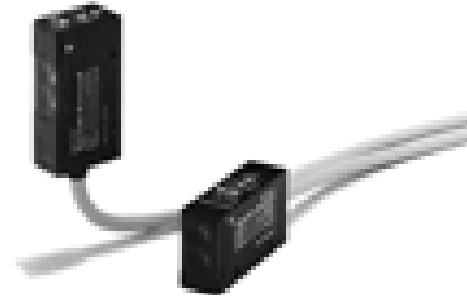


HPA Series Self-contained Photoelectric Sensors with High Functions

FEATURES

Strobe Light Emission, High Margin Regulation, Front Incoming Light Display, and Output Inhibit Functions Allow Sensing Range to be Reliably Adjusted at High Speed.

- Strobe light emission permits you to easily confirm the sensing range. (high performance thru scan and polarized retroreflective)
- The high margin regulation function permits you to adjust sensing range at a margin three times greater than usual. (high performance thru scan and polarized retroreflective)
- The front incoming light display facilitates adjustment of the sensing range. (thru scan)
- The Output Inhibit function permits secure adjustment of the sensing range while debugging the PLC. (high performance thru scan and polarized retro-reflective)
- An automatic pulse-phase shift system enhances mutual interference pre-vention. (polarized retroreflective type and diffuse scan)
- The binary latching self-diagnostic function permits online checking of incoming light for instability/shielded status.
- A high sealing monoblock housing. (IP67)
- Universal Features (PNP, DIN mounting)
- A polarized retroreflective model for transparent object detection is available.
- Diffuse scan small-spot detection is realized by a narrow-view lens attachment. (2mm dia. spot diameter)



ORDER GUIDE



- Pre-leaded type (2m lead)

| Model | Detection method | | Scanning distance | Light ON/dark ON selectable | Sensitivity adjustment | Self-diagnostic indication | Self-diagnostic output | Triple alignment (initial setting) function (Note 1) | Front light incoming indication | Supply voltage | Output mode | Catalog listing | | | | | | |
|----------------|------------------|---------------------------|--|-----------------------------|------------------------|----------------------------|------------------------|--|---------------------------------|----------------|--------------------|-----------------|---|--------------------|---------|--------------------|---------|--|
| Horizontal | Thru scan | General use | 10m | ○ | ○ (Note 2) | ○ | - | - | ○ | 10 to 30V dc | NPN open collector | HPA-T11 | | | | | | |
| | | High function | | | | | - | - | | | PNP open collector | HPA-T12 | | | | | | |
| | | Polarized retroreflective | General use | | | | 4m | ○ | | | ○ | - | - | NPN open collector | HPA-T13 | | | |
| | | | High function | | | | | | | | | ○ | ○ | PNP open collector | HPA-T14 | | | |
| | | | Transparent object detection polarized retroreflective | | | | 0.3 to 1m | | | | | ○ | ○ | - | - | NPN open collector | HPA-P11 | |
| | | | | | | | 20cm | | | | | | | ○ | ○ | PNP open collector | HPA-P12 | |
| | 80cm | | | ○ | ○ | NPN open collector | HPA-P13 | | | | | | | | | | | |
| | 80cm | | | ○ | ○ | PNP open collector | HPA-P14 | | | | | | | | | | | |
| | Diffuse scan | 20cm | | ○ | ○ | - | - | NPN open collector | HPA-F11 | | | | | | | | | |
| | | 80cm | | | | - | - | NPN open collector | HPA-D11 | | | | | | | | | |
| | | 20cm | | | | - | - | PNP open collector | HPA-D12 | | | | | | | | | |
| | | 80cm | | | | - | - | NPN open collector | HPA-A11 | | | | | | | | | |
| 20cm | | - | - | | | PNP open collector | HPA-A12 | | | | | | | | | | | |
| 80cm | | - | - | | | NPN open collector | HPA-T21 | | | | | | | | | | | |
| Vertical | Thru scan | General use | 10m | ○ | ○ (Note 2) | ○ | - | - | ○ | 10 to 30V dc | NPN open collector | HPA-T22 | | | | | | |
| | | High function | | | | | - | - | | | PNP open collector | HPA-T23 | | | | | | |
| | | Polarized retroreflective | General use | | | | 4m | ○ | | | ○ | - | - | NPN open collector | HPA-T24 | | | |
| | | | High function | | | | | | | | | ○ | ○ | PNP open collector | HPA-P21 | | | |
| | | | Transparent object detection polarized retroreflective | | | | 0.3 to 1m | | | | | ○ | ○ | - | - | NPN open collector | HPA-P22 | |
| | | | | | | | 20cm | | | | | | | ○ | ○ | PNP open collector | HPA-P23 | |
| | 80cm | | | ○ | ○ | NPN open collector | HPA-P24 | | | | | | | | | | | |
| | 80cm | | | ○ | ○ | PNP open collector | HPA-P24 | | | | | | | | | | | |
| | Diffuse scan | 20cm | | ○ | ○ | - | - | NPN open collector | HPA-F21 | | | | | | | | | |
| | | 80cm | | | | - | - | NPN open collector | HPA-D21 | | | | | | | | | |
| | | 20cm | | | | - | - | PNP open collector | HPA-D22 | | | | | | | | | |
| | | 80cm | | | | - | - | NPN open collector | HPA-A21 | | | | | | | | | |
| 20cm | | - | - | | | PNP open collector | HPA-A22 | | | | | | | | | | | |
| 80cm | | - | - | | | NPN open collector | HPA-A22 | | | | | | | | | | | |

Note 1: Triple alignment function: Stroboscopic light emitting function, high margin adjustment function, output inhibit function

Note 2: Sensitivity adjustment VR is provided on the emitter of high function models.


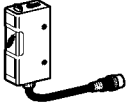
● Connector type

| Model | Detection method | | Scanning distance | Light ON/ dark ON selectable | Sensitivity adjustment | Self-diagnostic indication | Self-diagnostic output | Triple alignment (initial setting) function (Note 1) | Front light incoming indication | Supply voltage | Output mode | Catalog listing | |
|---|---|---------------------------|-------------------|------------------------------------|---------------------------|-------------------------------|---------------------------|--|---------------------------------------|--------------------|--------------------|--------------------|--------------------|
| Horizontal  | Thru scan | General use | 10m | ○ | ○ (Note 2) | ○ | - | - | ○ | 10 to 30V dc | NPN open collector | HPA-T31 | |
| | | High function | | | | | ○ | ○ | | | ○ | ○ | ○ |
| | Polarized retroreflective | General use | 4m | ○ | ○ | ○ | - | - | - | | NPN open collector | HPA-P31 | |
| | | High function | | | | | ○ | ○ | | | ○ | ○ | ○ |
| | Diffuse scan | 20cm | ○ | ○ | ○ | - | - | - | NPN open collector | | HPA-D31 | | |
| | | | | | | 80cm | - | | - | | - | - | PNP open collector |
| | | 80cm | - | - | - | | - | - | NPN open collector | | HPA-A31 | | |
| | | | - | - | - | - | - | - | - | | PNP open collector | HPA-A32 | |
| | Vertical  | Thru scan | General use | 10m | ○ | ○ (Note 2) | ○ | - | - | | ○ | NPN open collector | HPA-T41 |
| | | | High function | | | | | ○ | ○ | | | ○ | ○ |
| | | Polarized retroreflective | General use | 4m | ○ | ○ | ○ | - | - | | - | NPN open collector | HPA-P41 |
| | | | High function | | | | | ○ | ○ | | | ○ | ○ |
| Diffuse scan | | 20cm | ○ | ○ | ○ | - | - | - | NPN open collector | HPA-D41 | | | |
| | | | | | | 80cm | - | | - | - | - | PNP open collector | HPA-D42 |
| | | 80cm | - | - | - | | - | - | NPN open collector | HPA-A41 | | | |
| | | | - | - | - | - | - | - | - | PNP open collector | HPA-A42 | | |

Note 1: Triple alignment function: Stroboscopic light emitting function, high margin adjustment function, output inhibit function

Note 2: Sensitivity adjustment VR is provided on the emitter of high function models.

