

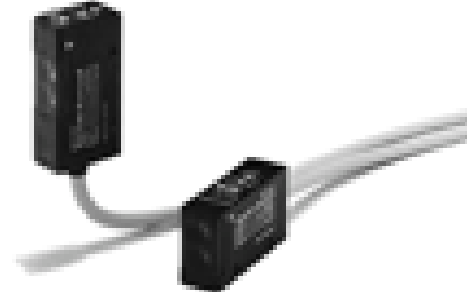
HPA Series Self-contained Photoelectric Controls with High Functions



FEATURES

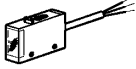
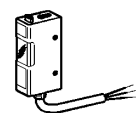
Strobe Light Emission, High Margin Regulation, Front Incoming Light Display, and Output Inhibit Functions Allow Sensing Range to be Reliably Adjusted at High Speed.

- 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				
		0.3 to 1m					○	○			○	○	○	PNP open collector	HPA-P12	
	Diffuse scan	20cm		○	○	○	-	-	-		NPN open collector	HPA-P13				
		80cm					○	○			○	○	○	PNP open collector	HPA-P14	
		20cm					○	○			○	-	-	-	NPN open collector	HPA-F11
		80cm										○	○		○	○
	Vertical 	Thru scan	General use	10m	○	○ (Note 2)	○	-	-		○	NPN open collector	HPA-D12			
			High function					○	○			○	○	○	PNP open collector	HPA-A11
Polarized retroreflective		General use	4m	○	○	○	-	-	-	NPN open collector	HPA-A12					
		High function					○	○		○	○	○	PNP open collector	HPA-A21		
Transparent object detection polarized retroreflective		0.3 to 1m		○	○	○	-	-	-	NPN open collector	HPA-T21					
		0.3 to 1m					○	○		○	○	○	PNP open collector	HPA-T22		
Diffuse scan		20cm		○	○	○	-	-	-	NPN open collector	HPA-T23					
		80cm					○	○		○	○	○	PNP open collector	HPA-T24		
		20cm					○	○		○	-	-	-	NPN open collector	HPA-P21	
		80cm									○	○		○	○	○
20cm		○	○	○	-	-	-	NPN open collector	HPA-P23							
80cm					○	○		○	○	○	PNP open collector	HPA-P24				
20cm		○	○	○	-	-	-	NPN open collector	HPA-F21							
80cm					○	○		○	○	○	PNP open collector	HPA-D21				
20cm		○	○	○	-	-	-	NPN open collector	HPA-D22							
80cm					○	○		○	○	○	PNP open collector	HPA-A21				
20cm		○	○	○	-	-	-	NPN open collector	HPA-A22							
80cm					○	○		○	○	○	PNP 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.

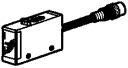
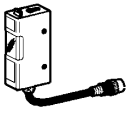
● Connector type

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					○	○			○	○	HPA-T32
	Polarized retroreflective	General use	4m	○	○	○	-	-	-		NPN open collector	HPA-T33	
		High function					○	○			○	○	HPA-T34
		High function					○	○			○	○	HPA-P31
	Diffuse scan	20cm	○	○	○	-	-	-	-		PNP open collector	HPA-P32	
											80cm	PNP open collector	HPA-P33
		80cm	PNP open collector	HPA-P34									
			PNP open collector	HPA-D31									
	Vertical 	Thru scan	General use	10m	○	○ (Note 2)	○	-	-		○	NPN open collector	HPA-A31
			High function					○	○			○	○
		Polarized retroreflective	General use	4m	○	○	○	-	-		-	PNP open collector	HPA-A32
High function			○					○	○	○		HPA-T41	
High function			○					○	○	○		HPA-T42	
Diffuse scan		20cm	○	○	○	-	-	-	-	NPN open collector	HPA-T43		
										80cm	PNP open collector	HPA-T44	
		80cm	PNP open collector	HPA-P41									
			PNP open collector	HPA-P42									
PNP open collector		HPA-P43											
PNP open collector		HPA-P44											
PNP open collector		HPA-D41											
PNP open collector	HPA-D42												
PNP 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					○	○			○	○	HPA-T52
	Polarized retroreflective	General use	4m	○	○	○	-	-	-		NPN open collector	HPA-T53	
		High function					○	○			○	○	HPA-T54
		High function					○	○			○	○	HPA-P51
	Diffuse scan	20cm	○	○	○	-	-	-	-		PNP open collector	HPA-P52	
											80cm	PNP open collector	HPA-P53
		80cm	PNP open collector	HPA-P54									
			PNP open collector	HPA-D51									
	Vertical 	Thru scan	General use	10m	○	○ (Note 2)	○	-	-		○	NPN open collector	HPA-T61
			High function					○	○			○	○
		Polarized retroreflective	General use	4m	○	○	○	-	-		-	NPN open collector	HPA-T63
High function			○					○	○	○		HPA-T64	
High function			○					○	○	○		HPA-P61	
Diffuse scan		20cm	○	○	○	-	-	-	-	PNP open collector	HPA-P62		
										80cm	PNP open collector	HPA-P63	
		80cm	PNP open collector	HPA-P64									
			PNP open collector	HPA-D61									
PNP open collector		HPA-D62											
PNP 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 30V dc (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 500V dc megger)						
Dielectric strength	1,000V ac, 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						

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

Note 2: CODAK 90% white paper is used.






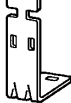
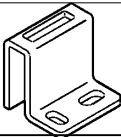
Note 3: The triple alignment function should be used within the range of 5 to 30°C.

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 (separate order)

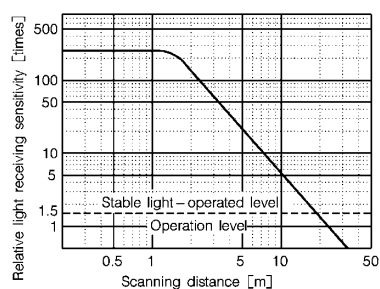
Name	Shape	Contents	Catalog listing	Application model
Slit for thru-scan model		One set of 2mm, 1mm, 0.5mm, 2mm dia., 1mm dia., and 0.5mm dia. (for emitter and receiver)	HAP-U01	All thru-scan models HPA-T □□
Mutual interference prevention filter for thru-scan model		2 sets of filters (for emitter and receiver)	HAP-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.	HAP-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-B02	All modes (cannot be used for a connector model)

