Ultraminiature Photoelectric Sensors with Self-contained Amplifier CE

HPJ Series

Fingertip-size, Provided with a various slit attachments. (six types)

- **Fingertip-size** 22 x 11 x 8mm (thru scan model)
  30 x 12 x 8mm (limited diffuse scan model)
- **Long distance scanning** 1.5m (thru scan model)
  30±5mm (limited diffuse scan model)
- **Various slit attachments** (six types)

A PHOTOELECTRIC SENSORS
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ORDER GUIDE

Shape	Scanning method		Scanning distance	Supply voltage	Output mode	Operation mode: Light ON	Operation mode: Dark ON	Sensitivity adjustment	Catalog listing
Horizontal type 	Thru scan		1.5m	10.8 to 26.4Vdc	NPN open collector	–	○	–	**HPJ-T11**
			0.5m			–	○	○	**HPJ-T11G**
Vertical type 			1.5m			–	○	–	**HPJ-T21**
			0.5m			–	○	○	**HPJ-T21G**
			1.5m		PNP open collector	–	○	–	**HPJ-T22**
					NPN open collector	○	–	–	**HPJ-T23**
	Limited diffuse scan	Red LED	3±0.5cm		NPN open collector	○	–	○	**HPJ-D21**
					PNP open collector	○	–	○	**HPJ-D22**
		Infrared LED			NPN open collector	○	–	○	**HPJ-A21**
					PNP open collector	○	–	○	**HPJ-A22**

SPECIFICATIONS

Scanning method	Thru scan				Limited diffuse scan			
Catalog listing	**HPJ-T□1**	**HPJ-T□1G**	**HPJ-T22**	**HPJ-T23**	**HPJ-D21**	**HPJ-D22**	**HPJ-A21**	**HPJ-A22**
Supply voltage	10.8 to 26.4Vdc (ripple 10% max.)							
Current consumption	Emitter 20mA max. Receiver 20mA max.	Emitter 10mA max. Receiver 20mA max.	Emitter 20mA max. Receiver 20mA max.		20mA max.			
Scanning distance	1.5m	0.5m	1.5m		30±5mm			
Detection object	Opaque object 6mm dia. max.	Opaque object 4mm dia. max.	Opaque object 6mm dia. max.		–			
Standard target object	–				10×10cm KODAK 90% white paper used		10×10cm KODAK 18% white paper used	
Scanning angle	2 to 20°	3 to 30°	2 to 20°		–			
Differential travel	–				25% max.			
Operation mode	Dark ON			Light ON	Light ON			
Output mode	NPN		PNP	NPN	NPN	PNP	NPN	PNP
Control output	Output switching circuit: 100mA max. (resistive load) Voltage drop: 1V max. (at 100mA switching circuit) Output dielectric strength: 26.4V	Output switching circuit: 80mA max. (resistive load) Voltage drop: 1V max. (at 80mA switching circuit) Output dielectric strength: 26.4V	Output switching circuit: 100mA max. (resistive load) Voltage drop: 1V max. (at 100mA switching circuit) Output dielectric strength: 26.4V		Output switching circuit: 80mA max. (resistive load) Voltage drop: 1V max. (at 80mA switching circuit) Output dielectric strength: 26.4V			
Response time	1ms max. for operation and recovery							
Sensitivity adjustment	–	1-turn control	–		1-turn control			
Light emitter	Infrared LED				Red LED		Infrared LED	
Indicator lamps	Operation indicator (other than thru scan emitter): red (lit at output ON)							
Ambient light immunity	Incandescent lamp: 3,000lx max., Sunlight: 10,000lx max.							
Operating temperature range	−20 to +50°C							
Storage temperature range	−40 to +70°C							
Humidity range	35 to 85%RH (condensation not allowed)							
Insulation resistance	20MΩ min. (by 500Vdc megger)							
Dielectric strength	1,000Vac (50/60Hz) for 1 minute between case and electrically live metals	Non-controlled sections: 1,000Vac (50/60Hz) for 1 minute Controlled sections: 500Vac (50/60Hz) for 1 minute between case and electrically live metals	1,000Vac (50/60Hz) for 1 minute between case and electrically live metals		Non-controlled sections: 1,000Vac (50/60Hz) for 1 minute Controlled sections: 500Vac (50/60Hz) for 1 minute between case and electrically live metals			
Vibration resistance	10 to 55Hz, 1.5mm peak-to-peak amplitude, 2 hrs in X, Y and Z directions							
Shock resistance	500m/s² 3 times in X, Y and Z directions							
Protection	IP40 (IEC standard)							
Wiring method	Pre-leaded							
Weight	Approx. 20g for both emitter and receiver (with 2m cable)	Approx. 25g for both emitter and receiver (with 2m cable)	Approx. 20g for both emitter and receiver (with 2m cable)		Approx. 20g (with 2m cable)			
Circuit protection	Reverse connection protection circuit							