● Pre-leaded connector type (30cm lead)

| Model | Detection method | | Scanning distance | Light ON/ dark ON selectable | Sensitivity adjustment | Self-diagnostic indication | Self-diagnostic output | Triple alignment (initial setting) function (Note 1) | Front light incoming indication | Supply voltage | Output mode | Catalog listing | |
|---|---|---------------------------|-------------------|------------------------------------|---------------------------|-------------------------------|---------------------------|--|---------------------------------------|--------------------|--------------------|--------------------|--------------------|
| Horizontal  | Thru scan | General use | 10m | ○ | ○ (Note 2) | ○ | - | - | ○ | 10 to 30V dc | NPN open collector | HPA-T51 | |
| | | High function | | | | | ○ | ○ | | | ○ | ○ | ○ |
| | Polarized retroreflective | General use | 4m | ○ | ○ | ○ | - | - | - | | NPN open collector | HPA-P51 | |
| | | High function | | | | | ○ | ○ | | | ○ | ○ | PNP open collector |
| | Diffuse scan | 20cm | ○ | ○ | ○ | - | - | - | NPN open collector | | HPA-D51 | | |
| | | | | | | 80cm | - | | - | | - | - | PNP open collector |
| | | 80cm | - | - | - | | - | - | NPN open collector | | HPA-A51 | | |
| | | | - | - | - | - | - | - | - | | PNP open collector | HPA-A52 | |
| | Vertical  | Thru scan | General use | 10m | ○ | ○ (Note 2) | ○ | - | - | | ○ | NPN open collector | HPA-T61 |
| | | | High function | | | | | ○ | ○ | | | ○ | ○ |
| | | Polarized retroreflective | General use | 4m | ○ | ○ | ○ | - | - | | - | NPN open collector | HPA-P61 |
| | | | High function | | | | | ○ | ○ | | | ○ | ○ |
| Diffuse scan | | 20cm | ○ | ○ | ○ | - | - | - | NPN open collector | HPA-D61 | | | |
| | | | | | | 80cm | - | | - | - | - | PNP open collector | HPA-D62 |
| | | 80cm | - | - | - | | - | - | NPN open collector | HPA-A61 | | | |
| | | | - | - | - | - | - | - | - | PNP open collector | HPA-A62 | | |

Note 1: Triple alignment function: Stroboscopic light emitting function, high margin adjustment function, output inhibit function

Note 2: Sensitivity adjustment VR is provided on the emitter of high function models.

SPECIFICATIONS

| Detection method | Thru scan | | Polarized retroreflective | | | Diffuse scan | |
|-------------------------------|--|--------------------|--|--------------------|---|--------------------------------|---------------------------------------|
| Model | General | High function | General | High function | Transparent object detection | Short distance | Long distance |
| Catalog listing | HPA-T□1 HPA-T□2 | HPA-T□3 HPA-T□4 | HPA-P□1 HPA-P□2 | HPA-P□3 HPA-P□4 | HPA-F11 HPA-F21 | HPA-D□1 HPA-D□2 | HPA-A□1 HPA-A□2 |
| Supply voltage | 10 to 30Vdc (ripple not over 10%) | | | | | | |
| Current consumption | 50mA max. (Note 1) Emitter 20mA max. Receiver 30mA max. | | 40mA max. (Note 1) | | | | |
| Scanning distance | 10m | | 4m (when used with FE-RR8 reflector) | 0.3 to 1m | 20cm | 80cm | |
| Target object | Opaque object, 8mm dia. min. | | Opaque object 80mm dia. min. (when used with FE-RR8 reflector) | | | — | |
| Standard target object | — | | — | | | 10 × 10cm white paper (Note 2) | 30 × 30cm white paper (Note 2) |
| Directional angle | 2 to 20° | | Sensor body 1 to 5°, reflector 40° | | | — | |
| Differential travel | — | | — | | | 20% | |
| Operation mode | Light-operated/dark-operated changeable by switch | | | | | | |
| Output mode | NPN or PNP transistor open collector | | | | | | |
| Control output | Switching current: 100mA max. (resistive load) Output dielectric strength: 30V max. Residual voltage: 1V max. (at 100mA switching current), with output short-circuit protection circuit | | | | | | |
| Self-diagnostic output | None | Provided | None | Provided | None | None | None |
| | Switching current: 50mA max. (resistive load) Output dielectric strength: 30V max. Residual voltage: 1V max. (at 50mA switching current), with output short-circuit protection circuit | | | | | | |
| Response time | 0.5ms max. for both operation and reset | | 1ms max. for both operation and reset | | 0.5ms max. for both operation and reset | | 5ms max. for both operation and reset |
| Sensitivity adjustment | 2-turn potentiometer with an indicator | | | | | | |
| Light emitter | Red LED | | | | | | Infrared LED |
| Indicator | Other than thru emitter; Light-operated (LO) indicator: Red (ON during LO), Stability indication: Green [ON during stable LO or DO (dark-operated), flashing during self-diagnostics] Thru emitter; Power indicator: Red (ON while power is supplied), HPA-E13 with SET mode indication: Green light ON | | | | | | |
| Operating ambient light | Incandescent lamp: Max. 5,000lx, Sun light: Max. 20,000lx | | | | | | |
| Operating ambient temperature | -25 to +60°C (Note3) | | | | | | |
| Storage temperature | -40 to +70°C | | | | | | |
| Humidity range | 35 to 85%RH (Non-condensing) | | | | | | |
| Insulation resistance | 20MΩ min. (by 500Vdc megger) | | | | | | |
| Dielectric strength | 1,000Vac, 50/60Hz for 1min. between case and electrically live metals | | | | | | |
| Vibration | 10 to 55Hz, 1.5mm peak-to-peak amplitude, 2 hours each in X, Y, and Z directions | | | | | | |
| Shock | 490m/s ² repeated 10 times in X, Y, and Z directions | | | | | | |
| Protection | IP67 (IEC standard) | | | | | | |
| Wiring method | Pre-leaded, pre-leaded quick connect, quick connect | | | | | | |
| Weight | About 55g (body only), with 2m cable | | | | | | |
| Others | Equipped with a power ON/OFF malfunction prevention circuit (about 100ms) and reverse connection protection circuit | | | | | | |

• Installation Instructions No.: CP-UM-3098E

Note 1: About 30mA consumption current increases at triple alignment operation.

Note 2: CODAK 90% white paper is used.







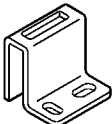
Note 3: The triple alignment function should be used within the range of 5 to 30°C.

CATALOG LISTING

HPA- I II III

| | | |
|-----------------------------|----|--|
| I detection method: | T: | Thru scan (E for emitter, R for receiver) |
| | P: | Polarized retroreflective |
| | D: | Short distance diffuse scan |
| | A: | Long distance diffuse scan |
| | F: | Polarized retroreflective |
| II Shape / wiring method: | 1: | Horizontal, pre-leaded |
| | 2: | Vertical, pre-leaded |
| | 3: | Horizontal, connector |
| | 4: | Vertical, connector |
| | 5: | Horizontal, pre-leaded connector |
| | 6: | Vertical, pre-leaded connector |
| III Output mode / function: | 1: | General purpose NPN transistor output |
| | 2: | General purpose PNP transistor output |
| | 3: | High function NPN transistor output (with self-diagnostic and triple alignment functions) |
| | 4: | High function PNP transistor output (with self-diagnostic and triple alignment functions) |

ATTACHMENT (sold separately)

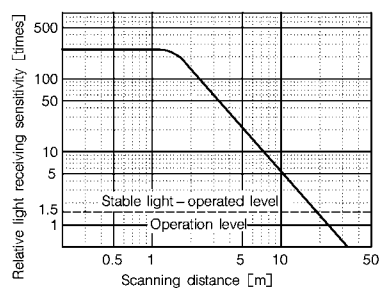
| Name | Shape | Contents | Catalog listing | Application model |
|---|---|---|-----------------|---|
| Slit for thru scan model |  | One set of 2mm, 1mm, 0.5mm, 2mm dia., 1mm dia., and 0.5mm dia. (for emitter and receiver) | HPA-U01 | All thru scan models HPA-T□□ |
| Mutual interference prevention filter for thru scan model |  | 2 sets of filters (for emitter and receiver) | HPA-U02 | All thru scan models HPA-T□□ |
| Narrow view lens attachment |  | Narrow view spot light is realized when lens is attached to the HPA-D . 2mm dia. at scanning distance 30mm. | HPA-U03 | All short distance diffuse scan models HPA-D□□ |
| Small reflector for polarized retroreflective model |  | A small reflector used when the mounting space of the reflector is not sufficient. To be ordered separately from HPA-P□□ or HPA-F□□ . | FE-RR15 | All polarized retro-reflective models HPA-P□□ , HPA-F□□ |
| Reflector for polarized retro-reflective model |  | To be ordered separately from HPA-P□□ or HPA-F□□ . | FE-RR8 | |
| Mounting bracket vertical model |  | — | HPA-B02 | All vertical models |
| Mounting bracket for vertical model |  | — | HPA-B03 | All modes (cannot be used for a connector model) |

EXCESS GAIN (light receiving level margin) (typical examples)