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

● Pre-leaded models

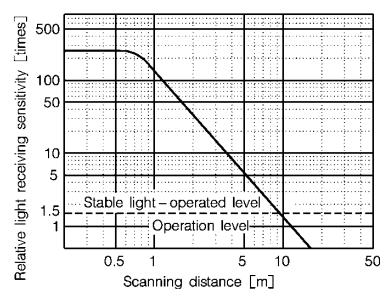
Thru scan type

HPA-T



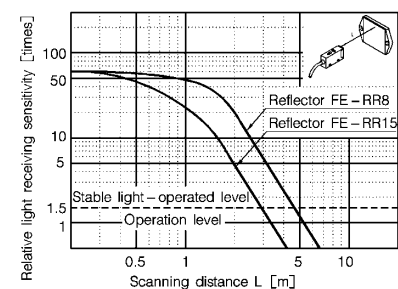
Thru scan type

HPA-T + Mutual interference prevention filter HPA-U02



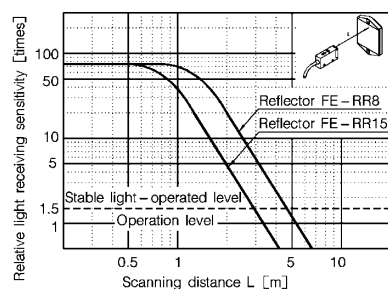
Polarized retroreflective type

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



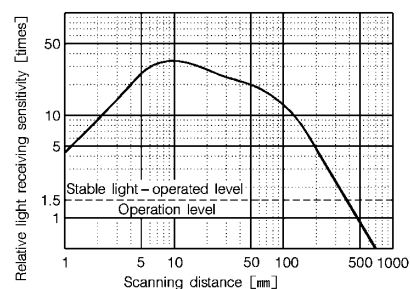
Polarized retroreflective type

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



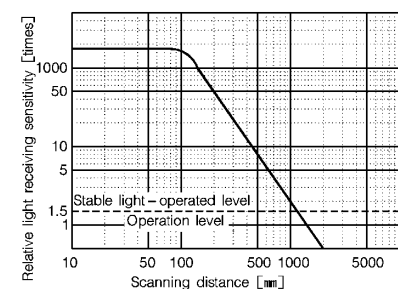
Short distance diffuse scan type

HPA-D



Long distance diffuse scan type

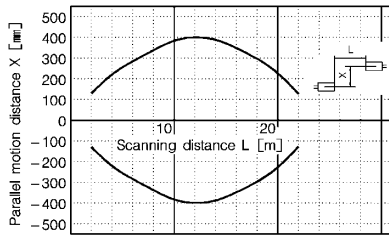
HPA-A



● PARALLEL MOTION CHARACTERISTICS (typical examples)

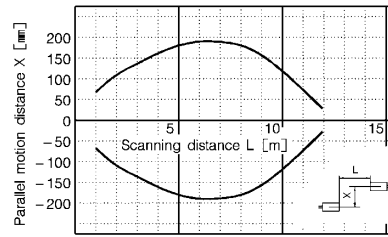
Thru scan type

HPA-T



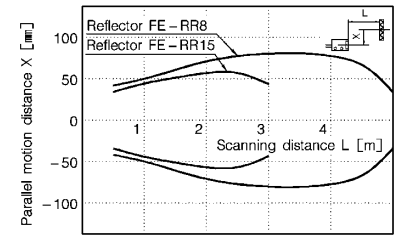
Thru scan type HPA-T +

Mutual interference prevention filter HPA-U02 (receiver side)



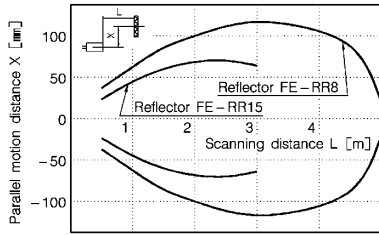
Polarized retroreflective type

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



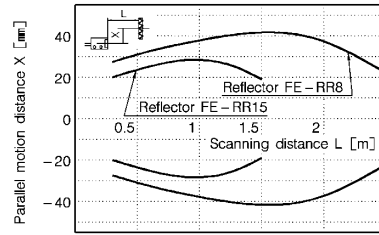
Polarized retroreflective type

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



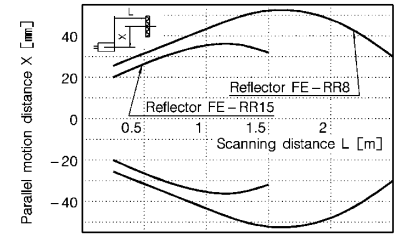
Transparent object detection, polarized retroreflective type

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



Transparent object detection, polarized retroreflective type

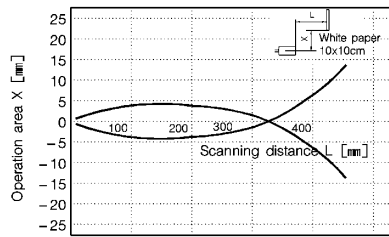
HPA-F + Small reflector FE-RR15 (horizontal direction)



DETECTION AREA CHARACTERISTICS (typical examples)

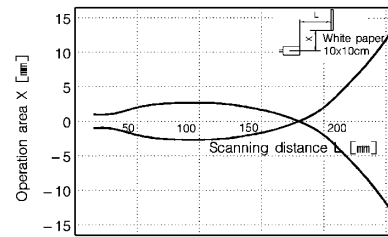
Short distance diffuse scan type

HPA-D



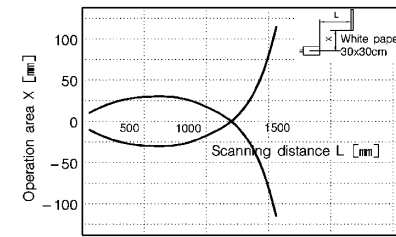
Short distance diffuse scan type HPA-D

+ Narrow view lens attachment HPA-U03



Long distance diffuse scan type

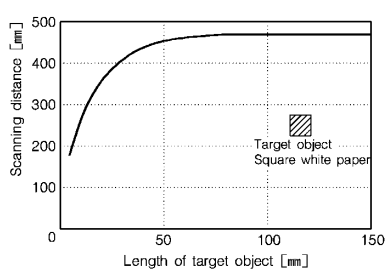
HPA-A



DETECTION OBJECT WIDTH VS SCANNING DISTANCE (typical examples)

