



Fiber Unit Selection Guide

HPF Series



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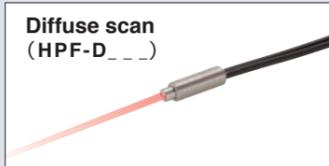
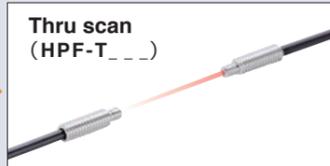
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Search by model number



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Search by type or application

Select by shape or optical type

Screw
Most generally used. Use by attaching to a bracket, etc. **P9**

Cylindrical
Suitable for installation where space is limited. Use by attaching with the setscrew. **P13**

Coaxial
Used for target object positioning or in combination with spot lenses. **P15**

Sleeve
Use to maintain a small distance between target object and sensor in a limited space. **P17**

Side view
Light emitted to the side. Use to maintain a small distance between target object and sensor in a limited space. **P19**

Narrow view
Light spread minimized. Use in a place where light intrusion is undesirable. **P21**

Flat/Vane
Suitable for installation where space is limited. Attach directly to casing. **P23**

Selective reflection
Resistant to ambient influences. Use for target object detection in a limited area. **P24**

Area
Wide light beam. Use for target object with varying detection positions, detection of meandering, etc. **P25**

Select by environment

Heatproof
Resistant to high temperatures. Use in environments up to 350 °C. **P27**

Chemical-proof
Protected with PFA tubing for excellent chemical resistance. **P29**

Vacuum-proof
Usable in a vacuum. Cable length can be specified. **P31**

Select by application

Liquid level detection **P37**

Liquid level detection **P35**

Liquid leak detection **P39**

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Accessories

Lens unit accessory **P43**

Long-distance lens / side view unit **P45**

Other accessories **P46**



- Screw
- Cylindrical
- Coaxial
- Sleeve
- Side view
- Narrow view
- Flat/Selective reflection
- Area
- Heatproof
- Chemical-proof
- Vacuum-proof
- Specialized Use
- Lens unit
- Other accessories

Technical Guide

List of Scanning Distance by Amplifiers Model

Introducing: Combination Amplifiers

High performance • Advanced functions

HPX-AG series

<Exterior view>



<Operation panel>



Typical models

Type	Model No.
Standard	HPX-AG00-1S
Space-saving (main unit)	HPX-AG00-3S
Space-saving (expansion unit)	HPX-AG00-5S

Double digital display
High-sensitivity, ultra-long distance detection
Multifunctional models
(Alarm output, differential output, two outputs, databank, etc.)

<Standards compliance>



Volume

HPX-EG series

<Exterior view>



<Operation panel>



Typical models

Type	Model No.
Standard	HPX-AG00-1S
Space-saving (main unit)	HPX-AG00-3S
Space-saving (expansion unit)	HPX-AG00-5S

Double digital display
Built for usability
(Sensitivity auto-change function, threshold value tracking function)

<Standards compliance>



Standard

HPX-A series HPX-H series

<Exterior view>



<Operation panel>



Typical models

Type	Model No.
Low hysteresis	HPX-A1
High sensitivity	HPX-H1

Sensitivity adjuster with indicator
Self-diagnostic display (output)
Slim 10 mm profile

<Standards compliance>



Introducing: Fiber Customization Services

Change the cable length

If fiber length is insufficient, you can specify a cable length.

<Example model number>

HPF-T001-L05

Base model number

L02: Fiber length 2 m

L05: Fiber length 5 m

L10: Fiber length 10 m

- Price: Determined by quantity
- Qty: No minimum (1 cable or more)

*For details on the scanning distances with a different cable length, see the Technical Guide (page 49).

*The cable cannot be lengthened on some models. For details, please contact our sales staff.

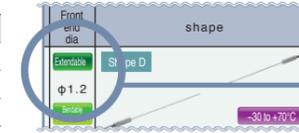
Change the sleeve length

A range of on-site services are available, such as emergency sensor additions and changes, and sample production evaluation.

Applicable models

Thru scan	Diffuse scan
HPF-T005	HPF-D003
HPF-T015	HPF-D006
HPF-T037	HPF-D011

<List example>



Customizable models have this label.

Example model number

For an HPF-T005 with a 120 mm sleeve and 5 m fiber unit cable

HPF-T005-S120L05 is the model number.

- Price: Determined by quantity

- Quantity: No minimum (1 cable or more)

The standard (base) model No.

"S" + 3-digit sleeve length.

Cable length. This can be omitted if length is standard.

Introducing: Element Types

Material of element

Plastic

Performance/Feature

General-purpose

Bend-tolerant

Unbreakable

Heatproof

Multi-component glass

Heatproof Two types, 200°C and 350°C

Vacuum 350°C

<List example>

Cable		
Bend radius	Length	Amp
R1	2 m	HPX-AG
Unbreakable	Free cut	HPX-EG
		HPX-H
		HPX-

Indicates element type.

Bend-tolerant fiber unit

R4

For use in moving environments



Cyclic bending test (reference)

Bent ±90°

[Measurement conditions]
Roller diameter: 8 mm (4 mm in radius)
Load: 500 g

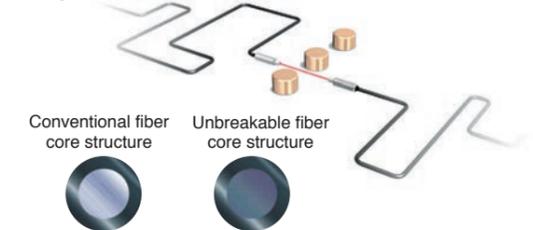
For example, HPF-T008 and -T009 withstand 1,000,000 bends under these conditions without breaking.

Unbreakable fiber unit (stationary bend type)

R1/R2

Even if the cable is bent at a small radius, the light level does not change.

Thanks to multi-core structure bundling several 100s of fiber elements, bending the cable does not attenuate the light level.



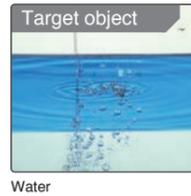
Case Studies (with actual workpiece data)

This section gives application case studies along with evaluation data using actual workpieces.

Liquid level detection

[Type] Specialized use (Thru scan)

[Catalog listing] HPF-D027, HPF-D033



Reference data Received light level display value

Combination amplifiers: HPX-EG series
(Sensing model : nL3)

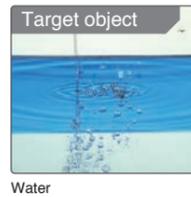
Catalog listing	Presence of liquid	Absence of liquid
HPF-D027	1900	120
HPF-D033	800	45

Liquid level detection ▶ P35

Liquid level detection

[Type] Specialized use (Thru scan)

[Catalog listing] HPF-T032_, HPF-T034_



Reference data Received light level display value

Combination amplifiers: HPX-AG series
(Sensing mode : nL3)
For 8mm dia. pipe only : nL2)

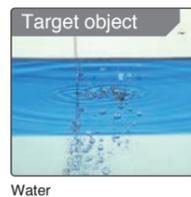
Catalog listing	Pipe diameter	Presence of liquid	Absence of liquid
HPF-T032	6 mm	530	5850
HPF-T032E	8 mm	150	5000
HPF-T034	12 mm	7500	110
HPF-T034E	19 mm	5000	75