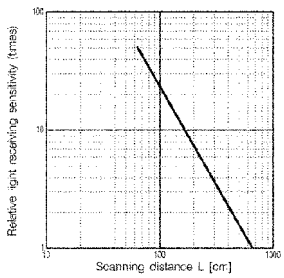
ATTACHMENTS (sold separately)

Name	Shape	Description	Catalog listing	Applicable model
Slits for thru scan model		Single set includes 1.5mm dia., 3mm dia., vertical 1mm width, vertical 2mm width, horizontal 1mm width, horizontal 2mm width (for emitter and receiver) slits	**HPJ-U01**	**HPJ-T11, T11G, T21, T21G, T22, T23**
Bracket for thru scan model		Q'ty: 1 (supplied with **HPJ-T11**)	**HPJ-B01**	**HPJ-T11, T11G, T21, T21G, T22, T23**
Bracket for thru scan model		Q'ty: 1 (supplied with **HPJ-T21, T22, T23**)	**HPJ-B02**	**HPJ-T11, T11G, T21, T21G, T22, T23**

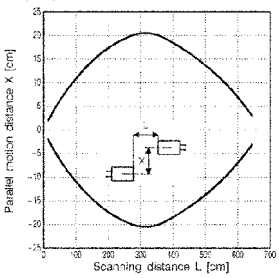
CHARACTERISTICS DIAGRAMS

● Thru scan HPJ-T11, T21, T22, T23

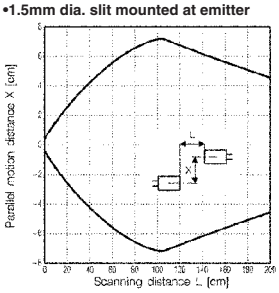
● Excess gain (Light receiving level margin) (typical example) ● Parallel motion characteristics (typical examples)



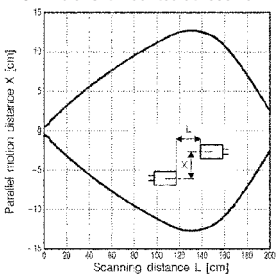
•Normal



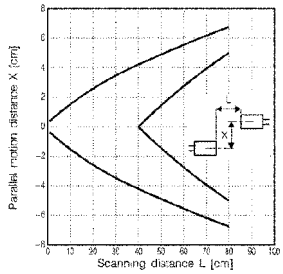
•1.5mm dia. slit mounted at emitter



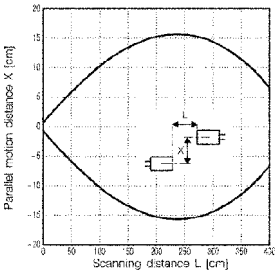
•1.5mm dia. slit mounted at receiver



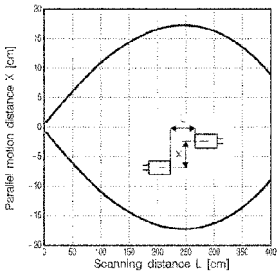
•1.5mm dia. slit mounted at both emitter and receiver