● Pre-loaded models

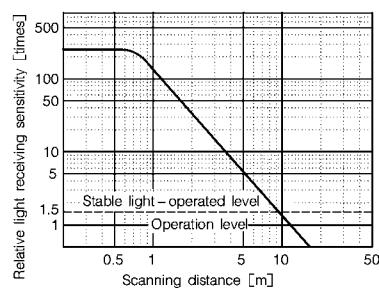
Thru scan model

HPA-T



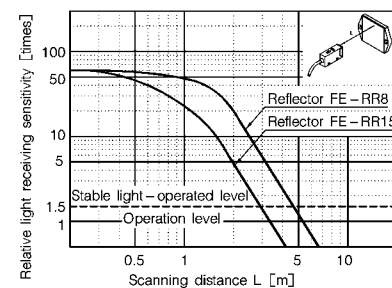
Thru scan model

HPA-T + Mutual interference prevention filter HPA-U02



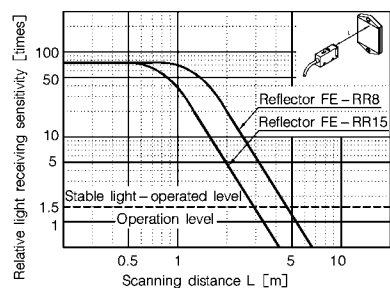
Polarized retroreflective model

HPA-P + Reflector FE-RR8/RR15 (horizontal reflector)



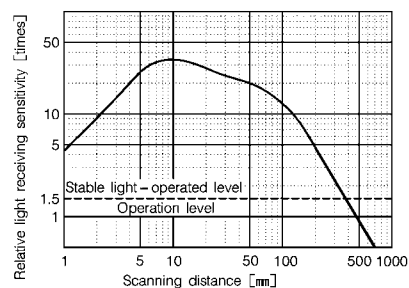
Polarized retroreflective model

HPA-P + Reflector FE-RR8/RR15 (vertical reflector)



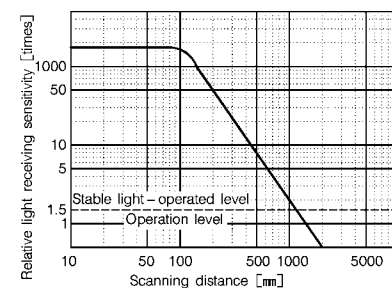
Short distance diffuse scan model

HPA-D



Long distance diffuse scan model

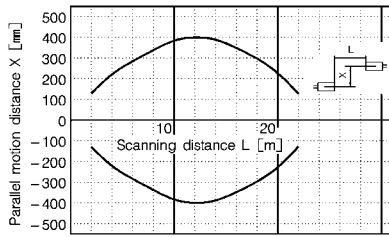
HPA-A



● PARALLEL MOTION CHARACTERISTICS (typical examples)

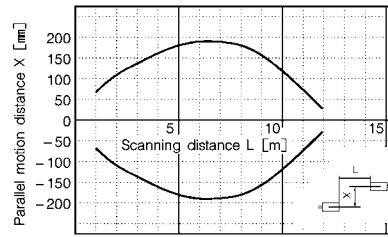
Thru scan model

HPA-T



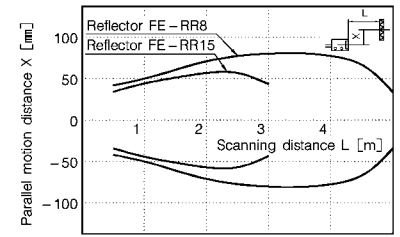
Thru scan model HPA-T +

Mutual interference prevention filter HPA-U02 (receiver side)



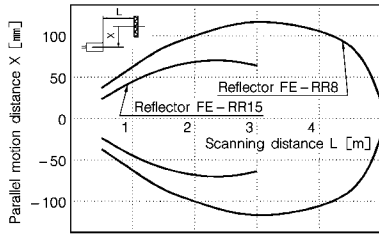
Polarized retroreflective model

HPA-P + Reflector FE-RR8/RR15 (vertical direction)



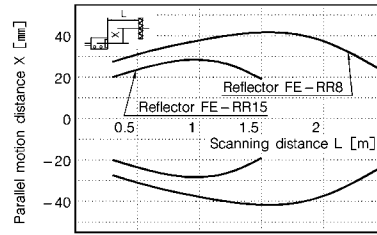
Polarized retroreflective model

HPA-P + Reflector FE-RR8/RR15 (horizontal direction)



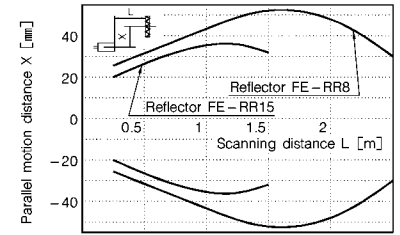
Transparent object detection, polarized retroreflective model

HPA-F + Reflector FE-RR8/RR15 (vertical direction)



Transparent object detection, polarized retroreflective model

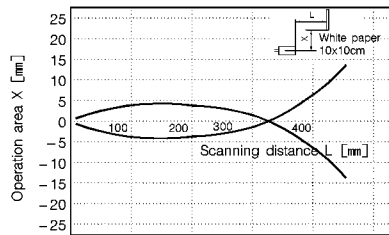
HPA-F + Small reflector FE-RR15 (horizontal direction)



DETECTION AREA CHARACTERISTICS (typical examples)

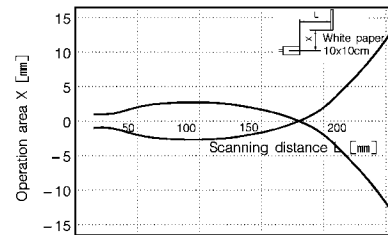
Short distance diffuse scan model

HPA-D



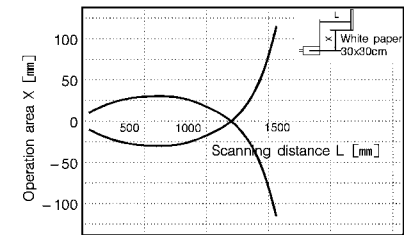
Short distance diffuse scan model HPA-D

+ Narrow view lens attachment HPA-U03



Long distance diffuse scan model

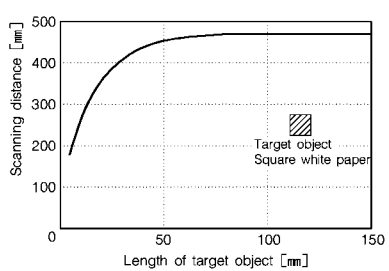
HPA-A



DETECTION OBJECT WIDTH VS SCANNING DISTANCE (typical examples)

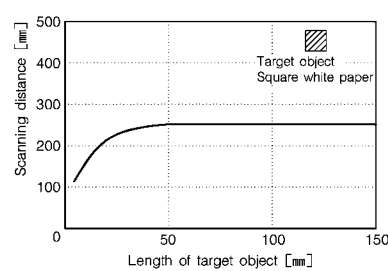
Short distance diffuse scan model

HPA-D



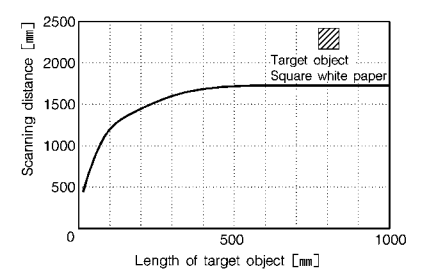
Short distance diffuse scan model HPA-D

+ Narrow view lens attachment HPA-U03



Long distance diffuse scan model

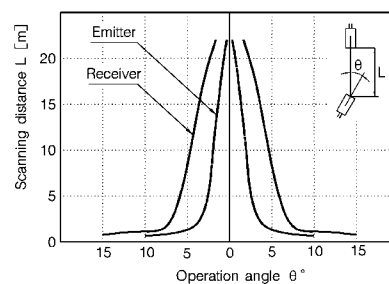
HPA-A



ANGULAR CHARACTERISTICS (typical examples)

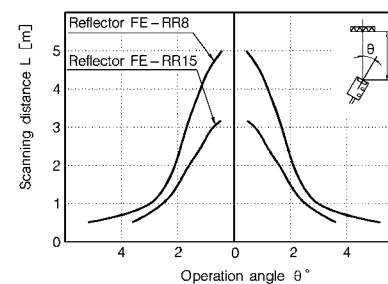
Thru scan model

HPA-T



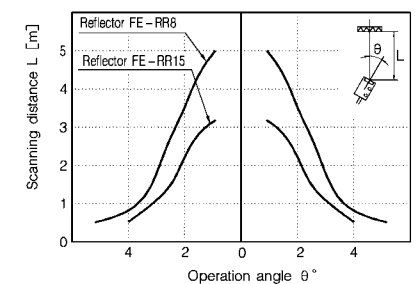
Polarized retroreflective model

HPA-P + Reflector FE-RR8/RR15 (vertical direction)