Liquid level detection ▶ P37

Liquid leak detection

[Type] Specialized use (Diffuse scan)

[Catalog listing] HPF-D040



Reference data Received light level display value

Combination amplifiers: HPX-EG series
(Sensing mode: nL3)

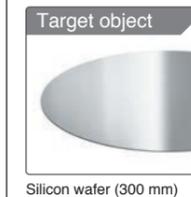
Catalog listing	Presence of liquid	Absence of liquid	Sensor floating
HPF-D040	2950	850	450

Liquid leak detection ▶ P39

Wafer mapping

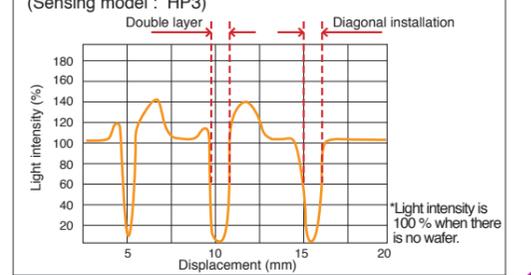
[Type] Narrow view (Thru scan)

[Catalog listing] HPF-T030



Reference data Light level change characteristics

Combination amplifiers: HPX-AG series
(Sensing model : HP3)

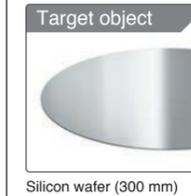


Narrow view ▶ P21

Wafer projection detection

[Type] Narrow view (Thru scan)

[Catalog listing] HPF-T020



Reference data

Combination amplifiers: HPX-AG series
(Sensing model: HP3)

Item	Amount
σ	3 μ m max.
Max - Min	11 μ m

■ Edge detection repeatability accuracy

Narrow view ▶ P21

Gold wire detection

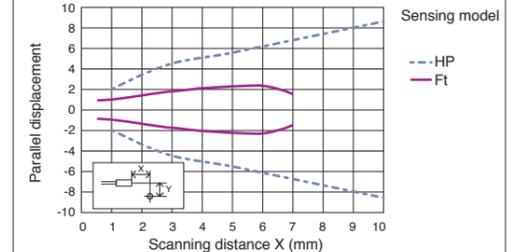
[Type] Coaxial (Diffuse scan)

[Catalog listing] HPF-D009



Reference data Detection area characteristics

Combination amplifiers: HPX-AG series
(Sensing model : HP, FT)

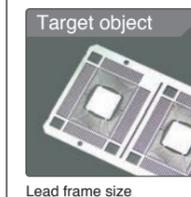
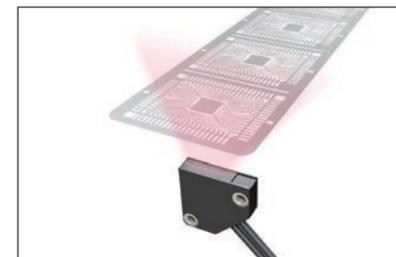


Coaxial ▶ P15

Lead frame detection

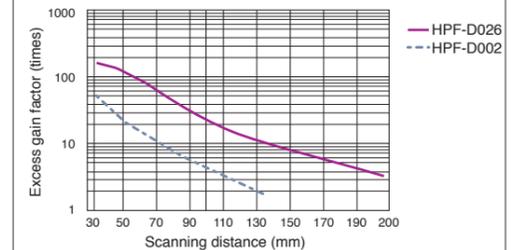
[Type] Area (Diffuse scan)

[Catalog listing] HPF-D026



Reference data Excess gain

Combination amplifiers: HPX-AG series
(Sensing model : HP3)

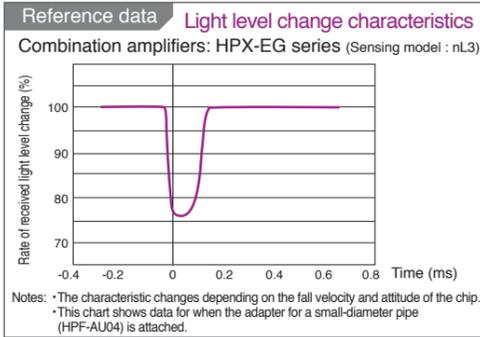
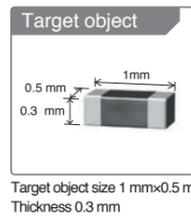
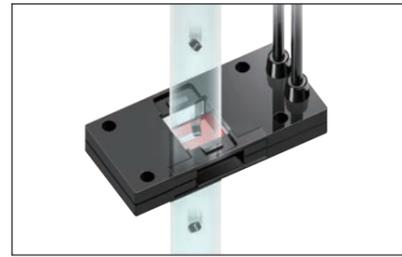


Area ▶ P25

Note: The possibility of detection, as well as the measurement performance and degree of accuracy, are affected by the actual working conditions. Before using the fiber unit, carry out a careful operation check.

Passing chip detection

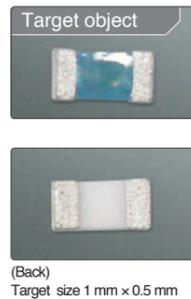
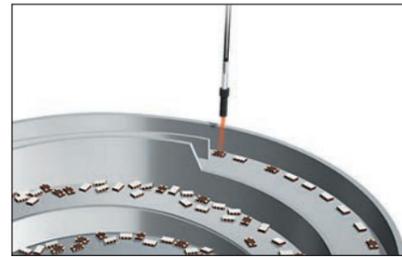
[Type] Specialized use (Thru scan)
 [Catalog listing] HPF-D027, HPF-D033



Passing chip detection P 33

Chip face/back discrimination

[Type] Coaxial (Diffuse scan)/ Micro-Spot Lens
 [Catalog listing] HPF-D034, HPF-LU07



Reference data Received light level display value
 Combination amplifiers: HPX-EG series (Sensing model : nL3)

Scanning distance	Front of component	Rear of component
-2 mm	100	67
-1 mm	143	57
Focal Distance	430	310
+1 mm	230	120
+2 mm	100	50

Coaxial/Micro-Spot Lens P 43

Substrate "Bad" mark detection

[Type] Coaxial (Diffuse scan) / Micro-Spot Lens
 [Catalog listing] HPF-D038, HPF-LU08



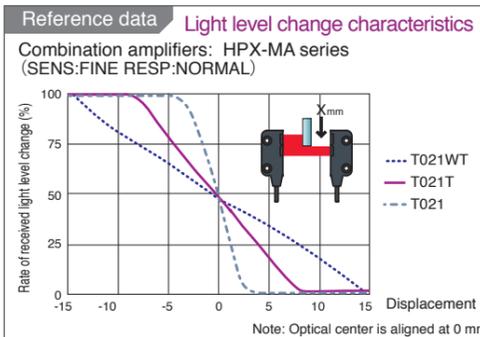
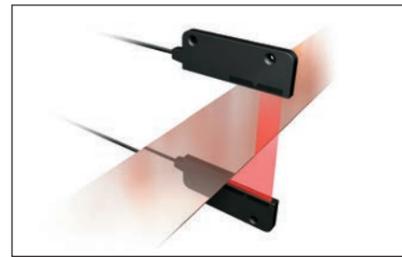
Reference data Received light level display value
 Combination amplifiers: HPX-AG series (Sensing model : Ft3)