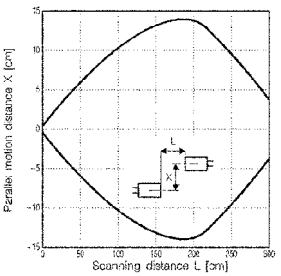
•3mm dia. slit mounted at emitter



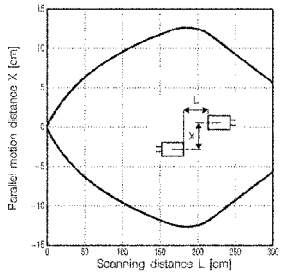
•3mm dia. slit mounted at receiver



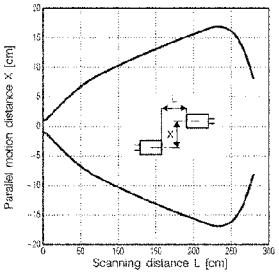
•3mm dia. slit mounted at bothemitter and receiver



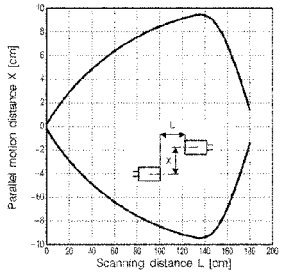
•1mm wide vertical slit mounted at emitter



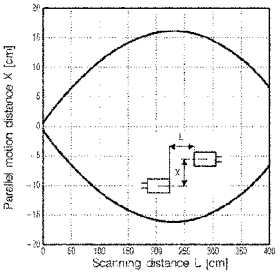
•1mm wide vertical slit mounted at receiver



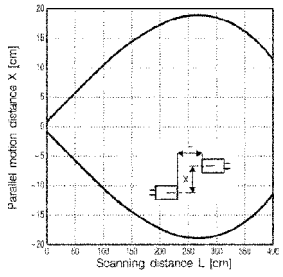
•1mm wide vertical slit mounted at both emitter and receiver



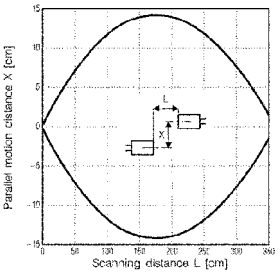
•2mm wide vertical slit mounted at emitter



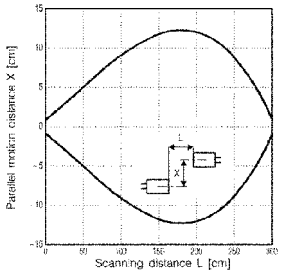
•2mm wide vertical slit mounted at receiver



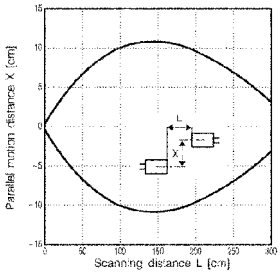
•2mm wide vertical slit mounted at both emitter and receiver



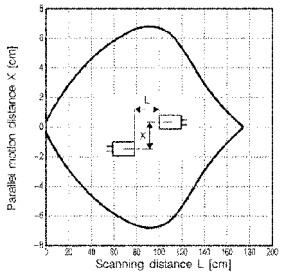
•1mm wide horizontal slit mounted at emitter



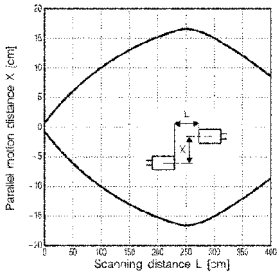
•1mm wide horizontal slit mounted at receiver



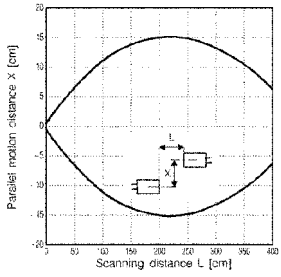
•1mm wide horizontal slit mounted at both emitter and receiver



