Handling Precautions

- This device is a precision instrument. Do not hit it or bump it against any object.
- The diameter of the mounting bracket holes must be 4 mm or less. Tighten the mounting screws to a maximum torque of 0.8 N•m.
- Up to 100 ms is required for stabilization after the power is turned on.
- For outdoor use, prevent direct exposure to sunlight and rainwater.
- Do not allow water, cutting oil, etc., to splash on the device or the cables.
- Do not expose the device to chemicals (organic solvents, acids, alkalis).
- If the lens is dirty, wipe it with a soft, damp, clean cloth. Do not use an organic solvent like alcohol.
- Switches cannot be connected in series (AND circuit). Parallel connection (OR circuit) is supported.

Wiring Precautions

- Bends in the cable should have a radius of at least 15 mm (30 mm min. for the section immediately next to the device).
- Avoid use in which the cable receives repeated bending stress.
- Do not pull the cable with excessive force (≥ 50 N). Doing so might cause disconnection, resulting in a short circuit and burnout.
- Tighten connectors firmly by hand.
- If extension of the cable is necessary, use at least 0.3 mm² wire, no more than 100 m long.
- Special care is required at low temperatures (below 0 °C), because cables become stiff and flexibility is much lower.
- When using an inverter or servo motor, be sure to ground the frame ground terminal and ground terminal.
- Do not put the wires of the photoelectric switch and motor power lines or other power wires in the same conduit. Doing so may cause malfunction or damage due to induction noise. Route the wires separately or put them in a different conduit.

Installation Precautions

- Install the device so that the target object moves in the direction shown in Fig. 1. If the switch is installed horizontally, false detection of an object that is situated away from the set distance may result. In this case, the use of a shielding plate is recommended. If it is not possible to install a shielding plate, thoroughly check device operation before use.
- If a mirrorlike or reflective object is located near the device, unreliable detection may occur. In this case, increase the distance between the device and the reflective object, or incline the optical axis as shown in Fig. 2.
- Depending on the shape or pattern of the object, unreliable detection may occur. Before use, thoroughly check device operation. If the background or the target object is reflective, incline the optical axis so that the device does not receive the reflected light directly.

Disposal Precautions

- When discarding the product, dispose of it as industrial waste, following local regulations.

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Advanced Automation Company

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Yamatake Corporation changed its name to Azbil Corporation on April 1, 2012.

Distance-Adjustable Photoelectric Switch
Model HP7-G/HP-F/HP7-S

Performance that exceeds expectations!

Reliable detection of any object under any conditions.
Compact size with super long-distance detection

Thanks to the triangulation method, objects of any color made from any material can be reliably detected. With long-distance detection of up to 750 mm, switch is suitable for use on conveyor lines.

Achieves formerly impossible performance

Compact & super range

Background Suppression type: 750 mm
Foreground Suppression type: 500 mm

Excellent basic characteristics

Detection performance
The use of triangulation and an infrared light source reduces detection distance variation resulting from differences in object color and material. Capable of detecting small differences.

Resistance to LED lighting and ambient light
Uses a new algorithm and a filter that cuts light from ambient illumination.

Temperature characteristics
Variation in sensing distance over full operating temperature range (-30 to +55 °C) is ±4 % max. (reference value when HP7-G81 is set to 500 mm).

Angle characteristics
Variation in sensing distance in the horizontal direction with a 45° incline: ±2 % max. (reference value when HP7-G81 is set to 500 mm).

Designed for ease of use

Regular installation
Industrial standard installation: mounting hole pitch of 25.4 mm (1 inch)

Metal threads
Metal screw threads improve workability by preventing stripping. Higher tightening strength (×1.6) prevents cracking of housing. *Compared to our resin threads (0.3 N·m)

Easier to use

Easier to use
Orange indicator
Green indicator
[Far] button (+)
[Center] button (C)
[Near] button (−)

Better display visibility
Models HP7-G / HP7-F
Easy and reliable adjustment using the [Center] button for tuning and [Far] and [Near] buttons for adjustment.

Model HP7-S
No adjustment required.