Polarized retroreflective model

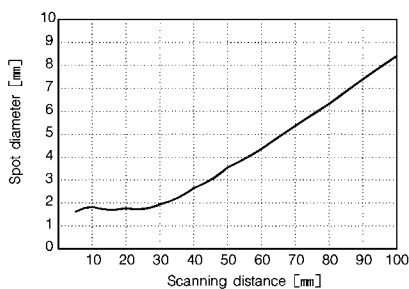
HPA-P + Reflector FE-RR8/RR15 (receiver side)



SCANNING DISTANCE VS. SPOT DIAMETER CHARACTERISTICS

HPA-D

+ Narrow view lens attachment HPA-U03



TYPICAL VALUES OF SCANNING DISTANCE CHARACTERISTICS WITH USE OF SLIT (ratio to the value without use of slit)

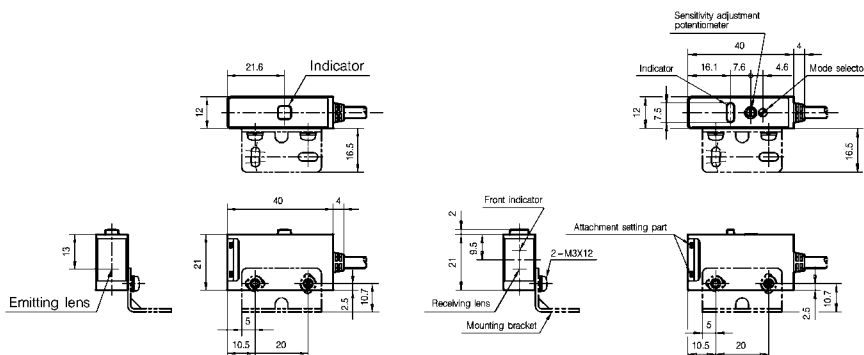
| Slit | Slit used to emitter only | Slit used to receiver only | Slit used to emitter/receiver |
|----------|---------------------------|----------------------------|-------------------------------|
| 2mm | 46% | 46% | 18% |
| 1mm | 30% | 32% | 11% |
| 0.5mm | 16% | 21% | 3.6% |
| 2mm dia. | 15% | 25% | 3.6% |
| 1mm dia. | 4.8% | 12% | 0.6% |

EXTERNAL DIMENSIONS

- General use thru scan model
- Horizontal type (pre-leaded, pre-leaded connector)
HPA-T11, T12, T51, T52

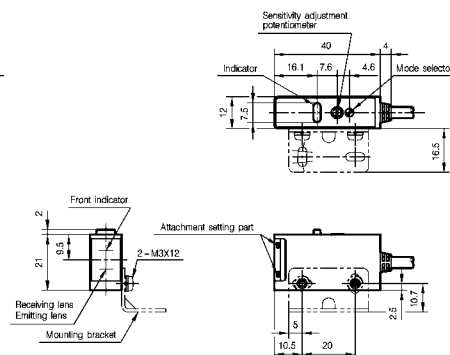
Emitter

Receiver



- High function thru scan model (unit: mm)
- Horizontal type (pre-leaded, pre-leaded connector)
HPA-T13, T14, T53, T54

Common to emitter and receiver



- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia.
Standard cord length 2m (pre-leaded)
Lead colors Receiver: Gray
Emitter: Black (pre-leaded)
Gray (pre-leaded connector)

- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia.
Standard cord length 2m (pre-leaded)
Lead colors Receiver: Gray
Emitter: Black (pre-leaded)
Gray (pre-leaded connector)

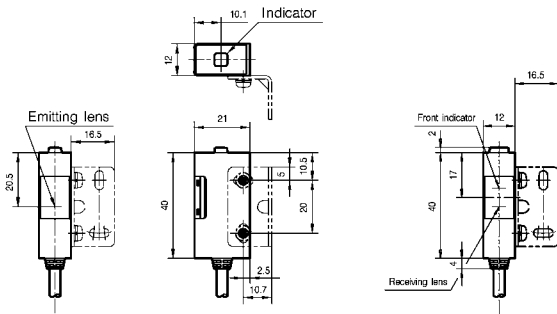
(unit: mm)

- General use thru scan model
- Vertical type (pre-leded, pre-leded connector)

HPA-T21, T22, T61, T62

Emitter

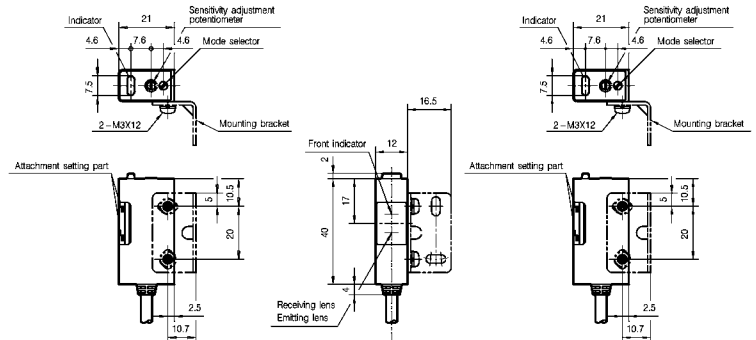
Receiver



- High function thru scan model
- Vertical type (pre-leded, pre-leded connector)

HPA-T23, T24, T63, T64

Common to emitter and receiver

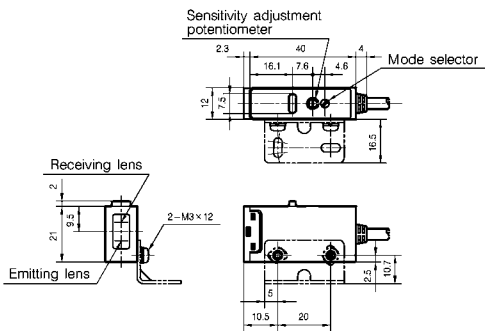


- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia. Standard cord length 2m (pre-leded)
- Lead colors Receiver: Gray
- Emitter: Black (pre-leded)
- Gray (pre-leded connector)

- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia. Standard cord length 2m (pre-leded)
- Lead colors Receiver: Gray
- Emitter: Black (pre-leded)
- Gray (pre-leded connector)

- Polarized retroreflective model
- Horizontal type (pre-leded, pre-leded connector)

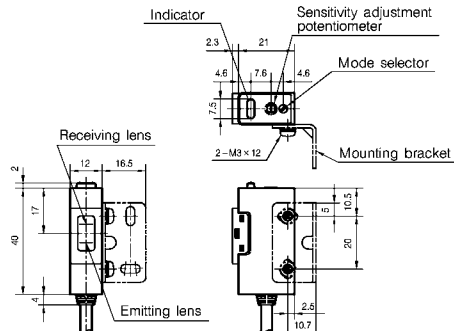
HPA-P11, P12, P13, P14, P51, P52, P53, P54, F11



- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia. Standard cord length 2m (pre-leded)
- Lead colors Gray

- Polarized retroreflective model
- Vertical type (pre-leded, pre-leded connector)

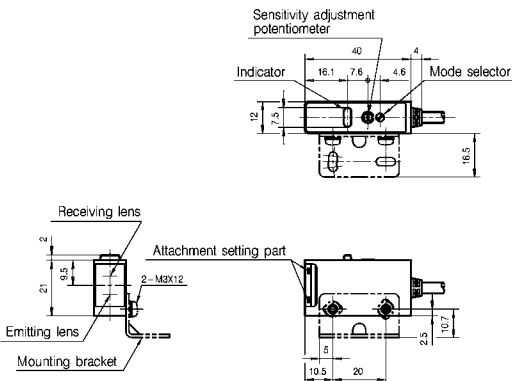
HPA-P21, P22, P23, P24, P61, P62, P63, P64, F21



- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia. Standard cord length 2m (pre-leded)
- Lead colors Gray

- Diffuse scan model
- Horizontal type (pre-leded, pre-leded connector)

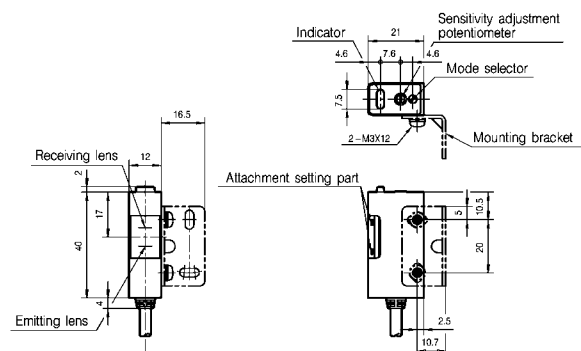
HPA-D11, D12, A11, A12



- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia. Standard cord length 2m (pre-leded)
- Lead colors Gray