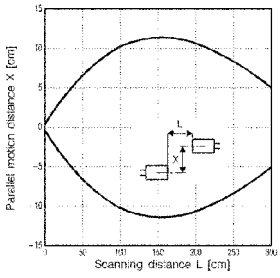
•2mm wide horizontal slit mounted at emitter



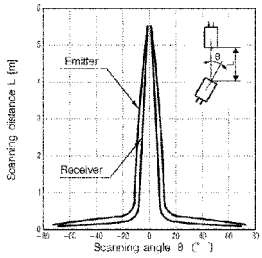
•2mm wide horizontal slit mounted at receiver



•2mm wide horizontal slit mounted at both emitter and receiver



● **Angular characteristics (typical example)**

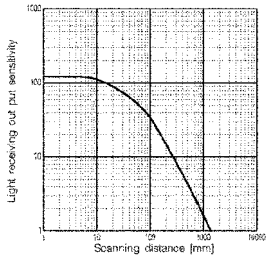


● **Scanning distance characteristics (typical values) when slit HPJ-U01 is attached (comparison with slit not attached)**

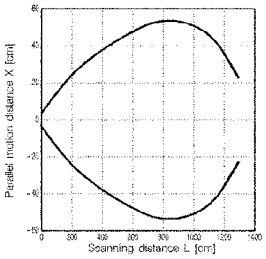
	Used on emitter	Used on emitter or receiver
No slit	100%	100%
1.5mm dia.	5%	30%
3mm dia.	40%	60%
1mm wide horizontal	20%	40%
2mm wide horizontal	40%	60%
1mm wide vertical	20%	40%
2mm wide vertical	40%	60%

● Thru scan HPJ-T11G, T21G (sensitivity adjustment)

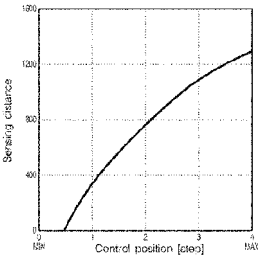
● **Excess gain (Light receiving level margin) (typical example)**



