**ORDER GUIDE**

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<td>NPN open collector</td>
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## SPECIFICATIONS

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<th>Thru-scan</th>
<th>Limited diffuse scan</th>
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<td>HPJ-T1</td>
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<td>HPJ-D21</td>
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<tr>
<td></td>
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<td>HPJ-A21</td>
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<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>10.8 to 26.4 Vdc (ripple 10% max.)</th>
</tr>
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<tr>
<td>Current consumption</td>
<td>Emitter 20 mA max.</td>
</tr>
<tr>
<td></td>
<td>Receiver 20 mA max.</td>
</tr>
<tr>
<td>Scanning distance</td>
<td>1.5 m</td>
</tr>
<tr>
<td>Directional angle</td>
<td>Opaque object 4 mm dia. max.</td>
</tr>
<tr>
<td>Standard target object</td>
<td>—</td>
</tr>
<tr>
<td>Scanning angle</td>
<td>3 to 20˚</td>
</tr>
<tr>
<td>Differential travel</td>
<td>—</td>
</tr>
<tr>
<td>Operation mode</td>
<td>Dark ON</td>
</tr>
<tr>
<td>Output mode</td>
<td>NPN</td>
</tr>
<tr>
<td>Control output</td>
<td>Output switching circuit: 100 mA max. (resistive load)</td>
</tr>
<tr>
<td></td>
<td>Voltage drop: 1V max. (at 100 mA switching circuit)</td>
</tr>
<tr>
<td></td>
<td>Output dielectric strength: 26.4V</td>
</tr>
<tr>
<td>Response time</td>
<td>1ms max. for operation and recovery</td>
</tr>
<tr>
<td>Sensitivity adjustment</td>
<td>—</td>
</tr>
<tr>
<td>Light emitter</td>
<td>Infrared LED</td>
</tr>
<tr>
<td>Indicator lamps</td>
<td>Operation indicator (other than thru scan emitter): red (lit at output ON)</td>
</tr>
<tr>
<td>Ambient light immunity</td>
<td>Incandescent lamp: 3,000 lx max., Sunlight: 10,000 lx max.</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>–20 to +50˚C</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>–40 to +70˚C</td>
</tr>
<tr>
<td>Humidity range</td>
<td>35 to 85%RH (condensation not allowed)</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>20 MΩ min (by 500 Vdc megger)</td>
</tr>
<tr>
<td>Dielectric strength</td>
<td>1,000 Vac (50/60 Hz) for 1 minute between case and electrically live metals</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55, 1.5 mm peak-to-peak amplitude, 2 hrs in X, Y, and Z directions</td>
</tr>
<tr>
<td>Shock resistance</td>
<td>500 m/s² 3 times in X, Y and Z directions</td>
</tr>
<tr>
<td>Protection</td>
<td>IP40 (IEC standard)</td>
</tr>
<tr>
<td>Wiring method</td>
<td>Pre-leaded</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 20 g for both emitter and receiver (with 2 m cable)</td>
</tr>
<tr>
<td>Circuit protection</td>
<td>Reverse connection protection circuit</td>
</tr>
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## ATTACHMENTS (sold separately)

<table>
<thead>
<tr>
<th>Name</th>
<th>Shape</th>
<th>Description</th>
<th>Catalog listing</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slits for thru scan model</td>
<td><img src="Slits.png" alt="Slits" /></td>
<td>Single set includes 1.5 mm dia., 3 dia., vertical 1 mm width, vertical 2 mm width, horizontal 1 mm width, horizontal 2 mm width (for emitter and receiver) slits</td>
<td>HPJ-U01</td>
<td>HPJ-T11, T21 T22, T23</td>
</tr>
<tr>
<td>Bracket for thru scan model</td>
<td><img src="Bracket.png" alt="Bracket" /></td>
<td>Q’ty: 1 (supplied with HPJ-T11)</td>
<td>HPJ-B01</td>
<td>HPJ-B02</td>
</tr>
<tr>
<td></td>
<td><img src="Bracket.png" alt="Bracket" /></td>
<td>Q’ty: 1 (supplied with HPJ-T21, T22, T23)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHARACTERISTICS DIAGRAMS