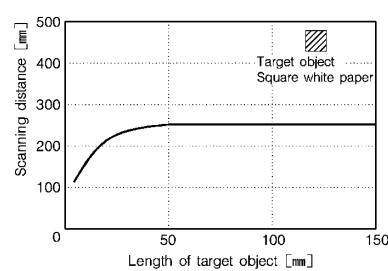
Short distance diffuse scan type

HPA-D



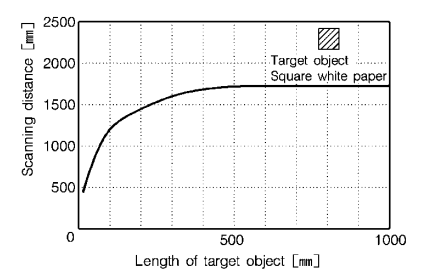
Short distance diffuse scan type HPA-D

+ Narrow view lens attachment HPA-U03



Long distance diffuse scan type

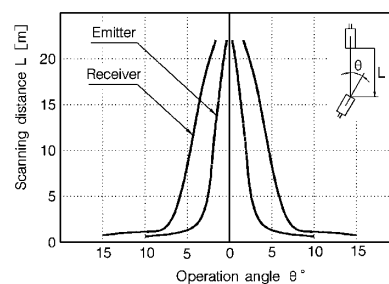
HPA-A



ANGULAR CHARACTERISTICS (typical examples)

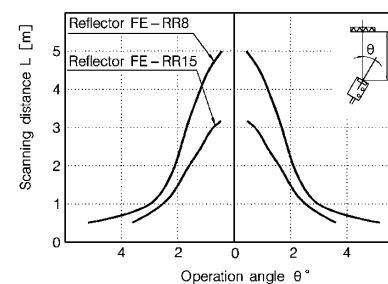
Thru scan type

HPA-T



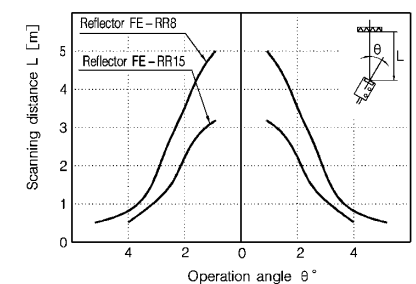
Polarized retroreflective type

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



Polarized retroreflective type

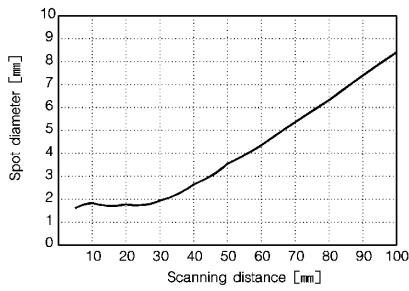
HPA-P + Reflector FE-RR8/RR15 (receiver side)



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)

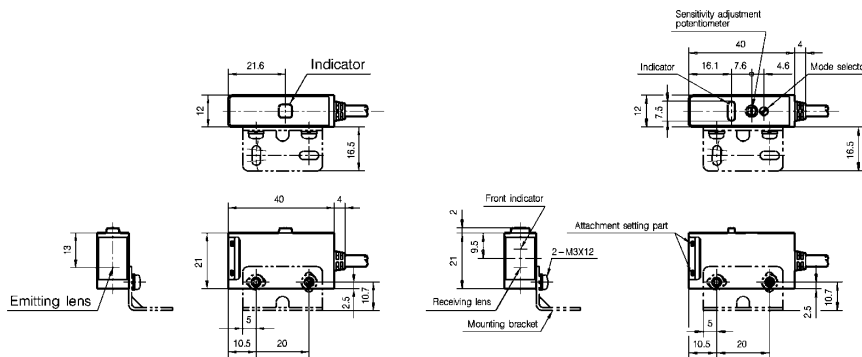
Slit	Slit used to emitter only	Slit used to receiver only	Slit used to emitter/receiver
2mm	46%	46%	18%
1mm	30%	32%	11%
0.5mm	16%	21%	3.6%
2mm dia.	15%	25%	3.6%
1mm dia.	4.8%	12%	0.6%

EXTERNAL DIMENSIONS

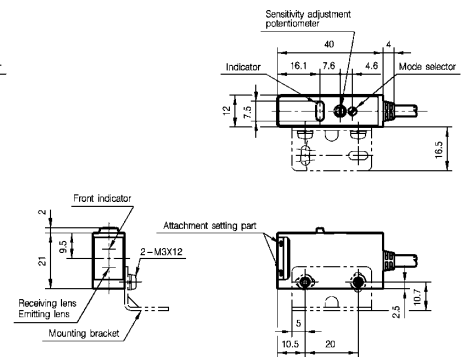
- General use thru scan type
 - Horizontal type (pre-leaded, pre-leaded connector)
- HPA-T11, T12, T51, T52**

Emitter

Receiver



- (unit: mm)
- High function thru scan type
 - Horizontal type (pre-leaded, pre-leaded connector)
- HPA-T13, T14, T53, T54**
- Common to emitter and receiver

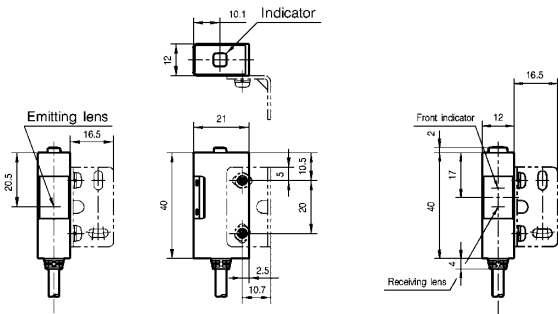


- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia.
- Standard cord length 2m (pre-leaded)
- Lead colors Receiver: Gray
- Emitter: Black (pre-leaded)
- Gray (pre-leaded connector)

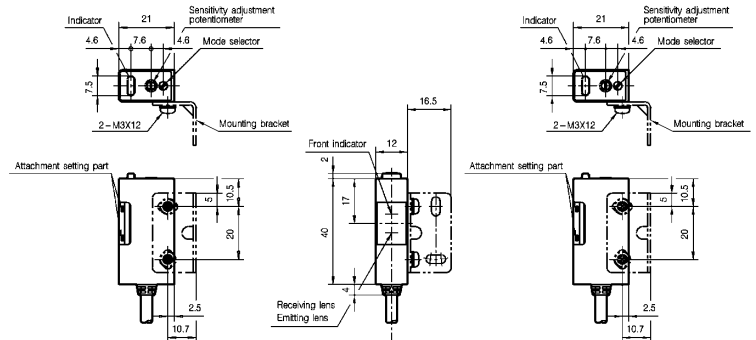
- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia.
- Standard cord length 2m (pre-leaded)
- Lead colors Receiver: Gray
- Emitter: Black (pre-leaded)
- Gray (pre-leaded connector)

(unit: mm)

- General use thru scan type
 - Vertical type (pre-leaded, pre-leaded connector)
- HPA-T21, T22, T61, T62**
- Emitter Receiver