Scanning distance	Mark	Reject mark
-2 mm	1000	1000
-1 mm	2450	1830
Focal Distance	3150	2370
+1 mm	3820	2900
+2 mm	3805	3030

Coaxial/Micro-Spot Lens P 43

Detection of meandering

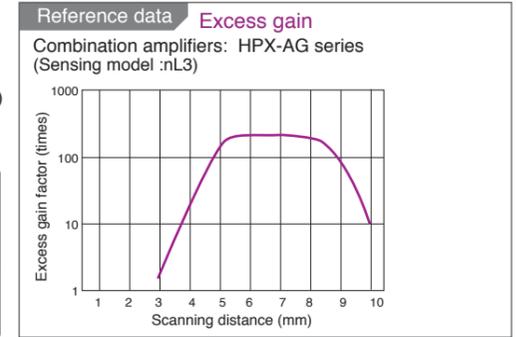
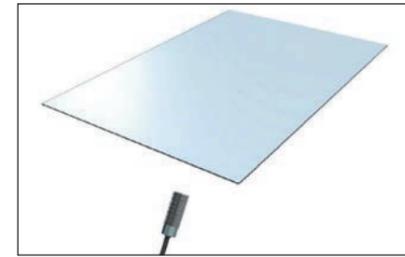
[Type] Area (Thru scan)
 [Catalog listing] HPF-T021T_



Area P 25

Glass detection

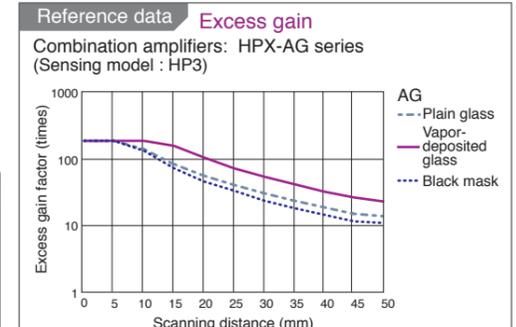
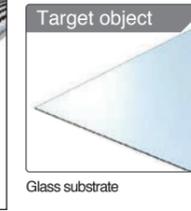
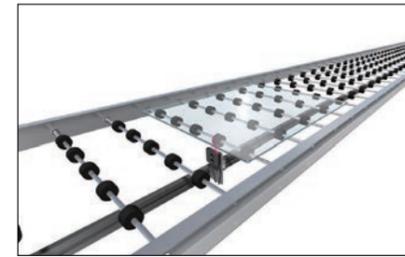
[Type] General-purpose screw (Diffuse scan)
 [Catalog listing] Fiber: HPF-D002 Amplifiers:HPX-AG series (HP3)



Screw P 11

Glass detection

[Type] Selective reflection (Diffuse scan)
 [Catalog listing] HPF-D028T

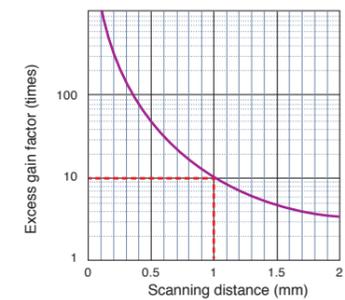


Selective reflection P 24

Understanding the graphs

Excess gain

The excess gain indicates the magnitude of output from the light-receiving element relative to the amount of light received by the fiber unit (which varies depending on the distance). The graph shows that at a distance of 1, the output from the light-receiving element is 10 times the level required for operation.

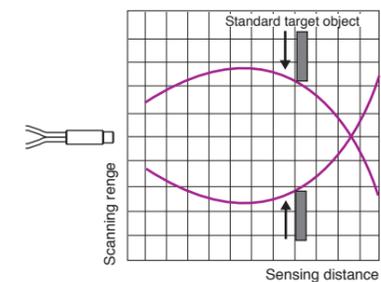


This surplus is available in case there is a decrease in the incoming light level due to misalignment of the optical axis, dirt on the light-receiving element, etc.

Note: On an excess gain graph, the minimum operating level of the amplifier is set at 1.

Detection area

The detection area is a characteristic used for diffuse scans. The graph shows the operation points of the fiber sensor when a standard target object (white paper) is moved perpendicular to the optical axis at the maximum sensitivity setting. This illustrates the extent of detectable light around the fiber unit.

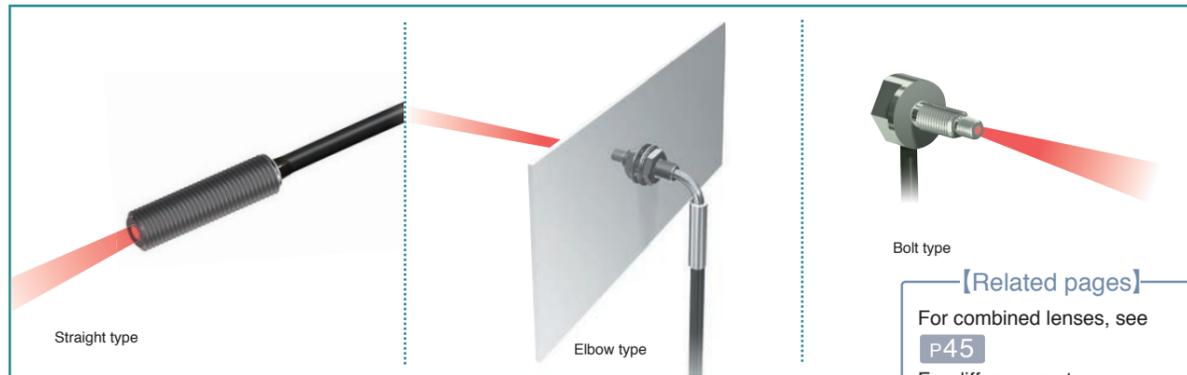


Note: For the excess gain graph, the minimum operating level of amplifier unit is set as 1.

Note: Detection availability, measurement performance, and accuracy also depend on actual working conditions. Use the fiber unit after carrying out in advance an operation check and evaluation.

Screw Thru scan

Most generally used.
Use by attaching to a bracket, etc.



[Related pages]

For combined lenses, see

P45

For diffuse scan type, see page 9.