- Thru scan HPJ-T11, T21
  - Excess gain (Light receiving level margin) (typical example)
  - Parallel motion characteristics (typical examples)

- Normal
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 1.5 mm dia. slit mounted at emitter
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 1.5 mm dia. slit mounted at receiver
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 1.5 mm dia. slit mounted at both emitter and receiver
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 3 mm dia. slit mounted at emitter
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 3 mm dia. slit mounted at receiver
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 3 mm dia. slit mounted at both emitter and receiver
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 1 mm wide vertical slit mounted at emitter
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 1 mm wide vertical slit mounted at receiver
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 1 mm wide vertical slit mounted at both emitter and receiver
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 2 mm wide vertical slit mounted at emitter
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 2 mm wide vertical slit mounted at receiver
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 2 mm wide vertical slit mounted at both emitter and receiver
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 1 mm wide horizontal slit mounted at emitter
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 1 mm wide horizontal slit mounted at receiver
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 1 mm wide horizontal slit mounted at both emitter and receiver
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 2 mm wide horizontal slit mounted at emitter
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 2 mm wide horizontal slit mounted at receiver
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]

- 2 mm wide horizontal slit mounted at both emitter and receiver
- Parallel motion, distance X [mm]
  - -50 -40 -30 -20 -10 0 10 20 30 40 50
  - Scanning distance L [cm]
Angular characteristics (typical example)

Scanning distance characteristics (typical values) when slit HPJ-U01 is attached (comparison with slit not attached)

<table>
<thead>
<tr>
<th>Slit Condition</th>
<th>No slit</th>
<th>1.5mm dia.</th>
<th>3mm dia.</th>
<th>1mm wide horizontal</th>
<th>2mm wide horizontal</th>
<th>1mm wide vertical</th>
<th>2mm wide vertical</th>
</tr>
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<tr>
<td>Used on emitter</td>
<td>100%</td>
<td>5%</td>
<td>40%</td>
<td>20%</td>
<td>40%</td>
<td>20%</td>
<td>40%</td>
</tr>
<tr>
<td>Used on emitter or receiver</td>
<td>100%</td>
<td>30%</td>
<td>60%</td>
<td>40%</td>
<td>60%</td>
<td>40%</td>
<td>60%</td>
</tr>
</tbody>
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Limited diffuse scan model HPJ-D21, HPJ-D22

Excess gain (Light receiving level margin) (typical example)

Detection area characteristics

Horizontal movement

Vertical movement

Object characteristics

Limited diffuse scan model HPJ-A21

Excess gain (Light receiving level margin) (typical example)

Detection area characteristics

Horizontal movement

Vertical movement

Sensitivity adjustment potentiometer rotation angle characteristics

Object characteristics
**EXTERNAL DIMENSIONS**

(Vertical type) HPJ-T21, T22, T23, (supplied with bracket HPJ-B02)

* Thru scan
  * (Horizontal type) HPJ-T11 (supplied with bracket HPJ-B01)

Note: Cord color: Gray (receiver), Black (emitter)

- Limited diffuse scan model
  * HPJ-D21, D22, A21 (bracket supplied)

Note: Cord color: Gray
OUTPUT STAGE CIRCUIT DIAGRAM

- Thru-scan receiver / Limited diffuse scan
  - NPN open collector type

\[ \text{Vcc} \quad \text{Brown} \]
\[ \text{Output} \quad \text{Black} \]
\[ \text{Main circuit} \quad \text{GND} \quad \text{Blue} \]

- Thru-scan emitter

\[ \text{Vcc} \quad \text{Brown} \]
\[ \text{Main circuit} \quad \text{GND} \quad \text{Blue} \]

- Thru-scan receiver / Limited diffuse scan
  - PNP open collector type

\[ \text{Brown} \]
\[ \text{Main circuit} \quad \text{Black} \quad \text{Blue} \]