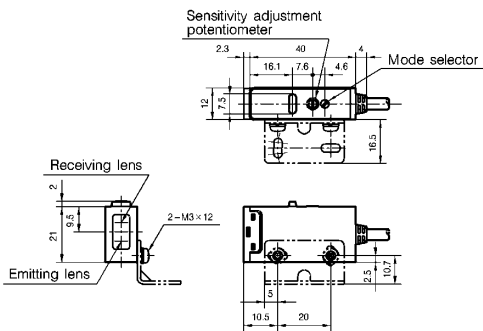
- High function thru scan type
 - Vertical type (pre-leaded, pre-leaded connector)
- HPA-T23, T24, T63, T64**
- Common to emitter and receiver



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

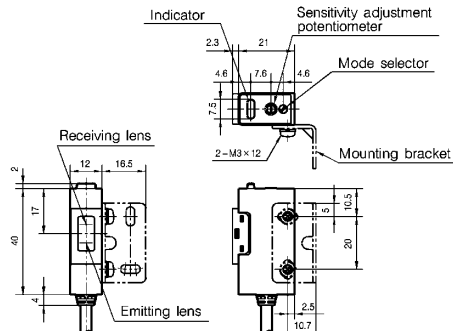
- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia. Standard cord length 2m (pre-leaded)
- Lead colors Receiver: Gray
- Emitter: Black (pre-leaded)
- Gray (pre-leaded connector)

- Polarized retroreflective type
 - Horizontal type (pre-leaded, pre-leaded connector)
- HPA-P11, P12, P13, P14, P51, P52, P53, P54, F11**



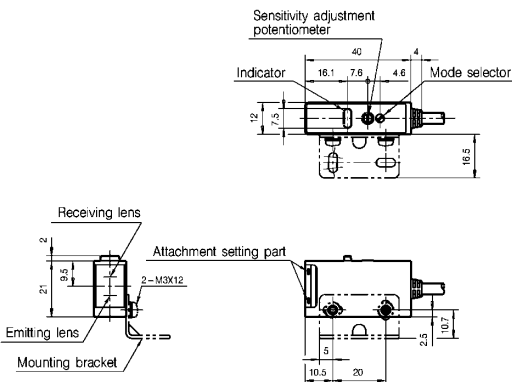
- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia. Standard cord length 2m (pre-leaded)
- Lead colors Gray

- Polarized retroreflective type
 - Vertical type (pre-leaded, pre-leaded connector)
- HPA-P21, P22, P23, P24, P61, P62, P63, P64, F21**



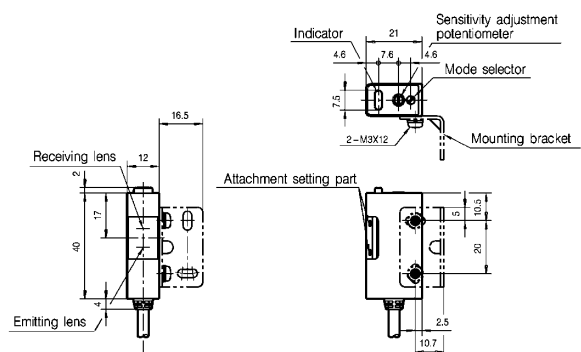
- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia. Standard cord length 2m (pre-leaded)
- Lead colors Gray

- Diffuse scan type
 - Horizontal type (pre-leaded, pre-leaded connector)
- HPA-D11, D12, A11, A12**



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

- Diffuse scan type
 - Vertical type (pre-leaded, pre-leaded connector)
- HPA-D21, D22, A21, A22**

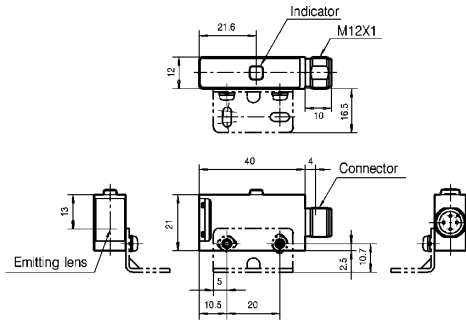


- Polyvinyl chloride insulated cord (oil resistant type: 0.2mm²) 4.2dia. Standard cord length 2m (pre-leaded)
- Lead colors Gray

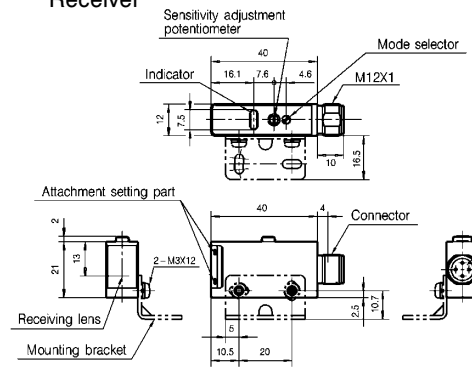
- General use thru scan type
- Horizontal type (connector)

HPA-T31, T32

Emitter



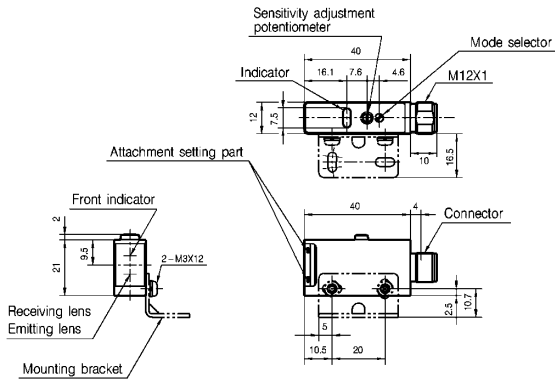
Receiver



- High function thru scan type
- Horizontal type (connector)