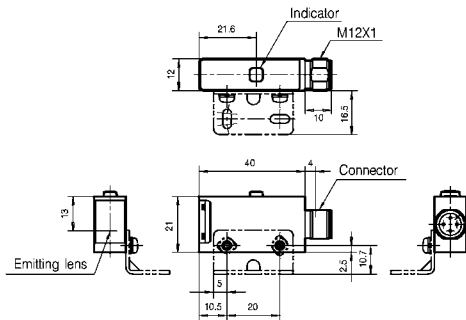
- Diffuse scan model
- Vertical type (pre-leded, pre-leded connector)

HPA-D21, D22, A21, A22

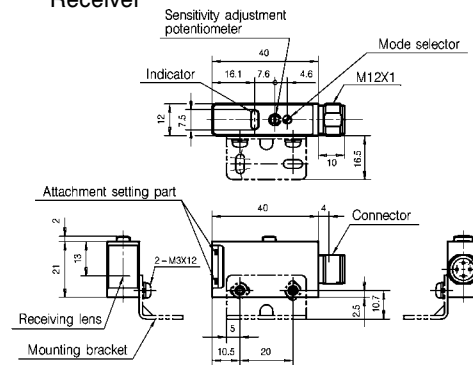


- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia. Standard cord length 2m (pre-leded)
- Lead colors Gray

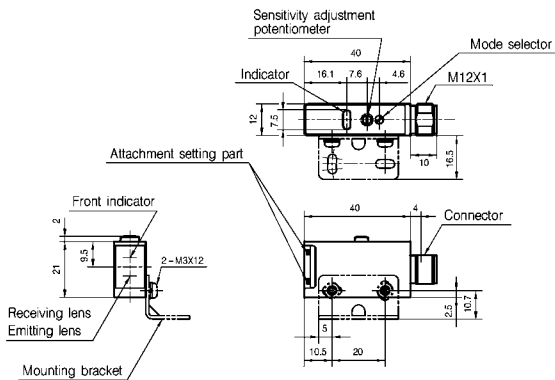
- General use thru scan model
- Horizontal type (connector)
- HPA-T31, T32**
- Emitter



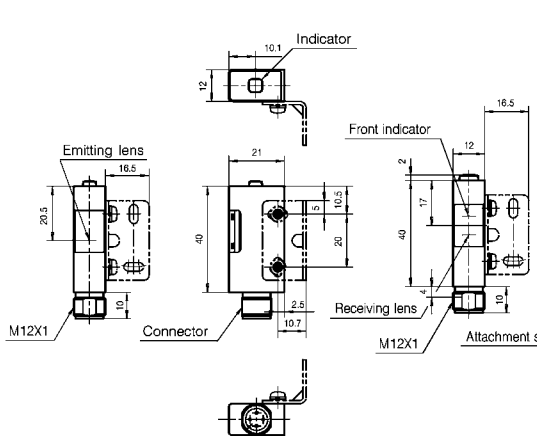
Receiver



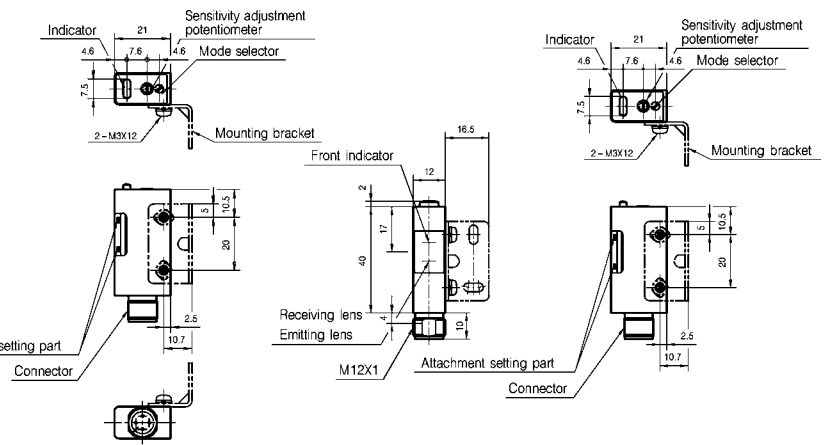
- High function thru scan model
- Horizontal type (connector)
- HPA-T33, T34**
- Common to emitter and receiver



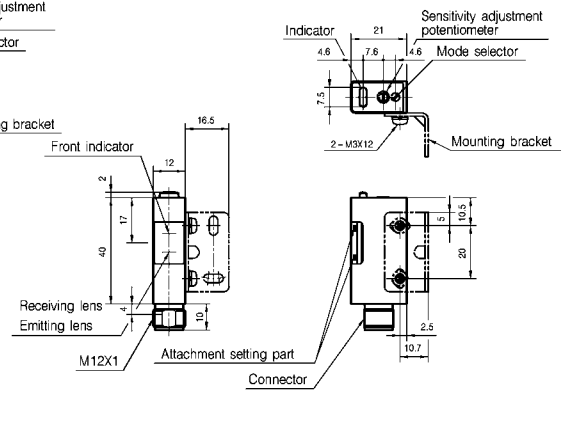
- General use thru scan model
- Vertical type (connector)
- HPA-T41, T42**
- Emitter



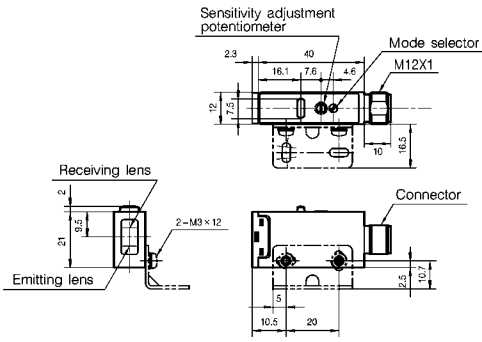
Receiver



- High function thru scan model
- Vertical type (connector)
- HPA-T43, T44**
- Common to emitter and receiver

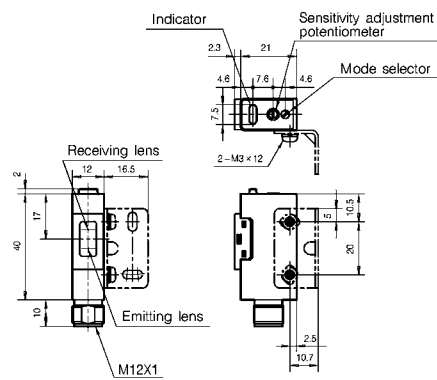


- Polarized retroreflective model
- Horizontal type (connector)
- HPA-P31, P32, P33, P34

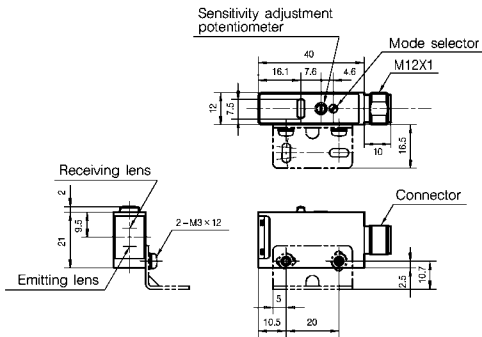


- Polarized retroreflective model
- Vertical type (connector)
- HPA-P41, P42, P43, P44

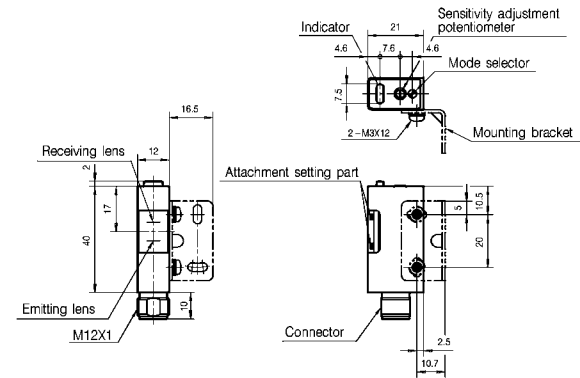
(unit: mm)



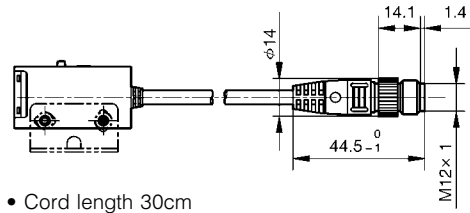
- Diffuse scan model
- Horizontal type (connector)
- HPA-D31, D32, A31, A32



