

- **Excess gain** (light received over the required amount)
  - FE-RR8/FE-RR21
  - FE-RR22
  - FE-RR15/FE-RR18
  - FE-RR20

- **Parallel displacement**
  - FE-RR21 horizontal
  - FE-RR21 vertical
  - FE-RR15/FE-RR18
  - FE-RR20 horizontal
  - FE-RR20 vertical

*All graphs represent typical data but not warranted specification. Use the sensor with appropriate margin.*

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

- **Excess gain** (light received over the required amount)
  - HP7-A1
  - HP7-A4

- **Detection area characteristics**
  - HP7-A1
  - HP7-A4

**Target specifications**

- **HP7-A1**
  - Scanning distance
  - White paper (90% reflectivity)
  - Black paper (6% reflectivity)
  - Matte SUS

- **HP7-A4**
  - Scanning distance
  - White paper (90% reflectivity)
  - Black paper (6% reflectivity)
  - Matte SUS

*When used with highly reflective backgrounds, tilting the sensor may improve background suppression.*

**Background interference during tuning**

- **HP7-A1**
  - (No workpiece) (background = matte SUS)

- **HP7-A4**
  - (No workpiece) (background = matte SUS)

*How to interpret the table*

Example: Tuning (without a workpiece) of model HP7-A1, against a matte SUS background at 1 m where white paper target is detected at distances of up to approx. 0.5 m.

* *All graphs represent typical data but not warranted specification. Use the sensor with appropriate margin.*
Handling

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.
- Output is disabled upon power-up for 60ms max. until the unit stabilizes.
- 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 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 cord 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 cord is not subject to splashing by water or oil.
- A bend in the cord immediately after it exits the device should have a radius of a least 30 mm. Also, avoid use in which the cord receives repeated bending stress.
- Do not pull the cord with excessive force (> 50 N). Cord disconnection can cause burnout.
- 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.
- Standard cord might get hardened under 0˚C. Do not bend or apply shock / vibration under 0˚C. Low temperature cord is available.
- Sensor 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:
  - Mount the sensor at an angle to the target object.
  - Increase the distance between the sensor and the target object.
  - Tune the sensor without a workpiece.

Wiring precautions

- If a cord extension is necessary, use wire at least 0.3 mm² in cross-sectional area and at most 100 m long.
- If the cord 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 cord 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 sensor operation using a target object then use the Auto Adjust button to adjust the sensitivity setting.
- Diffuse-scan model
  1. Mount the photoelectric sensor pointing toward the desired detection position.
  2. Check sensor operation using a target object then use the Auto Adjust button to adjust the sensitivity setting.
The operation method

**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.

**Tuning without a workpiece**
The factory default setting is maximum sensitivity. If the target is not detected consistently at this setting, adjust the sensitivity using the Auto Adjust button as described below.

1. **Thru-scan models**
   - If the target is translucent or has holes or openings that light can pass through, or if indirect sensor beam presents, the target object may not be able to block the sensor beam properly. By following the set up below, the sensitivity is automatically adjusted to trigger the sensor at approximately half the intensity of the light received when there is no target object present.
   - For thru-scan models, the light intensity may be too strong at the short distances noted below. This may cause the indicator lamp to flash repeatedly, as described under Indicator lamp flashes repeatedly.
   - HP7-T1_ _ _, HP7-T2_ _ _ : 1 m  HP7-T5_ _ _・: 0.3 m

2. **Retroreflective models**
   - If the target is translucent or has holes or openings that light can pass through, or if indirect sensor beam presents, the target object may not be able to block the sensor beam properly. By following the set up below, the sensitivity is automatically adjusted to trigger the sensor at approximately half the intensity of the light received when there is no target object present.

3. **Diffuse-scan models**
   - Use Auto Adjust button in situations where reflection from background is too strong to detect a target. The sensitivity is automatically adjusted to trigger the sensor at approximately twice the intensity of the light received when there is no target object present.

**2-point tuning**
2-point tuning is used in situations when tuning without a workpiece does not provide a stable detection. Two-point tuning automatically sets the light sensitivity to a value mid-way between the state when the target is present and when the target is absent.

1. 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.)
2. Without a workpiece, give the button a short press. Both LEDs turn OFF. (Measures light intensity without a target object and sets sensitivity as required.)
3. 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.)
4. Without a workpiece, give the button a short press. Both LEDs turn OFF. (Measures light intensity without a target object and sets sensitivity as required.)

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

Position tuning is the procedure for configuring a diffuse-scan sensor to detect a target at a specific position. Position tuning has a maximum 15% tolerance. Applicable distance range: HP7-A1__:_200–500 mm, HP7-A4__:_ 200–1,000 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

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.)

Reverts to normal Indication. (in about 2 seconds)

Reverts to normal Indication. (in about 2 seconds)

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

The factory default setting is maximum sensitivity. This procedure is used to restore the factory default setting, which may be useful for resolving confusion during the setting procedure. This procedure will restore sensitivity to the factory default setting from any state (irrespective of how the indicator is flashing).

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 sensor.