Thru scan

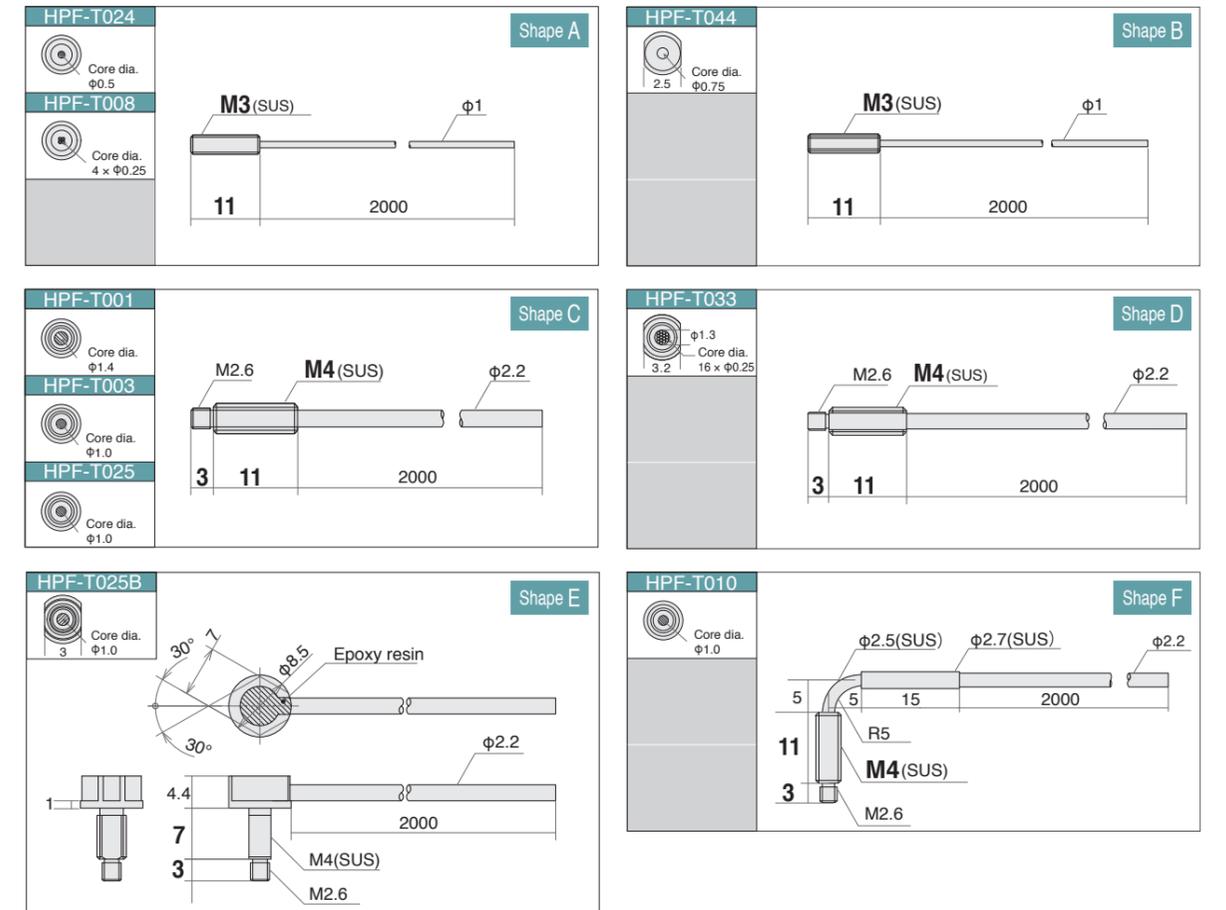
Type	Size	Shape	Cable		Scanning distance (mm)		Core	Min. detectable size (mm)	Model No.			
			Bend radius	Length	Amp	Mode				Distance		
Straight	M3	Shape A	Unbreakable	Free cut	R1	2m	HPX-AG	HP FT 140	φ0.5	φ0.005	HPF-T024	
							HPX-EG	nL FT 50				
							HPX-H	nL FT 29				
		Shape B	Bend toleranti	Free cut	R4	2m	HPX-AG	HP FT 180	4xφ0.25	φ0.01	HPF-T008	
							HPX-EG	nL FT 52				
							HPX-H	nL FT 60				
	M4	Shape C	Lens attachable	Unbreakable	Free cut	R2	2m	HPX-AG	HP FT 195	φ0.75	φ0.005	HPF-T044
								HPX-EG	nL FT 220			
								HPX-H	nL FT 130			
		Shape D	Lens attachable	Bend toleranti	Free cut	R20	2m	HPX-AG	HP FT 220	φ1.0	φ0.005	HPF-T025
								HPX-EG	nL FT 110			
								HPX-H	nL FT 150			
M4	Shape C	Lens attachable	Unbreakable	Free cut	R2	2m	HPX-AG	HP FT 260	φ1.0	φ0.005	HPF-T003	
							HPX-EG	nL FT 310				
							HPX-H	nL FT 180				
	Shape E	Lens attachable	Bend toleranti	Free cut	R20	2m	HPX-AG	HP FT 300	φ1.0	φ0.005	HPF-T003	
							HPX-EG	nL FT 350				
							HPX-H	nL FT 410				
Bolt	M4	Shape C	Lens attachable	Unbreakable	Free cut	R2	HPX-AG	HP FT 300	φ1.0	φ0.005	HPF-T025B	
							HPX-EG	nL FT 150				
							HPX-H	nL FT 200				
	Shape D	Lens attachable	Bend toleranti	Free cut	R4	2m	HPX-AG	HP FT 350	16xφ0.25	φ0.01	HPF-T033	
							HPX-EG	nL FT 410				
							HPX-H	nL FT 240				
Elbow	M4	Shape F	Lens attachable	Unbreakable	Free cut	R20	HPX-AG	HP FT 400	φ1.0	φ0.005	HPF-T010	
							HPX-EG	nL FT 630				
							HPX-H	nL FT 2175				
	Shape E	Lens attachable	Bend toleranti	Free cut	R2	2m	HPX-AG	HP FT 450	φ1.4	φ0.01	HPF-T001	
							HPX-EG	nL FT 770				
							HPX-H	nL FT 800				
Shape F	Lens attachable	Bend toleranti	Free cut	R20	2m	HPX-AG	HP FT 400	φ1.0	φ0.005	HPF-T033		
						HPX-EG	nL FT 265					
						HPX-H	nL FT 130					

*For scanning distances of the sensing modes, see the Technical Guide (page 51).

*Response times for the sensing types: HP 5 ms, nL 1 ms, and FT 250 μs.

*The values shown in the Minimum detectable size column were obtained with optimal scanning distance and sensitivity settings (HPX-AG).

Outer dimensions



NOTEWORTHY

Products allowing either nut or setscrew installation are available for flexible operability, maintenance parts consolidation, and other factors.

HPF-T025B

Nut installation



Setscrew installation



Applicable model number

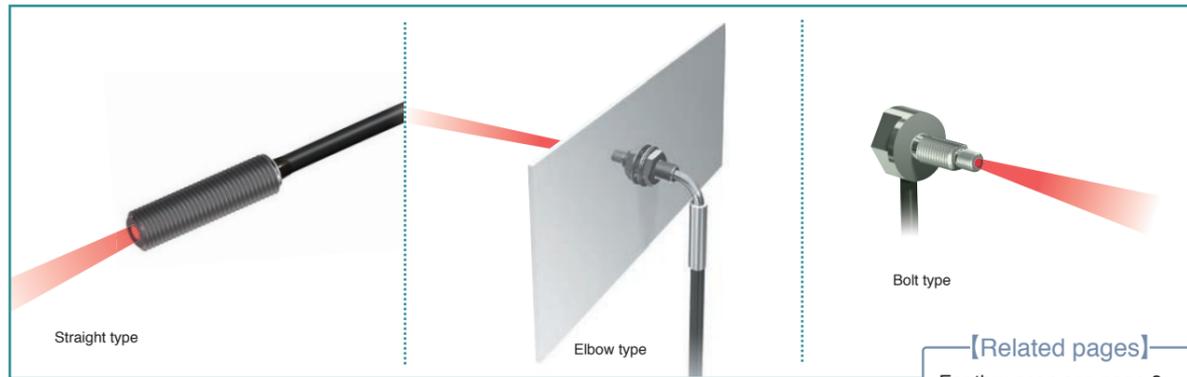
Form	Type	Model no.
Thru scan	Straight	HPF-T033
Thru scan	Straight	HPF-T044
Thru scan	Bolt	HPF-T025B

D-Shape cutout

Attachment method selectable

Screw Diffuse scan

Most generally used.
Use by attaching to a bracket, etc.