HPA-T33, T34

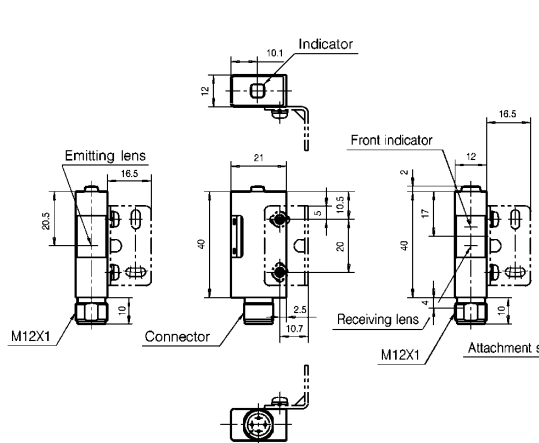
Common to emitter and receiver



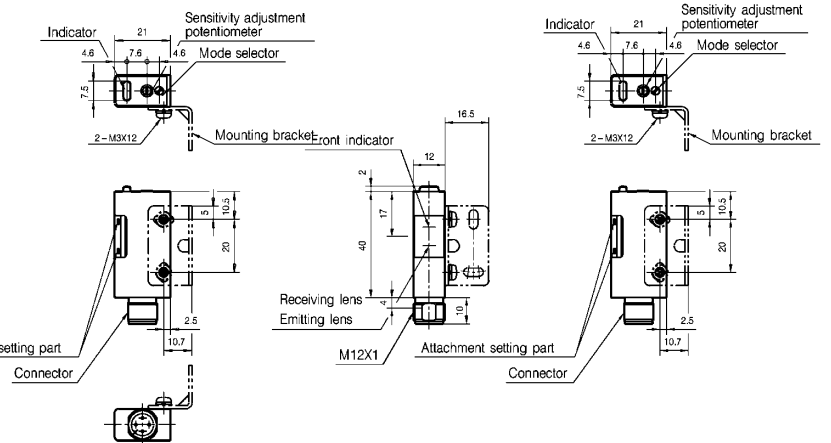
- General use thru scan type
- Vertical type (connector)

HPA-T41, T42

Emitter



Receiver

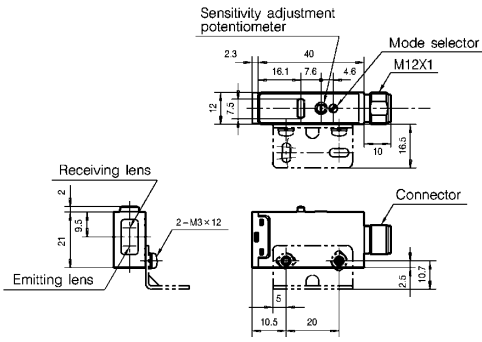


- High function thru scan type
- Vertical type (connector)

HPA-T43, T44

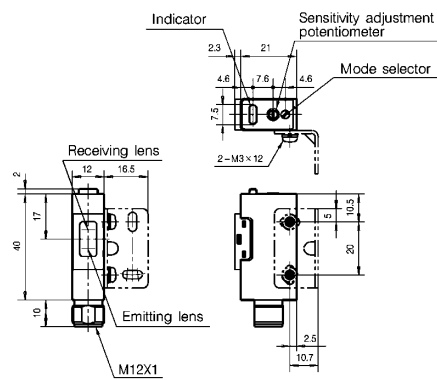
Common to emitter and receiver

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

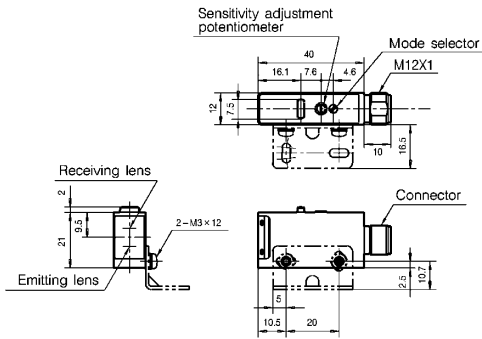


- Polarized retroreflective type
- Vertical type (connector)
- HPA-P41, P42, P43, P44

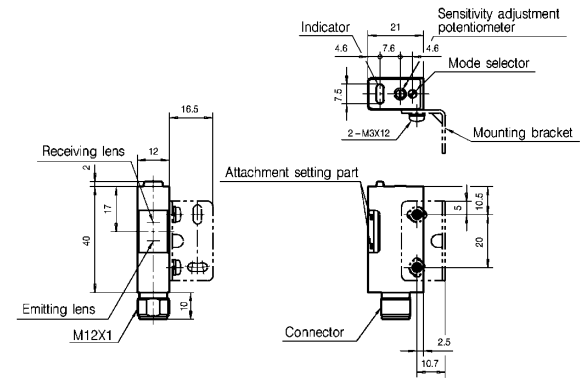
(unit: mm)



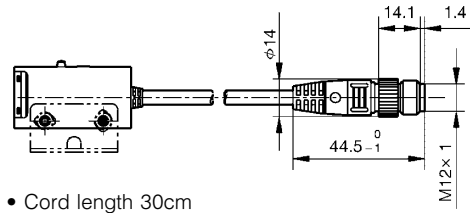
- Diffuse scan type
- Horizontal type (connector)
- HPA-D31, D32, A31, A32



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



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

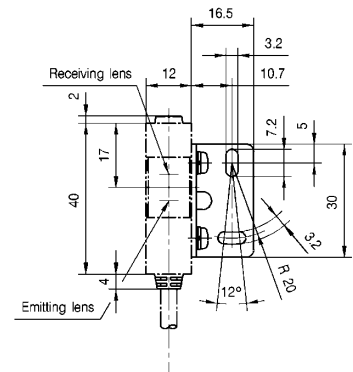
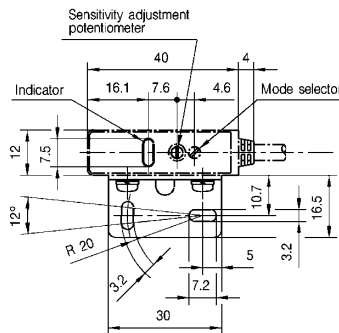
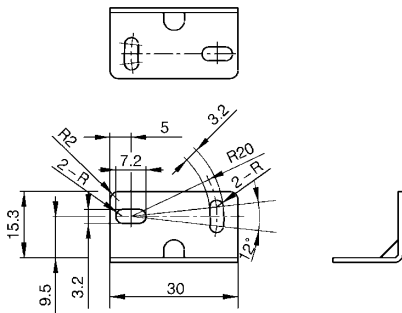


- Cord length 30cm

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

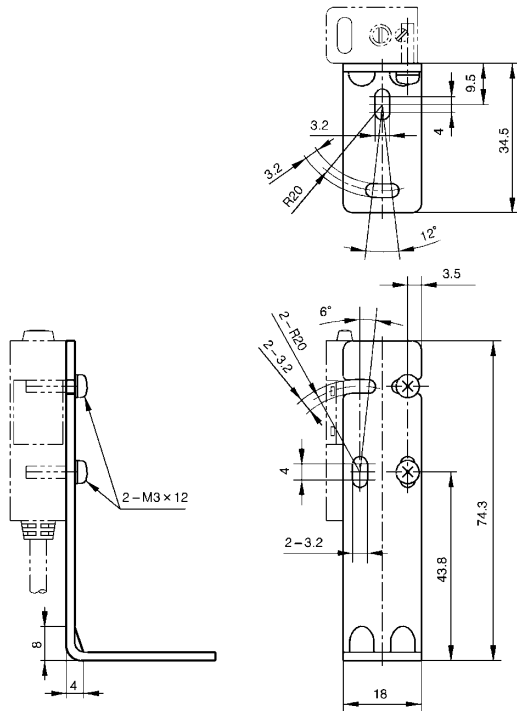
(When mounted on horizontal model)