- Diffuse scan model
- Vertical type (connector)
- HPA-D41, D42, A41, A42



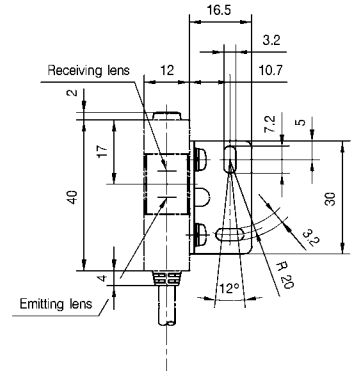
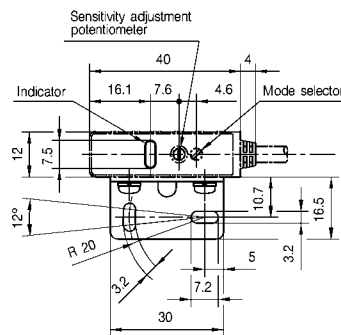
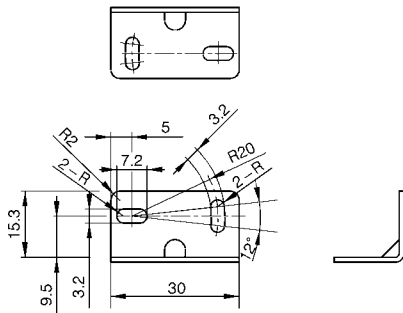
- Pre-leaded connector type connector (external dimensions of connector)
- HPA-□5□, □6□



- Bracket
- Mounting bracket HPA-B01 (attached as standard)

(When mounted on horizontal model)

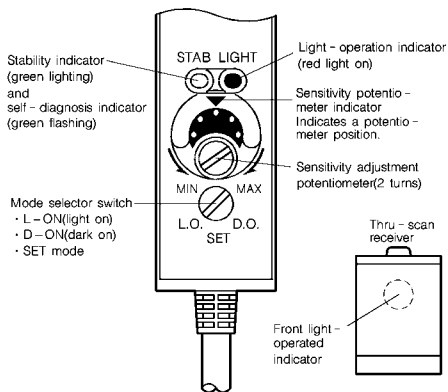
(When mounted on vertical model)



NAME OF COMPONENT

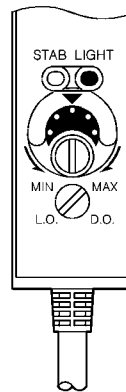
• High function thru scan receiver

High function polarized retroreflective model

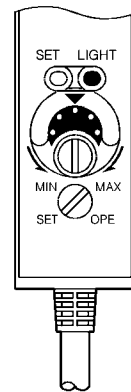


• General use thru scan receiver

General use polarized retroreflective and diffuse scan models



• High function thru scan emitter



TRIPLE ALIGNMENT (initial setting) FUNCTION

Switch the mode selector switch to the SET position, and the system will be put into the high-function mode. The following three functions are concurrently available: (See note)

1. Strobe Light Emission Function

A spot light with a relative luminosity factor twice the usual value strobes.

2. High Margin Regulating Function

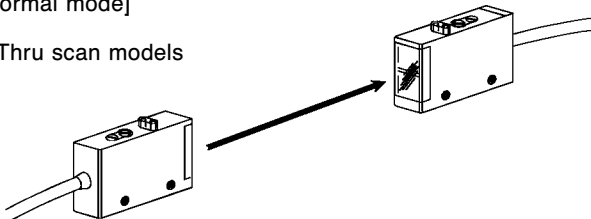
This function halves the quantity of light emitted. (Use this function in environments where the emitted light may not transmit reliably at normal levels.)

When switched back to the normal mode, a light quantity margin three times greater than usual is generated.

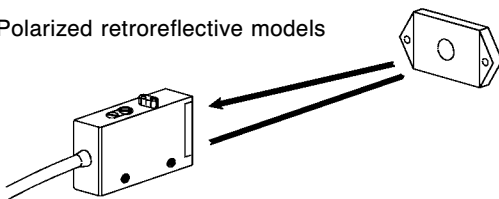
The Strobe Light Emission and High Margin Regulation functions referred to in 1 to 2 are simultaneously realized.

[Normal mode]

• Thru scan models

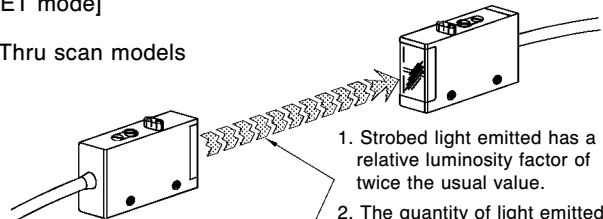


• Polarized retroreflective models

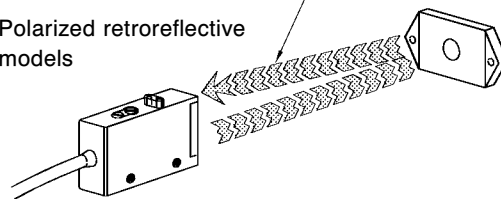


[SET mode]

• Thru scan models

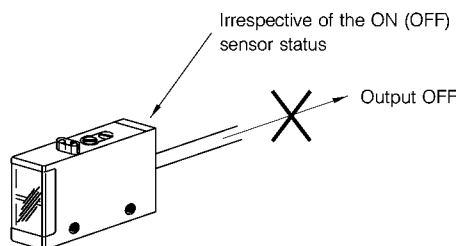


• Polarized retroreflective models



3. Output Inhibit Function

Output is forced to turn OFF irrespective of the sensor's ON/OFF status.



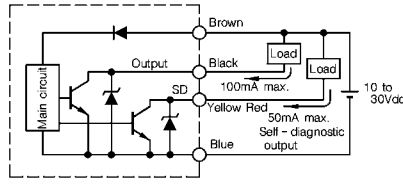
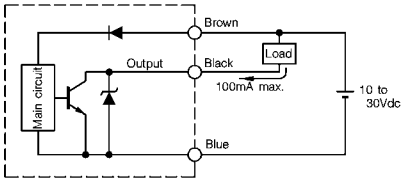
Notes:

- For thru scan models, a mode selector switch is built into both the emitter and receiver. When the mode selector switch on the emitter side is thrown to the SET position, the strobe light emission function and high margin regulating function modes are set. When the switch on the receiver side is thrown to the SET position, the output inhibit function mode is set.
- Note that the L-ON mode may momentarily occur when throwing the mode selector switch from one position to the others.
- After completion of the optical axis adjustment or after maintenance, reset the SET mode to normal mode.

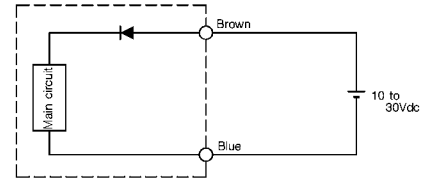
OUTPUT CIRCUIT DIAGRAM

- NPN type

- Thru scan receiver, polarized retroreflective and diffuse scan models
- Without self-diagnostic output
- With self-diagnostic output

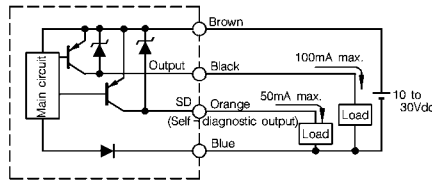
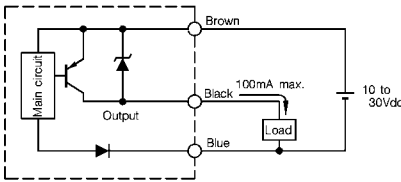


- Thru scan emitter

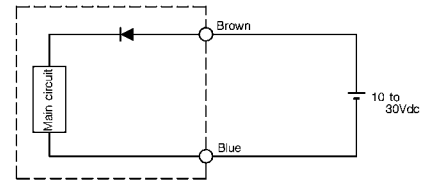


- PNP type

- Thru scan receivers, polarized retroreflective and diffuse scan models
- Without self-diagnostic output
- With self-diagnostic output