[Related pages]

For thru scan see page 9.

Diffuse scan

Type	Size	Shape	Cable		Scanning distance (mm)			Core	Min. detectable size (mm)	Model No.
			Bend radius	Length	Amp	Mode	Distance			
Straight	M3	Shape G	R1	2m	HPX-AG	HP	25	Receiver and emitter $\phi 0.5$	$\phi 0.005$	HPF-D029
					FT	8				
					nL	10				
		HPX-H	HP	10	Receiver and emitter $\phi 0.5$	$\phi 0.005$	HPF-D004			
			FT	5						
			nL	5						
	M4	Shape H	R4	2m	HPX-AG	HP	20	Receiver and emitter $2 \times \phi 0.25$	$\phi 0.005$	HPF-D037
					FT	6				
					nL	8				
		HPX-H	HP	8	Receiver and emitter $\phi 0.75$	$\phi 0.005$	HPF-D018			
			FT	5						
			nL	5						
M6	Shape I	R15	2m	HPX-AG	HP	105	Receiver and emitter $\phi 1.0$	$\phi 0.005$	HPF-D030	
				FT	34					
				nL	43					
	HPX-H	HP	40	Receiver and emitter $\phi 1.4$	$\phi 0.005$	HPF-D001				
		FT	20							
		nL	20							
M6	Shape J	R2	2m	HPX-AG	HP	210	Receiver and emitter $\phi 1.0$	$\phi 0.005$	HPF-D030	
				FT	69					
				nL	85					
	HPX-H	HP	80	Receiver and emitter $16 \times \phi 0.25$	$\phi 0.005$	HPF-D012				
		FT	50							
		nL	50							
M6	Shape J	R4	2m	HPX-AG	HP	250	Receiver and emitter $\phi 1.4$	$\phi 0.005$	HPF-D001	
				FT	80					
				nL	100					
	HPX-H	HP	100	Receiver and emitter $\phi 1.0$	$\phi 0.005$	HPF-D002				
		FT	50							
		nL	50							
M6	Shape J	R20	2m	HPX-AG	HP	530	Receiver and emitter $\phi 1.0$	$\phi 0.005$	HPF-D002	
				FT	170					
				nL	210					
	HPX-H	HP	120	Receiver and emitter $\phi 1.0$	$\phi 0.005$	HPF-D002				
		FT	120							
		nL	120							
M6	Shape J	R20	2m	HPX-AG	HP	400	Receiver and emitter $\phi 1.0$	$\phi 0.005$	HPF-D002	
				FT	130					
				nL	150					
	HPX-H	HP	150	Receiver and emitter $\phi 1.0$	$\phi 0.005$	HPF-D002				
		FT	90							
		nL	150							

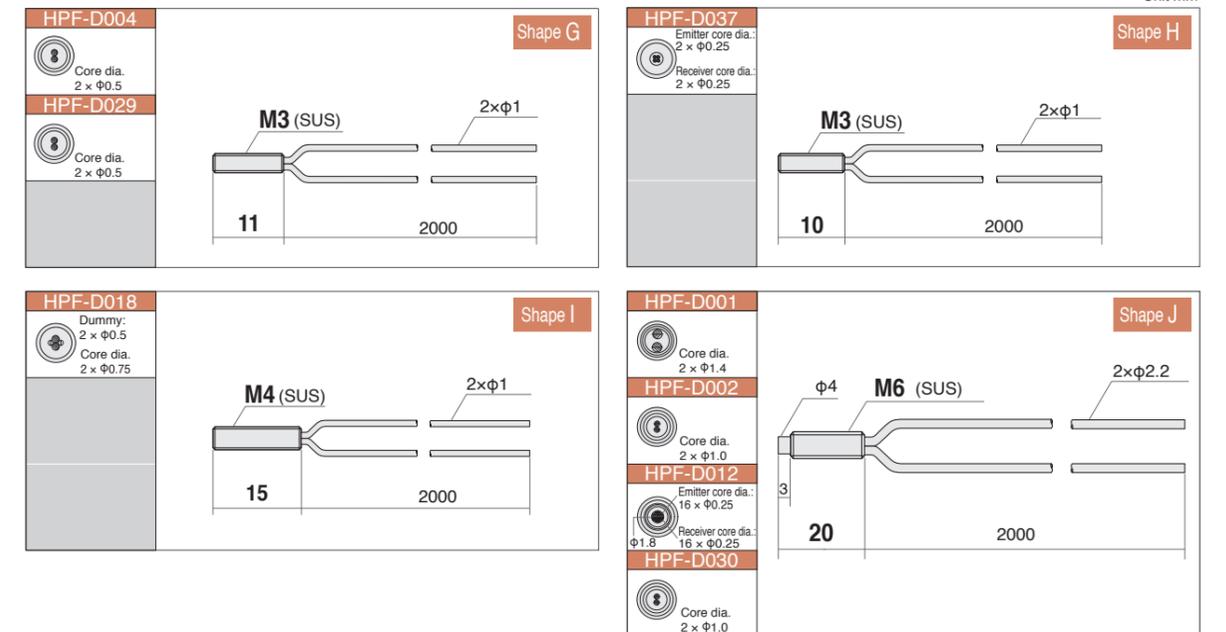
*For scanning distances of the sensing modes, see the Technical Guide (page 52).

*Scanning distances for diffuse scan are obtained with a standard target object (plain white paper).

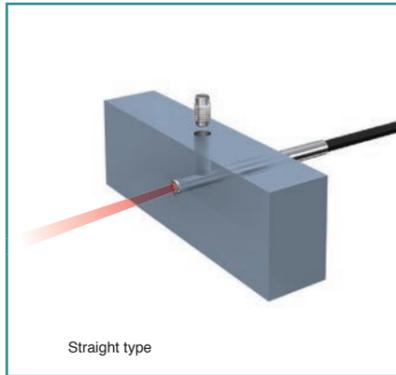
*Response times for the sensing types: HP 5 ms, nL 1 ms, and FT 250 μ s.

*The values shown in the Minimum detectable size column were obtained with optimal scanning distance and sensitivity settings (HPX-AG).

Outer dimensions



Suitable for installation where space is limited.
Use by attaching with the setscrew.



[Related pages]

Side-view sensors

P19

Compatible lenses

P45

For head dia. of less than $\phi 1.0$ mm (thru scan) or $\phi 1.5$ mm (diffuse scan), select from sleeve-type sensors.