(When mounted on vertical model)



- Mounting bracket **HPA-B02** for vertical model (separate order) (cannot be used for a connector model)

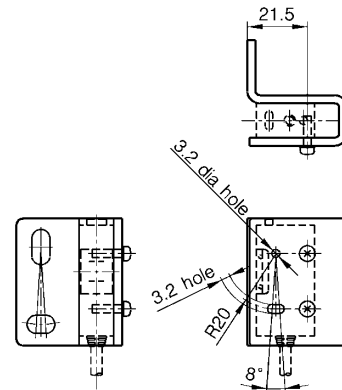
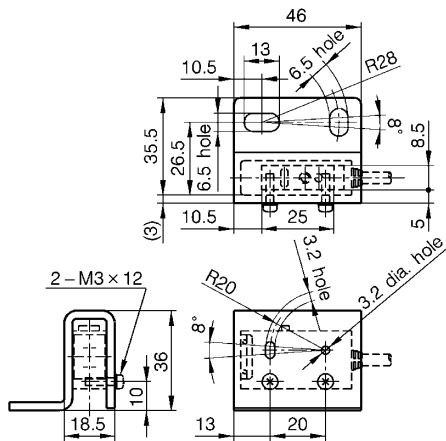
(unit: mm)



- Cover type mounting bracket **HPA-B03** (separate order) (cannot be used for a connector model)

Horizontal mounting

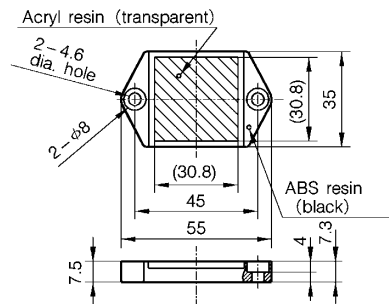
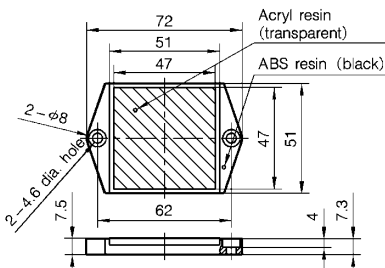
Vertical mounting



- Reflector

- Reflector **FE-RR8** (separate order)

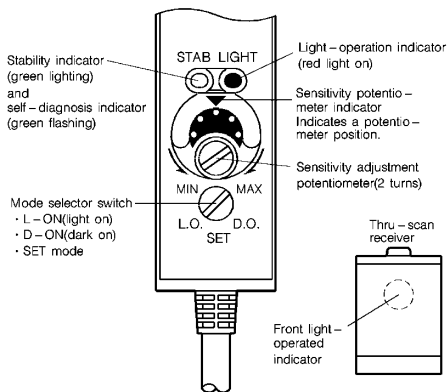
- Small reflector **FE-RR15** (separate order)



NAME OF COMPONENT

• High function thru-scan receiver

High function polarized retroreflective model

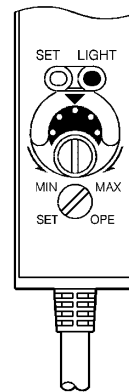


• General use thru-scan receiver

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

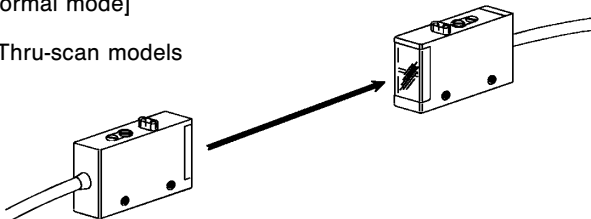
This function halves the quantity of light emitted. (Use this function in environments where the emitted light may not transmit reliably at normal levels.)

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

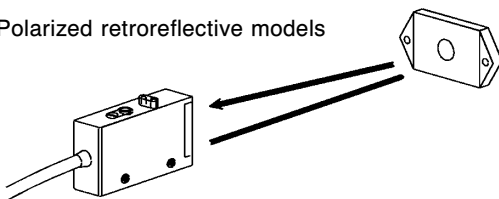
The Strobe Light Emission and High Margin Regulation functions referred to in 1 to 2 are simultaneously realized.

[Normal mode]

• Thru-scan models

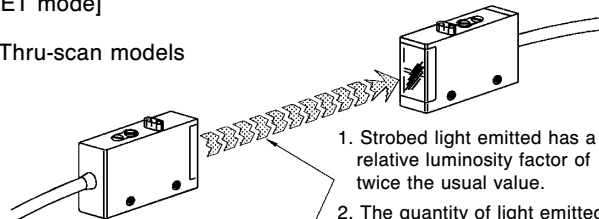


• Polarized retroreflective models

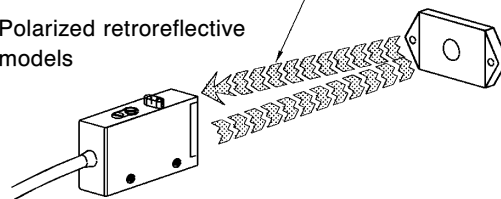


[SET mode]

• Thru-scan models

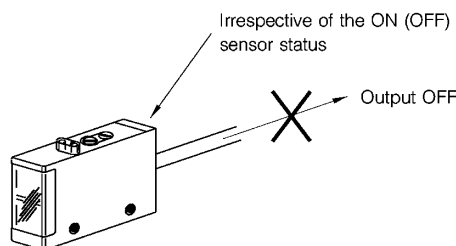


• Polarized retroreflective models



3. Output Inhibit Function

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



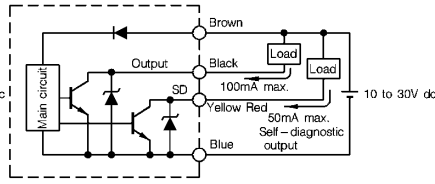
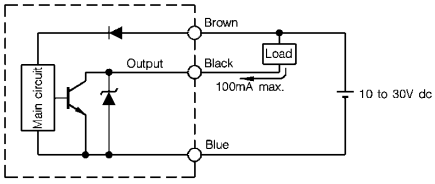
Notes:

- 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.