LINEUP

Three available models optimized for different purposes

High-performance model HP7-G
Background Suppression

High-resolution, high-precision model HP7-F
Foreground Suppression

Zone detection model HP7-S
Background suppression (fixed distance)

● Super-long 750-mm sensing distance
● Ability to tune and adjust allows detection of various types of objects

● Excellent step difference detection
● Two types, with sensing distances of 500 and 250 mm

● Sensing distance is adjusted at the factory
● Background suppression function is easier to use

Long-distance detection
Reliable detection
Adjustment is not required

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Can reliably detect multiple objects of various colors made from various materials.

Various types of corrugated cardboard cartons
Reliably detects corrugated cardboard cartons of various colors with various types of marking.

Reused pallets
Reliably detects dirty pallets of various colors.

Useful for locations where reflectors cannot be installed.

L-shape conveyors (direction converters and loaders)
The 750-mm sensing distance covers the width of the conveyor belt, simplifying switch layout.

Inspection and carry lines
Reliable detection of the target only, not the worker.

Approaching objects can be stopped at the desired position.

Can decelerate and stop moving racks
Large sensors are not required. Automatic tuning reduces setup time.

L-shape conveyors (direction converters and loaders)
Since detection does not rely on color or material, it is possible to stop objects at the same position.

Long-distance models can be located away from the target.

Between conveyor belts
Simplifies switch layout.

Objects of various heights
Detects objects of various thicknesses.

Application examples

Background suppression high-performance model Molde HP7-G
Compact, but capable of long-distance detection (to 750 mm). The automatic tuning and adjustment functions allow detection of various types of objects under various installation conditions.

Can reliably detect multiple objects of various colors made from various materials.

Foreground suppression high-resolution, high-precision model Molde HP7-F
In addition to detecting small step differences, this model can reliably detect reflective objects.

Detects thin objects
Detects reflective objects

Note: For use only with a stable background (conveyor belt, etc.).

Background suppression (fixed distance) zone detection model Molde HP7-S
Background suppression function is easier to use. Sensing distance is adjusted at the factory. Onsite adjustment is not required.

Circuit board transport
Detection at the bottom layer only of multi-layer conveyor belts
Explanation of functions

Background Suppression (Normally Open operation)

Detection function is based on the distance to the target object.
Background objects beyond the set distance are not detected.
In the figure on the left, the background and other (potentially interfering) object are not detected.

Note
Detection may not be reliable for objects with very low reflectivity or for reflective objects.

Foreground suppression function (Normally Open operation)

Detection function is based on the distance to the background object.
Effective when there is a conveyor belt or other stable background.
Enables detection of objects that cannot be detected reliably by background suppression (i.e., reflective or low reflectivity objects)
Suitable for detecting small step differences.

Note
Can be used only when there is a background object.
### Specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Distance measurement diffuse scan</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP7-G8</td>
<td>HP7-F21</td>
</tr>
<tr>
<td>HP7-G2</td>
<td>HP7-F22</td>
</tr>
</tbody>
</table>

#### Detection method
- Background Suppression
- Foreground Suppression
- Zone detection
- Background Suppression (fixed distance)

#### Distance setting method
- T: Tuning
- C: Center
- F: Far
- N: Near
- None

- Power: DC 10.2 to 28.4 V (taps: 10 % max.)
- Current consumption: 20 mA max.

#### Distance setting range (target: white paper)
- From 5 mm to set distance
- From about 25 mm to set distance

#### Sensing range (target: white paper)
- From about 30 mm to set distance
- From 5 mm to set distance

#### Sensing distance characteristic
- Graphs of sensing distance by object type

#### Hysteresis and distance characteristic
- Time response
- Operation range characteristics

#### Inclination characteristics
- Graphs of sensing distance by object type

#### Output stage circuit
- NPN type
- PNP type

#### Typical characteristics

##### Operation range characteristics
- Operation range Y [mm]
- Operation range X [mm]

##### Sensing range
- Sensing range
- Sensing range
- Sensing range

##### Hysteresis and distance characteristic
- Hysteresis and distance characteristic
- Hysteresis and distance characteristic

##### Inclination characteristics
- Inclination characteristics

The above characteristics are typical examples only, not guaranteed values. Always test first under actual conditions and allow a margin for error.