P17

Thru scan

Type	Size	Shape	Cable		Scanning distance (mm)			Core	Min. detectable size (mm)	Model No.
			Bend radius	Length	Amp	Mode	Distance			
Straight	$\phi 1$	Shape A	R4	0.5 m	HPX-AG	HP FT 37		$\phi 0.25$	$\phi 0.005$	HPF-T038
					HPX-EG	nL FT 12				
					HPX-H	FT 7				
	$\phi 1.5$	Shape B	R4	2 m	HPX-AG	HP FT 180		$4 \times \phi 0.25$	$\phi 0.01$	HPF-T009
					HPX-EG	nL FT 60				
		Shape C	R4	2 m	HPX-AG	HP FT 180		$4 \times \phi 0.25$	$\phi 0.01$	HPF-T046
					HPX-EG	nL FT 60				
		Shape D	R4	0.5 m	HPX-AG	HP FT 18		$\phi 0.125$	$\phi 0.005$	HPF-T036
					HPX-EG	nL FT 6				
	$\phi 2$	Shape E	R15	2 m	HPX-AG	HP FT 300		$\phi 0.5$	$\phi 0.005$	HPF-T043
					HPX-EG	nL FT 85				
					HPX-H	FT 100				
$\phi 3$	Shape F	R2	2 m	HPX-AG	HP FT 260		$\phi 1.0$	$\phi 0.005$	HPF-T031	
				HPX-EG	nL FT 310					
	Shape G	R20	2 m	HPX-AG	HP FT 350		$\phi 1.0$	$\phi 0.005$	HPF-T004	
				HPX-EG	nL FT 410					
	Shape G	R20	2 m	HPX-AG	HP FT 630		$\phi 1.4$	$\phi 0.01$	HPF-T002	
				HPX-EG	nL FT 770					
Shape G	R20	2 m	HPX-AG	HP FT 450		$\phi 1.4$	$\phi 0.01$	HPF-T002		
			HPX-EG	nL FT 450						

Diffuse scan

Type	Size	Shape	Cable		Scanning distance (mm)			Core	Min. detectable size (mm)	Model No.
			Bend radius	Length	Amp	Mode	Distance			
Straight	$\phi 1.5$	Shape H	R4	1 m	HPX-AG	HP FT 20		Receiver and emitter $2 \times \phi 0.25$	$\phi 0.005$	HPF-D036
					HPX-EG	nL FT 8				
Straight	$\phi 3$	Shape I	R15	2 m	HPX-AG	HP FT 105		Receiver and emitter $\phi 0.5$	$\phi 0.005$	HPF-D005
					HPX-EG	nL FT 43				

Outer dimensions

Unit: mm

HPF-T038

Shape A

HPF-T009

Shape B

HPF-T046

Shape C

HPF-T036

Shape D

HPF-T043

Shape E

HPF-T031

Shape F

HPF-T004

Shape G

HPF-D036

Shape H

HPF-D005

Shape I

NOTEWORTHY

Smallest fiber unit head dia. (1.0 mm) in the industry

HPF-T038



Compatible lens units are available for cylindrical types

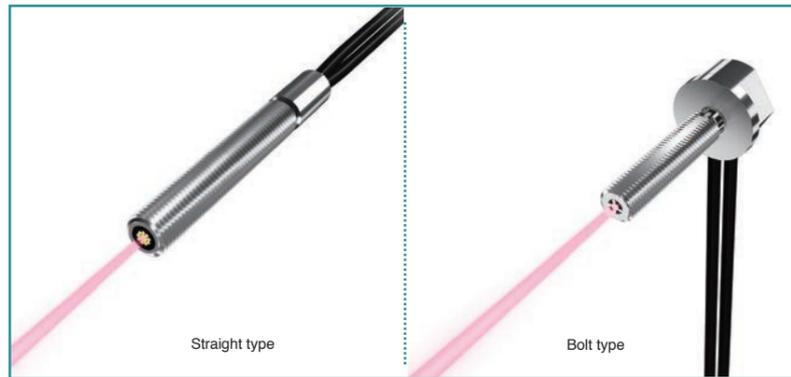
FE-PA-L1 (For long distance and narrow beam types)

HPF-T004

FE-PA-S1 (For side view types)

*For scanning distances of the sensing modes, see the Technical Guide (page 51).
 *Scanning distances for diffuse scan are obtained with a standard target object (plain white paper).
 *Response times for the sensing types: HP 5 ms, nL 1 ms, and FT 250 μ s.
 *The values shown in the Minimum detectable size column were obtained with optimal scanning distance and sensitivity settings (HPX-AG).

Used for target object positioning or in combination with spot lenses.



[Related pages]

For compatible micro-spot lenses
P43

Diffuse scan

Type	Size	Shape	Cable		Scanning distance (mm)			Core	Min. detectable size (mm)	Model No.
			Bend radius	Length	Amp	Mode	Distance			
Straight	M3	Shape A Lens attachable -30 to +70°C	R4	0.5m	HPX-AG	HP FT	60	Emitter: $\phi 0.25$ Receiver: $6 \times \phi 0.25$	$\phi 0.005$	HPF-D034
					HPX-EG	nL	25			
					HPX-H	FT	15			
		Shape B Lens attachable	Emitter: R1 Receiver: R4 Unbreakable	2m	HPX-AG	HP FT	46	Emitter: $\phi 0.5$ Receiver: $4 \times \phi 0.25$	$\phi 0.005$	HPF-D032
					HPX-EG	nL	18			
	HPX-H	FT	10							
	Shape C Lens attachable -30 to +70°C	R15	2m	HPX-AG	HP FT	86	Emitter: $\phi 0.5$ Receiver: $4 \times \phi 0.25$	$\phi 0.005$	HPF-D010	
				HPX-EG	nL	35				
	HPX-H	FT	21							
	Bolt	M3	Shape D Lens attachable -30 to +70°C	R4	1m	HPX-AG	HP FT	160	Emitter: $\phi 0.5$ Receiver: $9 \times \phi 0.25$	$\phi 0.005$
HPX-EG						nL	55			
HPX-H						FT	60			
HPX-AG						HP FT	38			
HPX-EG						nL	60			
Straight	M4	Shape E Lens attachable -30 to +70°C	R15	2m	HPX-AG	HP FT	95	Emitter: $\phi 0.5$ Receiver: $9 \times \phi 0.25$	$\phi 0.005$	HPF-D035
					HPX-EG	nL	43			
					HPX-H	FT	50			
					HPX-AG	HP FT	29			
					HPX-EG	nL	29			
	M6	Shape F Lens attachable -30 to +70°C	R15	2m	HPX-AG	HP FT	46	Emitter: $\phi 0.5$ Receiver: $4 \times \phi 0.25$	$\phi 0.005$	HPF-D032B
					HPX-EG	nL	18			
					HPX-H	FT	10			
					HPX-AG	HP FT	15			
					HPX-EG	nL	18			
Straight	M4	Shape G Lens attachable -30 to +70°C	R15	2m	HPX-AG	HP FT	95	Emitter: $\phi 0.5$ Receiver: $9 \times \phi 0.25$	$\phi 0.005$	HPF-D038
					HPX-EG	nL	43			
					HPX-H	FT	50			
					HPX-AG	HP FT	29			
					HPX-EG	nL	29			
	M6	Shape H Lens attachable -30 to +70°C	R20	2m	HPX-AG	HP FT	400	Emitter: $\phi 1.0$ Receiver: $16 \times \phi 0.25$	$\phi 0.005$	HPF-D009
					HPX-EG	nL	130			
					HPX-H	FT	150			
					HPX-AG	HP FT	90			
					HPX-EG	nL	90			
$\phi 2$	Shape I Lens attachable -30 to +70°C	R15	2m	HPX-AG	HP FT	86	Emitter: $\phi 0.5$ Receiver: $4 \times \phi 0.25$	$\phi 0.005$	HPF-D042	
				HPX-EG	nL	28				
				HPX-H	FT	35				
				HPX-AG	HP FT	21				
				HPX-EG	nL	21				
$\phi 3$	Shape J Lens attachable -30 to +70°C	R15	2m	HPX-AG	HP FT	95	Emitter: $\phi 0.5$ Receiver: $9 \times \phi 0.25$	$\phi 0.005$	HPF-D035C	
				HPX-EG	nL	43				
				HPX-H	FT	50				
				HPX-AG	HP FT	29				
				HPX-EG	nL	29				