● **Parallel motion characteristics (typical example)**

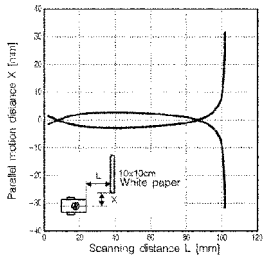


● **Control position vs. sensing distance characteristics**

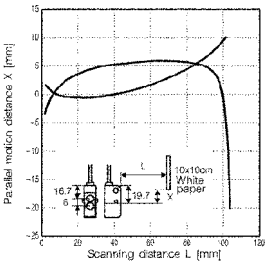


● **Detection area characteristics**

•Horizontal movement

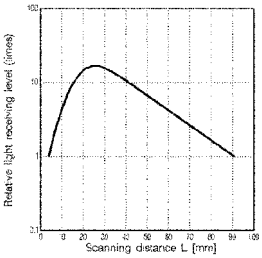


•Vertical movement

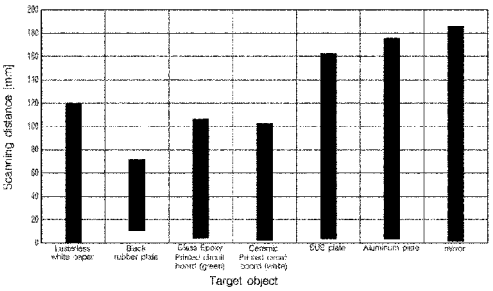


● Limited diffuse scan model HPJ-D21

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

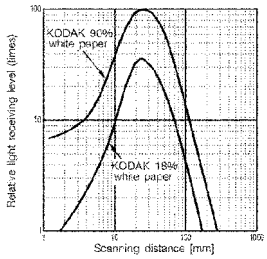


● **Object characteristics**



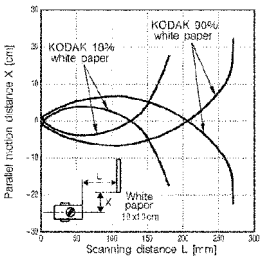
● Limited diffuse scan model HPJ-A21

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

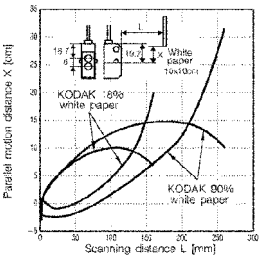


● **Detection area characteristics**

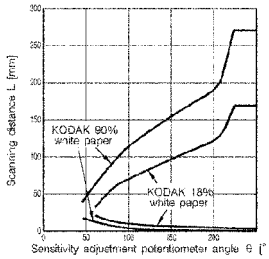
•Horizontal movement



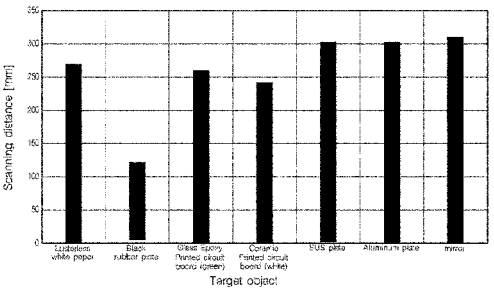
•Vertical movement



● **Sensitivity adjustment potentiometer rotation angle characteristics**



● **Object characteristics**

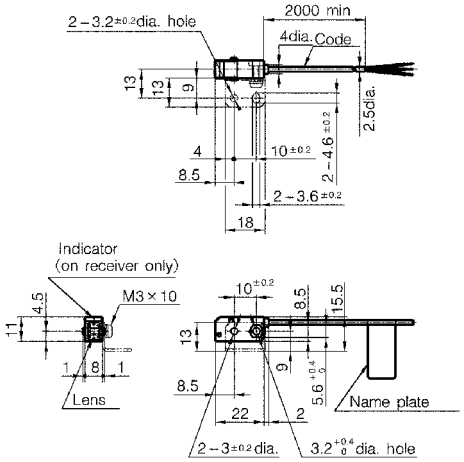


EXTERNAL DIMENSIONS

(unit: mm)

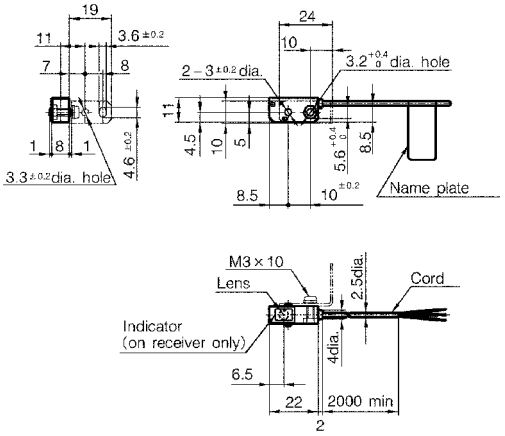
● Thru scan

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



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

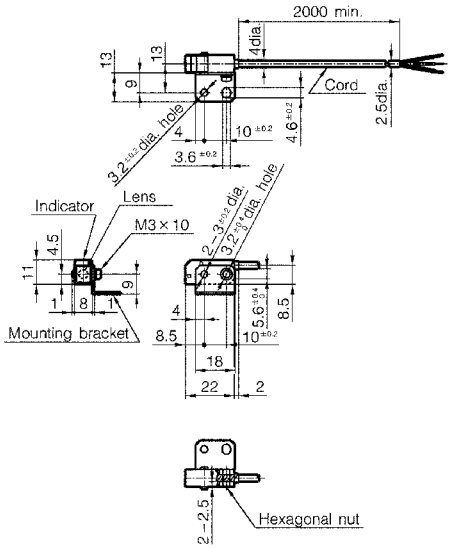
• (Vertical type) **HPJ-T21, T22, T23** (supplied with bracket **HPJ-B02**)