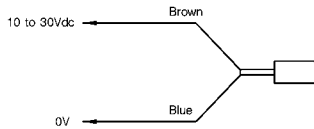
- Thru scan emitter



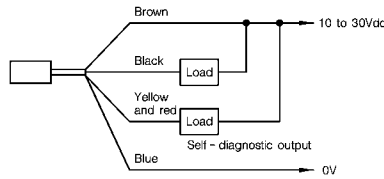
WIRING DIAGRAM

- Pre-leaded models

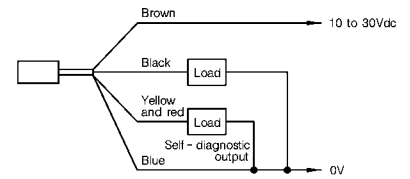
- Thru emitter



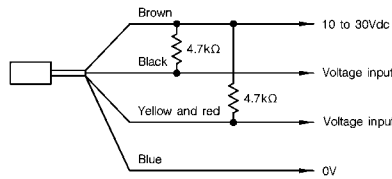
- Thru receiver, polarized retroreflective and diffuse scan models (when a load is directly applied)
- NPN type
- PNP type



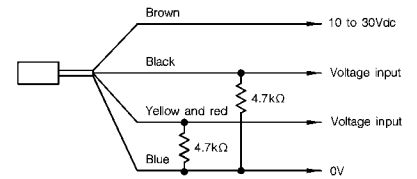
- PNP type



- (When a voltage input device is connected)
- NPN type
- PNP type

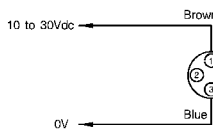


- PNP type

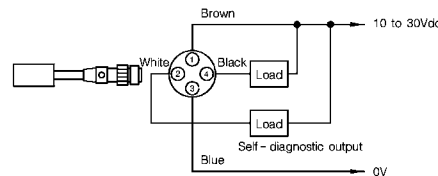


- Connector and pre-leaded connector models

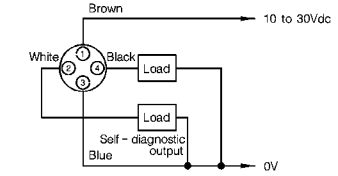
- Thru emitter



- Thru receiver, polarized retroreflective and diffuse scan models
- NPN type
- PNP type



- PNP type



Note: Lead colors match the Yamatake PA5 Series cord with VA connector.

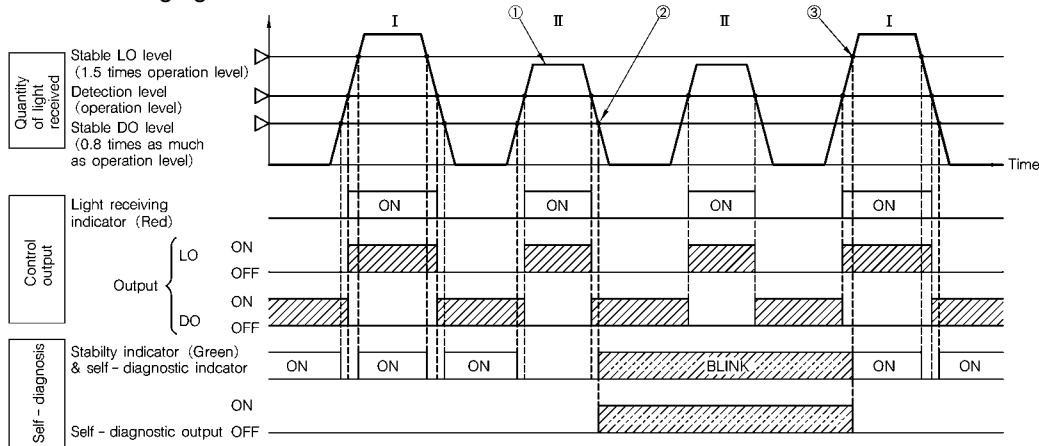
OPERATIONAL TIMING CHARTS OF OUTPUT AND INDICATORS

The **HPA's** self-diagnostic output and indicators latch when there is:

- ① insufficient incoming light (due to a decrease in the quantity of light caused by dirt, etc.)
- ② an incompletely blocked light (due to irregular position of a workpiece, etc.).

Latches in the dark on (DO) mode or in the LIGHT ON (LO) mode.

● Diagnosis of incoming light



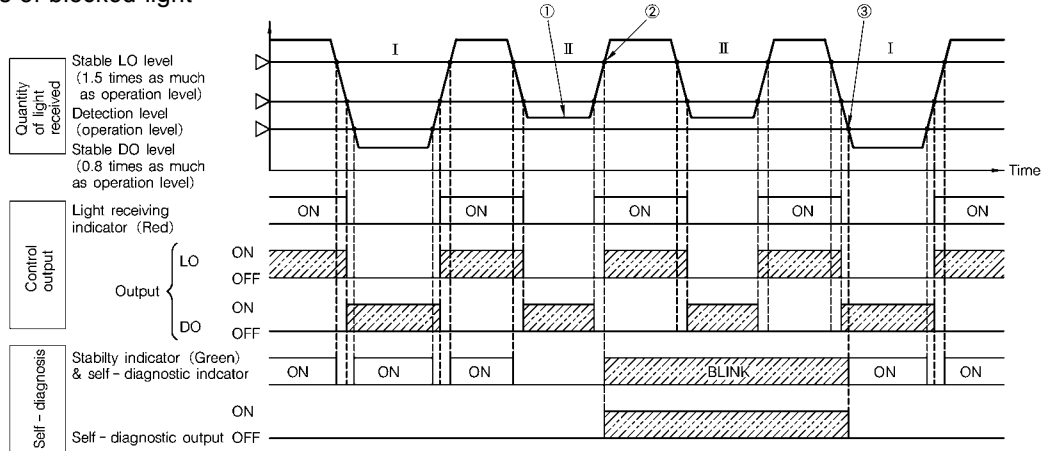
I : The incoming light is sufficient for correct operation.

II : The incoming light is insufficient, making the self - diagnostic output and indicator go ON.

Explanation of timing charts:

1. If the photoelectric sensor returns to the stable LO level without reaching the stable LO state after the photoelectric sensor operates, the self-diagnostic output will go ON and latch high when the stability indicator starts blinking.
2. The self-diagnostic output will go OFF and latch low when the quantity of light received reaches the stable LO level 2 and the stability indicator finishes blinking.

● Diagnosis of blocked light



I : No problem; the receiving light is sufficient.

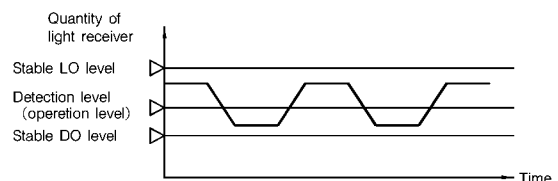
II : The incoming light is insufficient, in which case the self - diagnostic output and indicator go ON.

Explanation of timing charts:

1. If the photoelectric sensor returns to the stable LO level without reaching the stable DO state after the photoelectric sensor operates, the self-diagnostic output will go ON and latch high when the stability indicator starts blinking.
2. The self-diagnostic output will go OFF and latch low when the quantity of light received reaches the stable DO level (as shown at 2 above) and the stability indicator finishes blinking (self-diagnostic indication).

Caution: Status that may not be diagnosed: The control output will be inverted in an unstable LO and DO state.

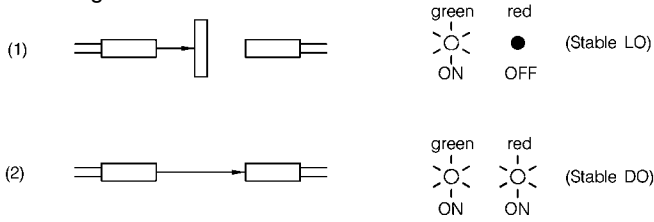
When a workpiece with a slight difference in the quantity reflected of light is scanned, such as in scanning a transparent body, the quantity of light received will neither fall to the stable DO level nor rise to the stable LO level. In this case, neither the self-diagnostic output nor the indicating lamps go ON. ① An incoming light signal is neither output nor indicated until the quantity of light received falls to the stable DO level. ② An blocked light signal is neither output nor indicated until the quantity of light received rises to the stable LO level.



SENSITIVITY VR ADJUSTMENT METHOD

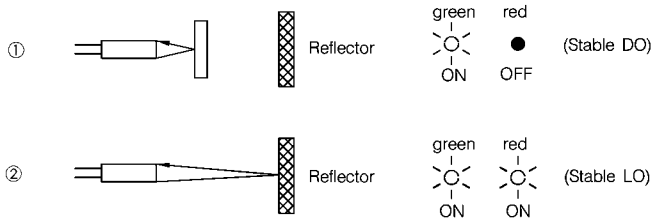
• Thru scan models

Adjust the optical axis and sensitivity until the indicators light in the following two conditions:

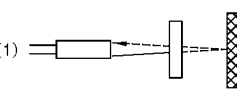
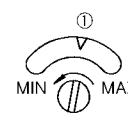
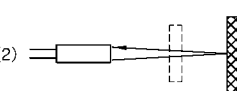

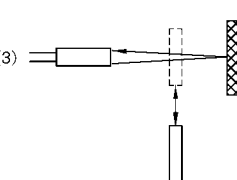
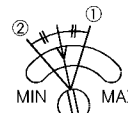


• Polarized retroreflective models

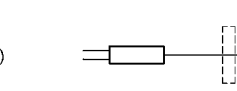
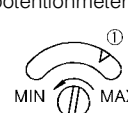
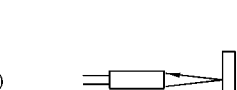

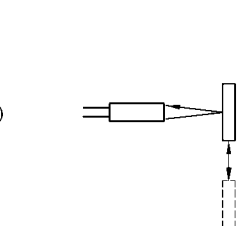
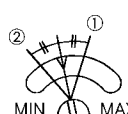
Basically, the adjustment is the same as thru scan models.