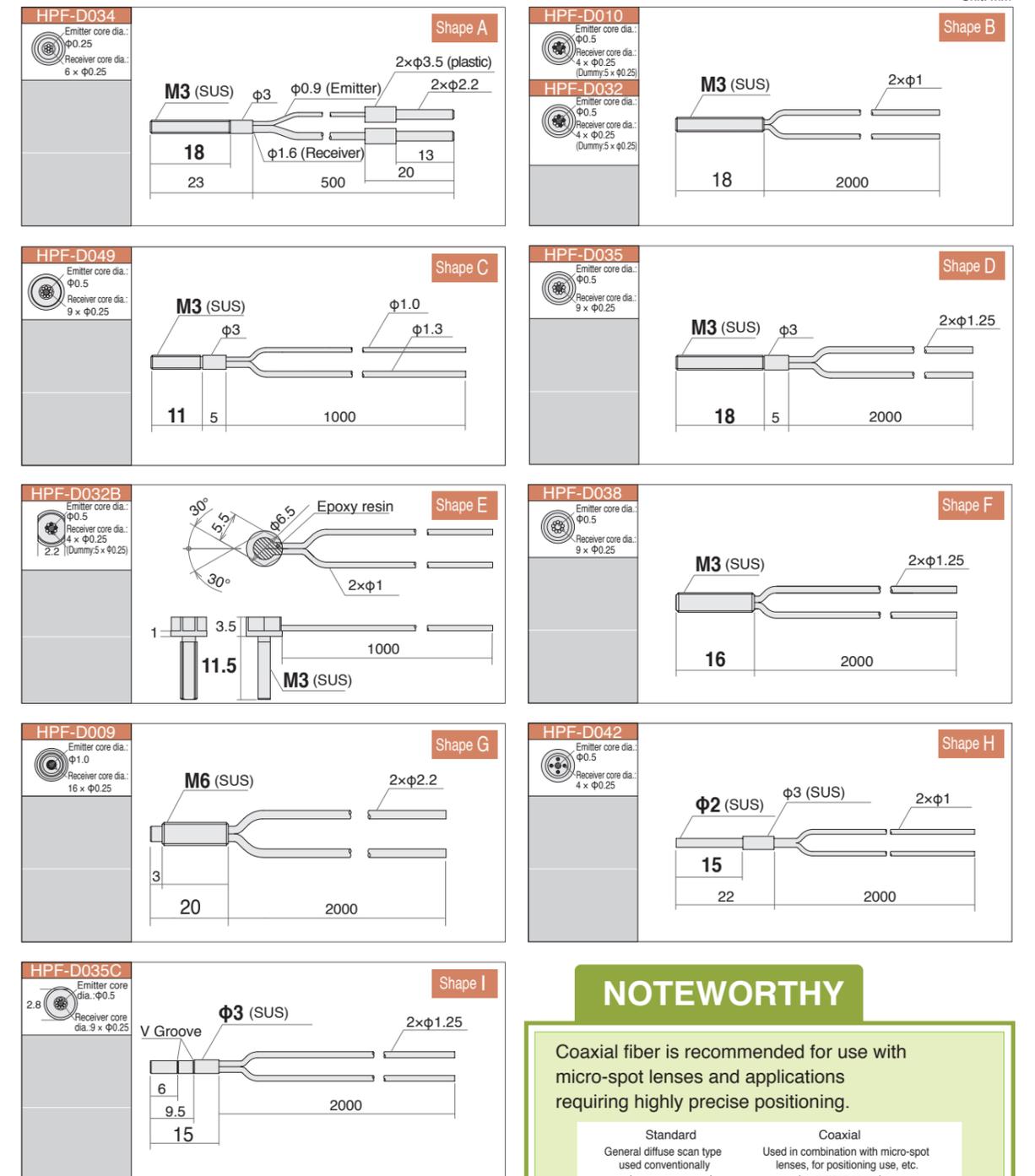
*For scanning distances of the sensing modes, see the Technical Guide (page 51).

*Scanning distances for diffuse scan are obtained with a standard target object (plain white paper).

*Response times for the sensing types: HP 5 ms, nL 1 ms, and FT 250 μ s.

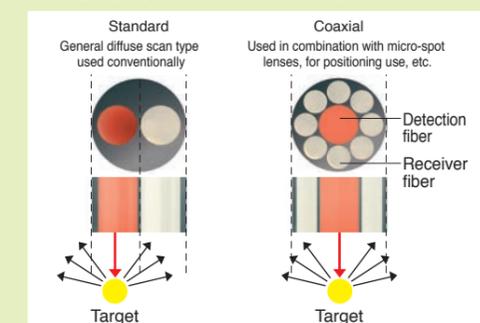
*The values shown in the Minimum detectable size column were obtained with optimal scanning distance and sensitivity settings (HPX-AG).

Outer dimensions



NOTEWORTHY

Coaxial fiber is recommended for use with micro-spot lenses and applications requiring highly precise positioning.



Use to maintain a small distance between target object and sensor in a limited space.



[Related pages]

- Sleeve-length customization **P8**
- Side-view sensing **P19**

Thru scan

Front end dia.	Shape	Cable		Scanning distance (mm)			Core	Min. detectable size (mm)	Model No.
		Bend radius	Length	Amp	Mode	Distance			
φ0.4	Shape A	R4	0.5m	HPX-AG	HP FT 18	φ0.125	φ0.005	HPF-T039	
				HPX-EG	nL FT 5				
				HPX-H	3				
				HPX-A	6				
Extendable φ0.5	Shape B	R15	2m	HPX-AG	HP FT 37	φ0.25	φ0.005	HPF-T015	
				HPX-EG	nL FT 12				
				HPX-H	7				
				HPX-A	12				
Extendable φ1.2	Shape C	R20	2m	HPX-AG	HP FT 350	φ1.0	φ0.005	HPF-T005	
				HPX-EG	nL FT 1,200				
				HPX-H	410				
				HPX-A	240				
Extendable φ1.2	Shape D	R20	2m	HPX-AG	HP FT 350	φ1.0	φ0.005	HPF-T006	
				HPX-EG	nL FT 1,200				
				HPX-H	410				
				HPX-A	240				