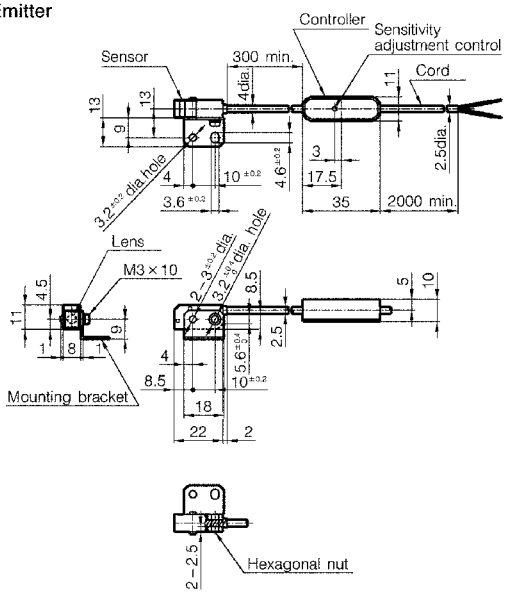
Note: Cord color: Gray (receiver), Black (emitter)

• (Sensitivity adjustment horizontal type) **HPJ-T11G** (supplied with bracket **HPJ-B01**)

Receiver



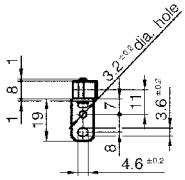
Emitter

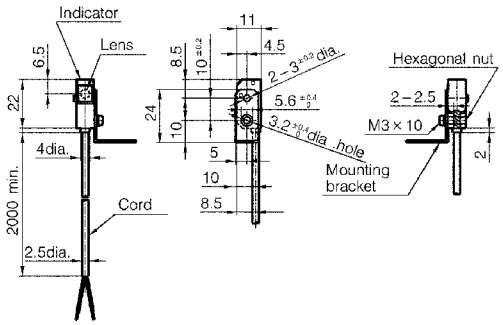


Note: Cord color: Gray (receiver), Black (emitter)

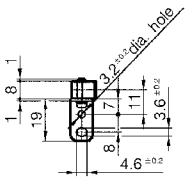
• (Sensitivity adjustment vertical type) **HPJ-T21G** (supplied with bracket **HPJ-B02**)

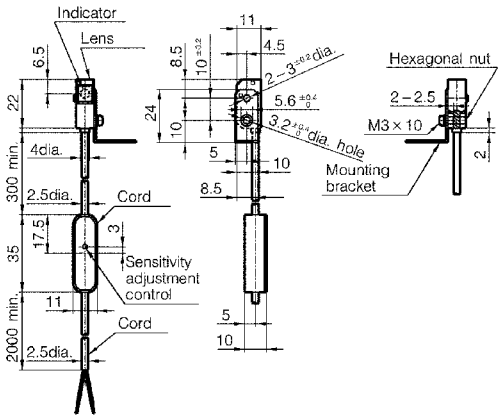
Receiver





Emitter

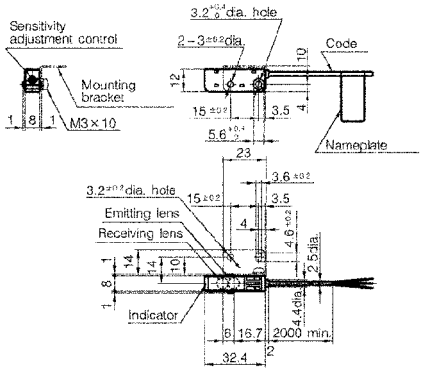




Note: Cord color: Gray (receiver), Black (emitter)

● Limited diffuse scan model

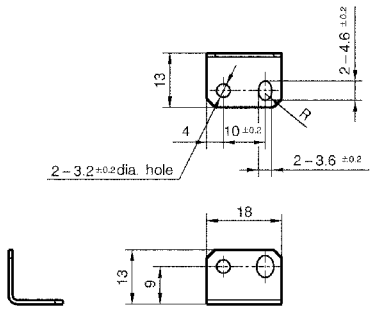
• **HPJ-D2□, A2□** (bracket supplied)