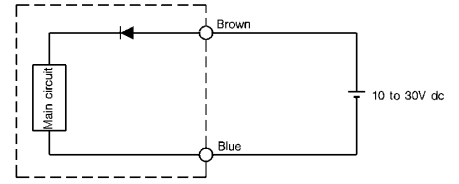
OUTPUT CIRCUIT DIAGRAM

• NPN type

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

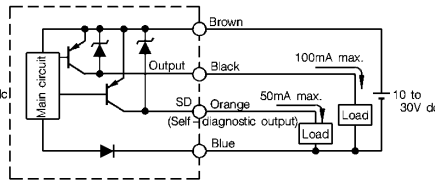
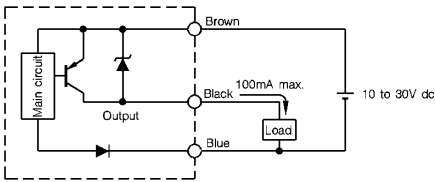


• Thru scan emitter

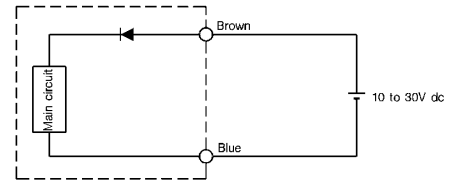


• PNP type

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



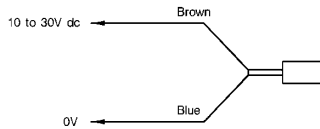
• Thru scan emitter



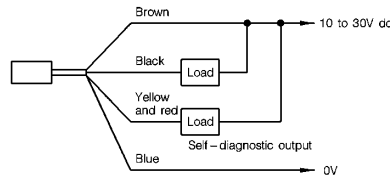
WIRING DIAGRAM

• Pre-leaded models

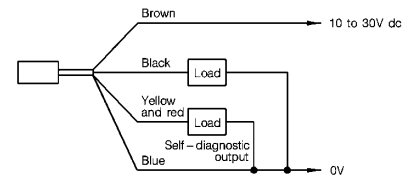
- Thru emitter



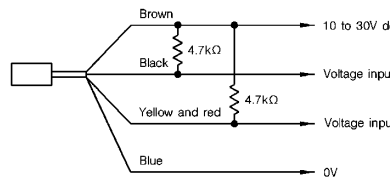
- Thru receiver, polarized retroreflective and diffuse scan models
(when a load is directly applied)
NPN type



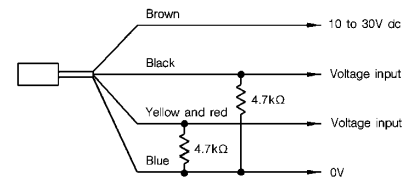
PNP type



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

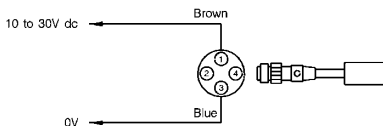


PNP type

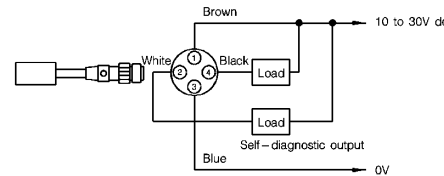


• Connector and pre-leaded connector models

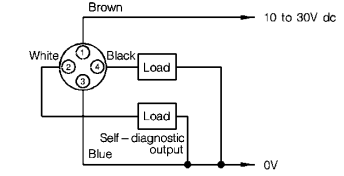
- Thru emitter



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



PNP type



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

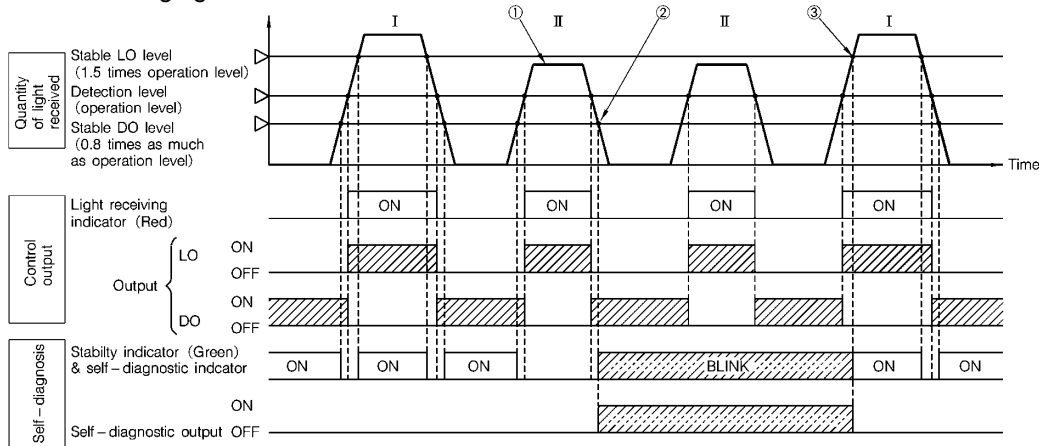
OPERATIONAL TIMING CHARTS OF OUTPUT AND INDICATORS

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



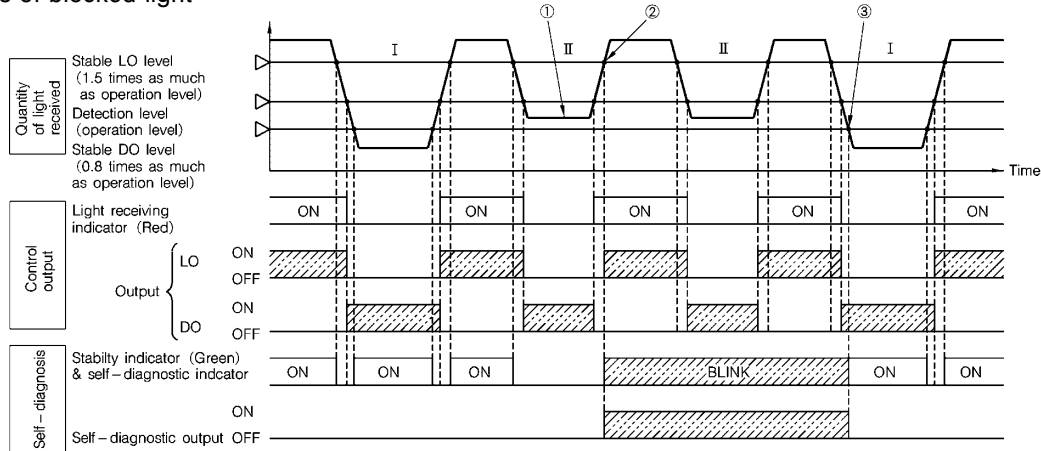
I : The incoming light is sufficient for correct operation.