• Polarized retroreflective models

| Work sequence | Placement of target object | Sensitivity adjustment potentiometer | Indicators | Adjustment method |
|---------------|---|---|--|---|
| (1) |  |  | green ON, red OFF | With the target in position, turn the potentiometer from maximum counterclockwise until the red indicator goes off. This may be maximum setting. This is point ①. |
| (2) |  |  | green OFF, red ON | With no target object present, turn the potentiometer from minimum clockwise to find point ② where the red indicator turns on. |
| (3) |  |  | green ON, red ON (Stable DO) green OFF, red OFF (Stable LO) | Set the sensitivity potentiometer to the center of positions ① and ②. This is the optimal setting. Note: If the potentiometer has been turned completely once or more, make adjustment on the basis of the position of the indicator. |

• Diffuse scan models

| Work sequence | Placement of target object | Sensitivity adjustment potentiometer | Indicators | Adjustment method |
|---------------|---|---|--|---|
| (1) |  |  | green ON, red OFF | With the target in position, turn the potentiometer from maximum counterclockwise until the red indicator goes off. This may be maximum setting. This is point ①. |
| (2) |  |  | green ON, red ON | With no target object present, turn the potentiometer from minimum clockwise to find point ② where the red indicator turns on. |
| (3) |  |  | green ON, red ON (Stable DO) green OFF, red OFF (Stable LO) | Set the sensitivity potentiometer to the center of positions ① and ②. This is the optimal setting. Note: If the potentiometer has been turned completely once or more, make adjustment on the basis of the position of the indicator. |

CONNECTOR SPECIFICATIONS Note 1

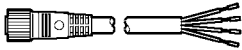
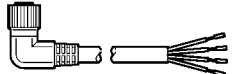
| Item | Specifications |
|--|---|
| Operating voltage / current | 5Vac/dc, 5mA min., 125Vac/dc, 3A max. |
| Insulation resistance | 100M Ω min. (by 500Vdc megger) |
| Dielectric strength | 1500Vac, for 1min (between contacts, between contact and connector housing) |
| Initial contact resistance | 40m Ω max., (when 3A current is fed to a male/female contact, except for the resistances of cords) |
| Connector pulling-out force | 0.4 to 4.0N (per contact) |
| Number of times of connector pulling-out | 50 times |
| Contact fastening strength | 0.8Nm min (See note 2) |
| Cord tensile strength | 100N min |
| Vibration | 10 to 55Hz, peak-to-peak amplitude 1.5mm, 2hr each direction of X, Y and Z |
| Shock | 300m/s ² (about 30G), three times in each direction of X, Y and Z |
| Protection | IP67 (IP65 with panel-mount connector) |
| Operating ambient temperature | - 10 to +70°C |
| Storage temperature | - 20 to +80°C |
| Humidity range | 95%RH max. |
| Material | Contacts: Gold-plated brass Contact holder: Glass-lined polyester resin Housing: Polyester elastomer (panel-mount contactor housing: A1) Coupling: Ni-plated brass O-ring: NBR |

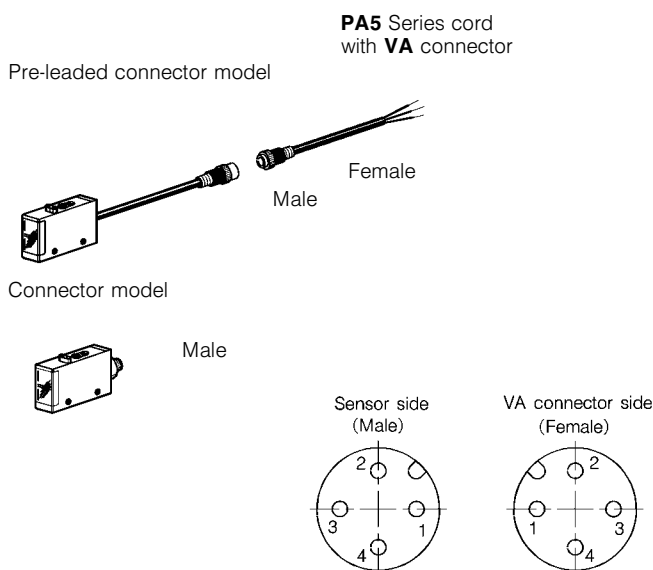
- Notes: 1. Specifications assume Yamatake male/female connectors.
2. The recommended torque is 0.4 to 0.6N-m.
If fastened poorly, the IP67 protection is lost, or looseness occurs.
Fasten the connector securely by hand.

CONNECTION CORD WITH CONNECTOR

Be sure to use **PA5** Series cord with **VA** connector when connecting a pre-leaded connector or connector type sensors.

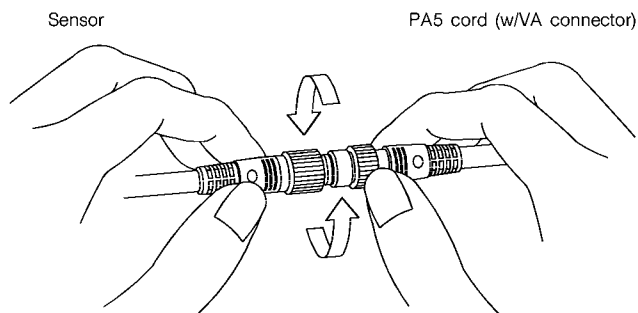
• PA5 Series cord with VA connector

| Shape | Power supply | Cord length | Catalog listing | Lead color |
|---|--------------|-------------|--------------------|-----------------------------------|
|  | dc | 2m | PA5-4ISX2HK | 1-brown, 2-white, 3-blue, 4-black |
| | | 5m | PA5-4ISX5HK | |
|  | | 2m | PA5-4ILX2HK | |
| | | 5m | PA5-4ILX5HK | |



● Fastening the connector

Align the grooves of the connectors and turn the fastening screw of the **VA** connector of the **PA5** cord by hand until it fits tightly with the screw on the sensor side.



BASIC PRECAUTIONS

● Wiring

- Be sure to connect a photoelectric sensor to the power supply and load correctly.
- If a high-voltage or power cable exists near a photoelectric sensor cord, lay the photoelectric sensor's cord independently or lay in another conduit to prevent surge and noise influence.
- Connect the lead end securely using crimp terminals.
- Use a cord of at least 0.3mm² in cross-sectional area for extensions. The lead length should not be over 100m. Consider the influence of noise due to lead extension.
- If a controlling power unit is used, ground its frame.
- If capacitive load is used, connect a current limiting resistor so as to limit the inrush current to max. 100mA.

● Handling

- Do not swing a photoelectric sensor by its lead.
- Do not pull the cord of a photoelectric sensor with excessive force. The tensile strength of the lead is 49N max.
- Do not impact or damage the sensing head.
- Do not use a photoelectric sensor outdoors, in environments where chemicals (organic solvent, acid, alkali) are present, or where there is water or oil may splash onto the sensor.
- Fasten the connectors securely by hand.
- Set the bending radius R of the cord to 30mm min.

● Polarized retroreflective model

The polarized retroreflective model uses a light-polarizing filter, and employs a detection method intended to prevent reflection from mirror surfaces or shiny detection objects. For this reason, malfunction may occur when the characteristics of the detection body are such that the body itself polarizes light. Check this before use.

Example

- : Detection objects covered in transparent film
- : Mirror surfaces with slight surface unevenness or shiny detection objects



RESTRICIONES ON USE

This product has been designed, developed and manufactured for general-purpose application in machinery and equipment. Accordingly, when used in applications outlined below, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.

- Safety devices for plant worker protection
- Start/stop control devices for transportation and material handling machines
- Aeronautical/aerospace machines
- Control devices for nuclear reactors

Never use this product in applications where human safety may be put at risk.

YAMATAKE

Specifications are subject to change without notice.

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