80 mA or less
10.8 to 26.4Vdc

Bracket (Sold separately)
- Bracket for thru scan model: HPJ-B01

Bracket for thru scan model: HPJ-B02

Slit (attachable on thru scan model)
- HPJ-U01

Translucent material
Background printed black
Mounting board

Load
Blue
Black
Brown

Control output

10.8 to 26.4Vdc

Load
SENSITIVITY ADJUSTMENT

When there are many types of target objects or the sensing position changes, we recommend that operation be checked during trial operation adjustments.

During this operation, make sure that adjustments are not influenced by light reflected from surrounding objects.

• Thru scan model
  - Temporarily install the emitter and receiver in a straight line so that they face each other.
  - Move the emitter vertically and horizontally, and fix it at the center of the area where the receiver’s operating indicator turns OFF.
  - Move the receiver vertically and horizontally, and fix it at the center of the area where its operating indicator turns OFF.
  - Place a target between the emitter and receiver. Make sure that the indicator turns ON.

• Limited diffuse scan model
  - Mount the photoelectric switch facing the sensing position.
  - Next, with no target object placed, gradually rotate the sensitivity adjustment control from MAX towards MIN until the indicator turns OFF. Take this position as B.
  - If the indicator turns OFF even if the sensitivity adjustment control is at MAX, take the MAX position as A.
  - Place the target object at the predetermined position, and gradually rotate the sensitivity adjustment control from MIN towards MAX until the operation indicator turns ON. Take this position as A and B.

BASIC PRECAUTIONS

• Wiring Precautions
  - Route the cord separately from electric or power lines or through an exclusive conduit. Otherwise, electrical noise or power surge may cause incorrect operation or damage.
  - When extending cords, use 0.3mm² min. cable. Keep the cable length to within 100m.
  - When using a commercially available switching regulator, ground the FG (frame ground) terminal. Otherwise, switching noise may cause incorrect operation.
  - When using a load that generates rush current (e.g. capacitive load, ramp load), connect a current-limiting resistor between the load and the output. Otherwise, the output may become damaged.
  - Do not connect the output terminal without a load. Doing so might damage the output transistor.

• Handling Precautions
  - Do not swing the photoelectric switch by its cord.
  - Do not tug the cord with excessive force (30N or more). Doing so might break the cord.
  - The photoelectric switch is precision assembled. Do not allow objects to hit the switch, in particular, its lens. Scratches or cracks in the lens might impair its characteristics.
  - If dirty, wipe with a soft, clean cloth. Do not use benzene, acetone, paint thinner or other organic solvents.
  - Do not bend the part of the cord nearest to the photoelectric switch with a minimum radius of 20mm. Also, avoid applying continuous bending stress.
  - Do not turn the sensitivity adjustment control at a torque greater than 0.02N·m.
  - It takes about 1ms for operation to stabilize after the power is turned ON.
  - Be careful of mutual interference when two or more photoelectric switches are used in close proximity.
  - Tighten the mounting screws to a torque of 0.5 N·m or less. If a bracket or screws other than those supplied with the switch are used, the allowable tightening torque may differ depending on the bracket, the material of the screws, and the condition of the surface.
  - For outdoor use, put inside a case, etc., To prevent direct exposure to sunlight and rain water.
  - Avoid locations with strong vibration or impact. They may cause optical axis misalignment.
  - Shield the lens from water and oil. Water or oil on the lens can cause faulty operation.
  - Do not expose to chemicals (Organic solvents, acids, alkalis).
  - Use a cover or change the mounting direction to ensure correct switch operation if there is heavy interference from ambient light.
  - When used in a very dusty environment, be sure to take countermeasures to keep dust away from the lens surface by using a sealed case or air purging.

Before use, thoroughly read the “Precautions for use” and “Precautions for handling” in the Technical Guide on pages A-141 to A-156 as well as the instruction manual and product specification for this switch.