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

Explanation of timing charts:

1. If the photoelectric control returns to the stable LO level without reaching the stable LO state after the photoelectric control 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.

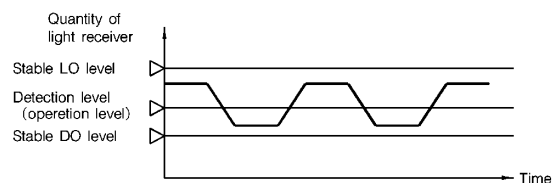
II : The incoming light is insufficient, in which case the self-diagnostic output and indicator go ON.

Explanation of timing charts:

1. If the photoelectric control returns to the stable LO level without reaching the stable DO state after the photoelectric control 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.

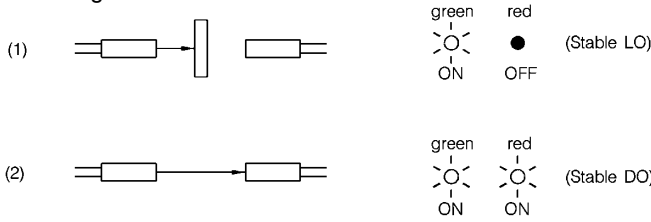
When a workpiece with a slight difference in the quantity reflected of light is scanned, such as in scanning a transparent body, the quantity of light received will neither fall to the stable DO level nor rise to the stable LO level. In this case, neither the self-diagnostic output nor the indicating 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

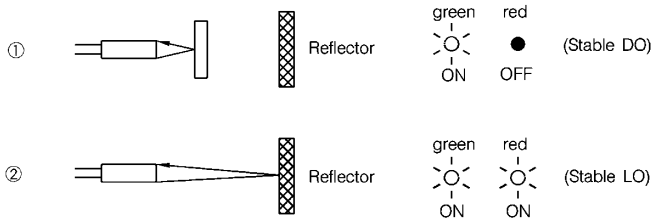
• Thru-scan models

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

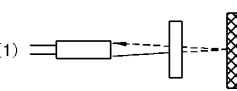
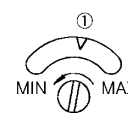
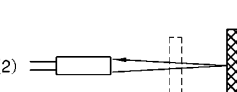

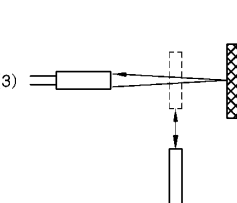



• Polarized retroreflective models

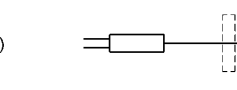

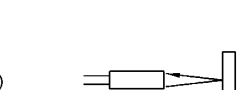

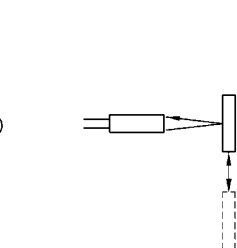
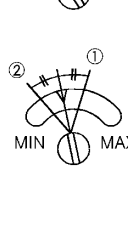
Basically, the adjustment is the same as thru-scan models.



• 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

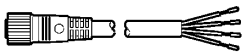
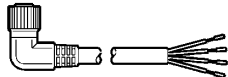
Item	Specifications
Operating voltage / current	5V ac/dc, 5mA min., 125V ac/dc, 3A max.
Insulation resistance	100MΩ min. (by 500V dc megger)
Dielectric strength	1500V ac, for 1min (between contacts, between contact and connector housing)
Initial contact resistance	40mΩ max., (when 3A current is fed to 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

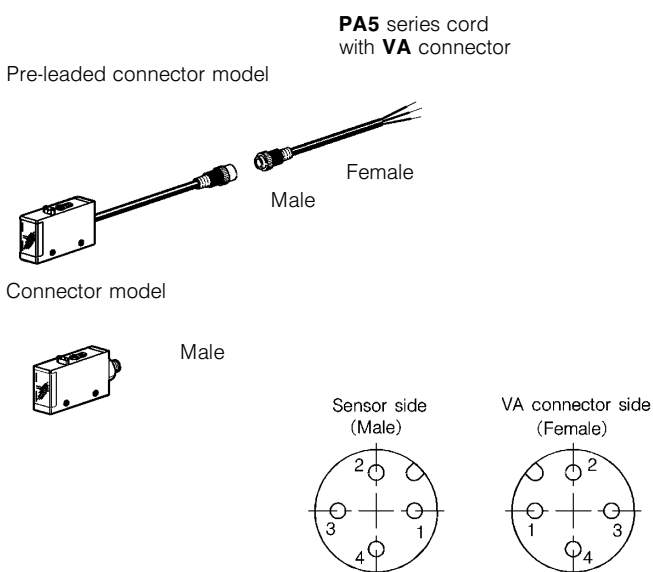
- Notes: 1. Specifications assume Yamatake male/female connectors.
 2. The recommended torque is 0.4 to 0.6N-m.
 If fastened poorly, the IP67 protection is lost, or looseness occurs.
 Fasten the connector securely by hand.

CONNECTION CORD WITH CONNECTOR

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

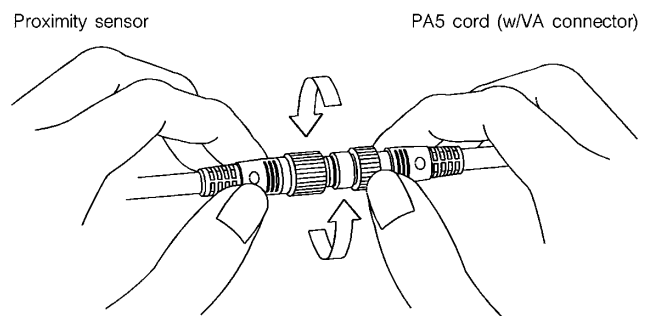
• PA5 series cord with VA connector

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 proximity sensor side.



BASIC INSTRUCTIONS

● Wiring

- (1) Be sure to connect a photoelectric control to the power supply and load correctly.
- (2) If a high-voltage or power cable exists near a photoelectric control cord, lay the photoelectric control's independently or lay in another conduit to prevent surge and noise influence.
- (3) Connect the lead end securely using crimp terminals.
- (4) Use a cord of at least 0.3mm^2 in cross-sectional area for extensions. The lead length should not be over 100m. Consider the influence of noise due to lead extension.
- (5) If a controlling power unit is used, ground its frame.
- (6) If capacitive load is used, connect a current limiting resistor so as to limit the inrush current to max. 100mA.

● Handling

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