---

1. FETs are used for output components.
2. Response time may be shorter if affected by light from other switches.
3. For indicators, see p. 8.
4. HP7-G8: [HP7-F4]; Incandescent light: 10,000 lx max. Sunlight: 40,000 lx max.
5. No. ON
6. No OFF

---

The above characteristics are typical examples only, not guaranteed values. Always test first under actual conditions and allow a margin for error.
**Operation procedures (Model HP7-G / HP7-F)**

### Names of parts

- **Green indicator**
- **Orange indicator**
- **[Far] button (+)**
- **[Center] button (C)**
- **[Near] button (−)**

### Operation procedures

#### STEP 1 Disabling and setting the key lock

**Disabling the key lock**

Turn the key lock off.

Hold down the [Far] or [Near] button until the orange LED starts to blink slowly (approx. 3 seconds).

The orange LED blinks slowly (at approx. 1 Hz) when keys are unlocked.

**Enabling the key lock**

To enable the key lock, turn the power off and back on, or do the following.

Hold down the [Far] or [Near] button until the orange LED starts to blink slowly (approx. 3 seconds).

The orange LED blinks slowly (at approx. 1 Hz) when the keys are locked.

#### STEP 2 Tuning (Model HP7-G / HP7-F)

**After adjusting the optical axis, tune the device.** The set distance (OP) is automatically adjusted based on the state of the target object and background. If desired, change the set distance by doing **STEP 3**.

Hold down the [Center] button. The orange LED starts to blink, and then release.

Orange LED blinks rapidly (at approx. 10 Hz).

####STEP 3 Adjusting

After adjusting the optical axis, tune the device. The set distance (OP) is automatically adjusted based on the distance to the background. The set distance differs depending on the distance to the background. It is set slightly in front of the background (by 2 to 15 mm). If desired, change the set distance by doing **STEP 3**.

Press the [Far] button to set a longer sensing distance and the [Near] button to set a shorter one.

Quickly press and release the [Center] button. Blinking stops and normal operation begins.

Setup is complete.

### Indicator status

<table>
<thead>
<tr>
<th>Indicator</th>
<th>During normal operation</th>
<th>During tuning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Always on</td>
<td>Blink to indicate guidance</td>
</tr>
<tr>
<td>Orange</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Output operation (N.O./N.C.)

The relationship between N.O./N.C. setting and output operation is shown below:

- **With a target object**
  - Sensing distance: approx. 1 mm
  - Background suppression: approx. 20 mm
  - Foreground suppression: approx. 7 mm
- **Without target object**
  - Sensing distance: approx. 1 mm
  - Background suppression: approx. 20 mm
  - Foreground suppression: approx. 7 mm

<table>
<thead>
<tr>
<th>Setting</th>
<th>Target object</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.O.</td>
<td>Yes</td>
<td>ON</td>
</tr>
<tr>
<td>N.C.</td>
<td>No</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Helpful Hint**

Do not press and hold the button down. Doing so will lock the keys.

**Operation process flow: Relevant operation procedures**

**STEP 1** Disable key lock

**STEP 2** Adjust optical axis, tune device

**STEP 3** Adjust set distance

**Setup is complete**

### Output status

- **Far**
  - Green LED blinks rapidly (at approx. 10 Hz)
  - Orange LED indicates output status
- **Near**
  - Green LED blinks rapidly (at approx. 10 Hz)
  - Orange LED indicates output status

**Setup is complete**

### Relevant operation procedures

- **Output operation**
  - Sensing distance: approx. 1 mm
  - Background suppression: approx. 20 mm
  - Foreground suppression: approx. 7 mm

<table>
<thead>
<tr>
<th>Sensing distance</th>
<th>Background Suppression</th>
<th>Foreground Suppression</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 mm</td>
<td>Approx. 2.5 mm</td>
<td>Approx. 0.5 mm</td>
</tr>
<tr>
<td>500 mm</td>
<td>Approx. 5 mm</td>
<td>Approx. 1.5 mm</td>
</tr>
<tr>
<td>750 mm</td>
<td>Approx. 10 mm</td>
<td></td>
</tr>
</tbody>
</table>