<table>
<thead>
<tr>
<th>LED Indicators</th>
<th>Status</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tuning in progress</td>
<td>Hold down the button until the green indicator flashes rapidly (about 7 seconds) to restore the factory default setting (maximum sensitivity).</td>
</tr>
<tr>
<td></td>
<td>Tuning without a workpiece</td>
<td>Press the button once to revert to normal operation at the pre-tuning sensitivity. Adjust the light axis and then repeat the tuning procedure.</td>
</tr>
<tr>
<td></td>
<td>2-point tuning</td>
<td>Press the button once to revert to normal operation at the pre-tuning sensitivity. Adjust the light axis and then repeat the tuning procedure.</td>
</tr>
<tr>
<td></td>
<td>Diffuse-scan models</td>
<td>Move the sensor closer to the target to boost the reflected light intensity and then repeat the tuning procedure.</td>
</tr>
<tr>
<td></td>
<td>Tuning without workpiece</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>2-point tuning</td>
<td>Press the button once to revert to normal operation at the pre-tuning sensitivity. Adjust the light axis and then repeat the tuning procedure.</td>
</tr>
<tr>
<td></td>
<td>Thru-scan and retroreflective models</td>
<td>Minimize the reflected light by painting the background black, and then repeat the tuning procedure.</td>
</tr>
<tr>
<td></td>
<td>2-point tuning</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Thru-scan and retroreflective models</td>
<td>Move the sensor closer to the target to boost the reflected light intensity and then repeat the tuning procedure.</td>
</tr>
<tr>
<td></td>
<td>Tuning without workpiece</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>2-point tuning</td>
<td>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.</td>
</tr>
</tbody>
</table>

---

* The table above 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 sensor.
PA5 Series cable

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

- **PA5 Series cable with connector**

<table>
<thead>
<tr>
<th>Shape</th>
<th>Power supply</th>
<th>Cable properties</th>
<th>Cable length</th>
<th>Catalog listing</th>
<th>Lead colors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preleaded connector type</td>
<td>DC</td>
<td>Vinyl-insulated cable with high resistance to oil and vibration (UL/NFPA79 CM, CL3)</td>
<td>2 m</td>
<td>PA5-4I SX2SK</td>
<td>1: brown, 2: white, 3: blue, 4: black</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 m</td>
<td>PA5-4I SX5SK</td>
<td>1: brown, 2: white, 3: blue, 4: black</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 m</td>
<td>PA5-4I LX2SK</td>
<td>1: brown, 2: white, 3: blue, 4: black</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 m</td>
<td>PA5-4I LX5SK</td>
<td>1: brown, 2: white, 3: blue, 4: black</td>
</tr>
</tbody>
</table>

- **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.

---

PA7 Series cable

Be sure to use a PA7 Series cable with connector when connecting Quick Lock type sensor.

- **PA7 Series cable with connector**

<table>
<thead>
<tr>
<th>Shape</th>
<th>Power supply</th>
<th>Cable properties</th>
<th>Cable length</th>
<th>Catalog listing</th>
<th>Lead colors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick Lock type</td>
<td>DC</td>
<td>Vinyl-insulated cable with high resistance to oil and vibration (UL/NFPA79 CM)</td>
<td>2 m</td>
<td>PA7-4I SX2SK</td>
<td>1: brown, 2: white, 3: blue, 4: black</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 m</td>
<td>PA7-4I SX5SK</td>
<td>1: brown, 2: white, 3: blue, 4: black</td>
</tr>
</tbody>
</table>

- **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.
Other products

Digital Fiber – Optic Sensors

<table>
<thead>
<tr>
<th>High-performance HPX-AG series</th>
<th>Standard HPX-EG series</th>
<th>Potentiometer HPX-A/H series</th>
<th>Analog output HPX-MA series</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
</tbody>
</table>

Sample applications

An extensive lineup of products to suit any and every application.

<table>
<thead>
<tr>
<th>Simple present/absent detection</th>
<th>Meander detection</th>
<th>Detection of front/back</th>
<th>Liquid level detection</th>
<th>Leak detection</th>
<th>High heat/vacuum applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
<td><img src="image9.png" alt="Image" /></td>
<td><img src="image10.png" alt="Image" /></td>
</tr>
</tbody>
</table>

Photoelectric sensors

Compact general-purpose photoelectric sensor HPJ

- Fully sealed die-cast zinc body HP800
- Vane configuration HPV

- Background suppression Type
- Designed for use machining applications
- For positioning applications

Proximity sensors

General-purpose proximity sensor FL7M series

- Compact proximity sensors APM series
- Compact proximity sensors APT series
- Compact proximity sensors FL7N/M
- Square proximity sensor FL2 series

- Standard cylinder shapes
- 8×6 mm
- φ 3/3.5 mm²
- φ 4/MS mm
- For confined spaces and longer distances

Mechanical switches

General-purpose limit switches

- Compact limit switches
- Safety limit switches with positive opening mechanism

- Standard limit switch
- Fully sealed, available in various plunger configurations
- Available in a range of housing material, from low-cost plastic to durable die-cast metals

- [Image](image11.png)
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Yamatake Corporation changed its name to Azbil Corporation on April 1, 2012.

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