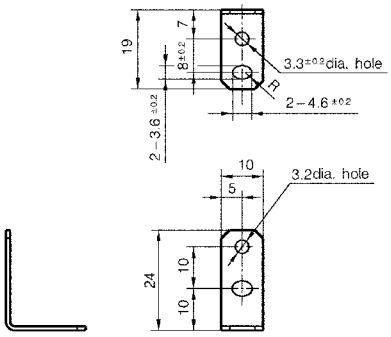
Note: Cord color: Gray

● Bracket (Sold separately)

• Bracket for thru scan model: **HPJ-B01**

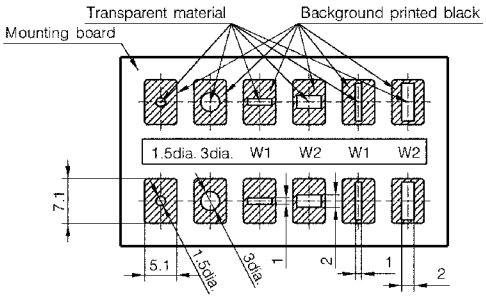


• Bracket for thru scan model: **HPJ-B02**

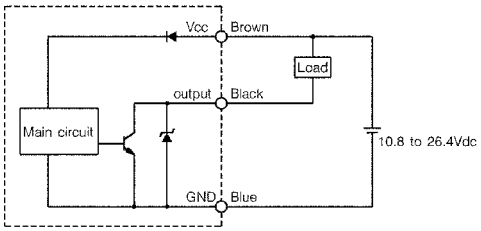


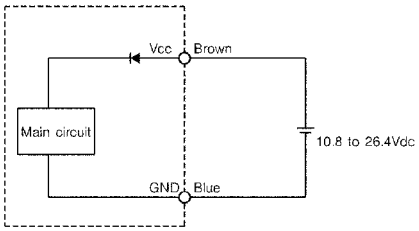
● Slit (attachable on thru scan model)

• **HPJ-U01**



OUTPUT STAGE CIRCUIT DIAGRAM





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 (turns ON in the case of the **T23**).
- Move the receiver vertically and horizontally, and fix it at the center of the area where its operating indicator turns OFF (turns OFF in the case of the **T23**).
- Place a target between the emitter and receiver. Make sure that the indicator turns ON (turns OFF in the case of the **T23**). The following procedure must be carried out if the sensitivity adjustment control on the **HPJ-T□G** is being adjusted.
- With the target object placed at the predetermined position, gradually rotate the sensitivity adjustment control from MAX towards MIN until the operation indicator turns ON. Take this position as A.
- Next, with no target object placed, gradually rotate the sensitivity adjustment control from MIN towards MAX until the indicator turns OFF. Take this position as B.
- Set the sensitivity adjustment control at position C between A and B.

● Limited diffuse scan model

- Mount the photoelectric sensor 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 grdually rotate the sensitivity adjustment control from MIN towards MAX until the operation indicator turns ON. Take this poisition as B.
- Set the sensitivity adjustment control at position C between 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 0.3mm^2 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 sensor by its cord.
- Do not tug the cord with excessive force (30N or more). Doing so might break the cord.
- The photoelectric sensor is precision assembled. Do not allow objects to hit the sensor, 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 sensor 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 photo electric sensors are used in close proximity.
- Tighten the mounting screw at a torque of less than 0.5N-m.
- Do not use in an atmosphere with chemicals (organic solvents, acid, alkali).
- Prevent water or oil from splashing the photoelectric sensor.
- Confirm stable operation by shielding the hood or changing its mounting direction if ambient light is very strong.
- Do not use outdoors.
- Keep dirt or dust away from the lens by inserting in a sealed case or by applying air purge.
- Avoid use in locations subject to large vibrations or shock which may cause misalignment of the optical axis.