Diffuse scan

Front end dia.	Shape	Cable		Scanning distance (mm)			Core	Min. detectable size (mm)	Model No.
		Bend radius	Length	Amp	Mode	Distance			
φ0.82	Shape E	R4	0.5m	HPX-AG	HP FT 20	Receiver and emitter φ0.25	φ0.005	HPF-D039	
				HPX-EG	nL FT 6				
				HPX-H	4				
				HPX-A	2				
φ0.82	Shape F	R15	0.5m	HPX-AG	HP FT 20	Receiver and emitter φ0.25	φ0.005	HPF-D019	
				HPX-EG	nL FT 6				
				HPX-H	4				
				HPX-A	2				
Extendable φ1.2	Shape G	R15	2m	HPX-AG	HP FT 105	Receiver and emitter φ0.5	φ0.005	HPF-D006	
				HPX-EG	nL FT 34				
				HPX-H	43				
				HPX-A	25				
φ1.5	Shape H	R15	2m	HPX-AG	HP FT 86	Receiver and emitter φ0.5	φ0.005	HPF-D021	
				HPX-EG	nL FT 28				
				HPX-H	35				
				HPX-A	21				
Extendable φ2.5	Shape I	R20	2m	HPX-AG	HP FT 400	Receiver and emitter φ1.0	φ0.005	HPF-D003	
				HPX-EG	nL FT 130				
				HPX-H	90				
				HPX-A	150				

*For scanning distances of the sensing modes, see the Technical Guide (page 51).

*Scanning distances for diffuse scan are obtained with a standard target object (plain white paper).

*Response times for the sensing types: HP 5 ms, nL 1 ms, and FT 250 μs.

*The values shown in the Minimum detectable size column were obtained with optimal scanning distance and sensitivity settings (HPX-AG).

Outer dimensions

Unit: mm

HPF-T039 Shape A

HPF-T015 Shape B

HPF-T005 Shape C

HPF-T006 Shape D

HPF-D039 Shape E

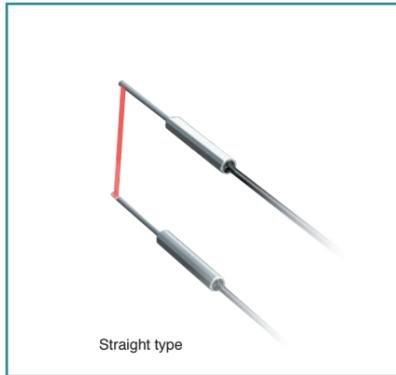
HPF-D019 Shape F

HPF-D006 Shape G

HPF-D021 Shape H

HPF-D003 Shape I

Light emitted to the side.
Use to maintain a small distance between target object and sensor in a limited space.



[Related pages]

Narrow view sensing
P21
Sleeve-length customization
P8

Thru scan

Front end dia.	Center of optical axis (From front end)	Shape	Cable		Scanning distance (mm)			Core	Min. detectable size (mm)	Model No.
			Bend radius	Length	Amp	Mode	Distance			
Extendable φ 0.88	0.6	Shape A	R5	1m	HPX-AG	HP FT	15	φ 0.5	φ 0.005	HPF-T037
					HPX-EG	nL FT	20			
					HPX-H	FT	11			
					HPX-A	FT	10			
φ 1	1.5	Shape B	R1	2m	HPX-AG	HP FT	15	φ 0.5	φ 0.005	HPF-T026
					HPX-EG	nL FT	20			
					HPX-H	FT	11			
					HPX-A	FT	10			
φ 1	1.5	Shape C	R15	2m	HPX-AG	HP FT	48	φ 0.5	φ 0.005	HPF-T007
					HPX-EG	nL FT	55			
					HPX-H	FT	33			
					HPX-A	FT	30			
φ 3	1.5	Shape D	R5	2m	HPX-AG	HP FT	190	φ 0.5	φ 0.005	HPF-T042
					HPX-EG	nL FT	220			
					HPX-H	FT	130			
					HPX-A	FT	120			

Diffuse scan

Front end dia.	Center of optical axis (From front end)	Shape	Cable		Scanning distance (mm)			Core	Min. detectable size (mm)	Model No.
			Bend radius	Length	Amp	Mode	Distance			
Extendable φ 2	1.5	Shape E	R15	2m	HPX-AG	HP FT	13	Receiver and emitter φ 0.5	φ 0.005	HPF-D011
					HPX-EG	nL FT	17			
					HPX-H	FT	10			
					HPX-A	FT	8			
φ 2	1.5	Shape F	R15	2m	HPX-AG	HP FT	13	Receiver and emitter φ 0.5	φ 0.005	HPF-D041
					HPX-EG	nL FT	17			
					HPX-H	FT	10			
					HPX-A	FT	8			
φ 6	1.5	Shape G	R20	2m	HPX-AG	HP FT	52	Receiver and emitter φ 1.0	φ 0.005	HPF-D043
					HPX-EG	nL FT	65			
					HPX-H	FT	40			
					HPX-A	FT	32			

*For scanning distances of the sensing modes, see the Technical Guide (page 51).
 *Scanning distances for diffuse scan are obtained with a standard target object (plain white paper).
 *Response times for the sensing types: HP 5 ms, nL 1 ms, and FT 250 μs.
 *The values shown in the Minimum detectable size column were obtained with optimal scanning distance and sensitivity settings (HPX-AG).

Outer dimensions

Unit: mm

HPF-T037 Shape A

HPF-T026 Shape B

HPF-T007 Shape C

HPF-T042 Shape D

HPF-D011 Shape E

HPF-D041 Shape F

HPF-D043 Shape G

NOTEWORTHY

Unique feature

All side view types have D-shape cutout on the fiber unit head. This can greatly reduce adjustment man-hours during installation.

The D-shape cutout perpendicular to the optical axis facilitates alignment.

Selection point

The distance from the front end to the center of the optical axis depends on the product structure. Select the model that is suitable for your application.

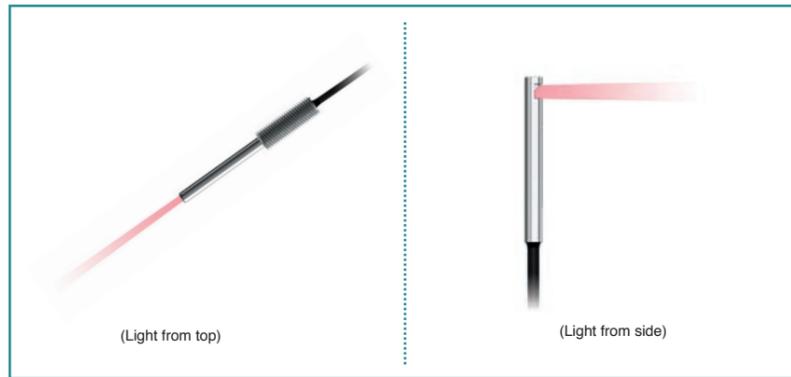
Optical axis position for side view unit

(Example)

In detection of small component dislocation, the distance from the front end to the center of the optical axis is important.

Narrow view

Light spread minimized.
Use in a place where light intrusion is undesirable.



【Related pages】
If a narrow beam is not required:
Sleeve-type units [P17](#)
Side-view units [P19](#)

Thru scan

Light emitter	Directional angle (half angle)	Shape	Cable		Scanning distance (mm)			Effective lens diameter	Min. detectable size (mm)	Model No.	
			Bend radius	Length	Amp	Mode	Distance				
Side	1.5°	Shape A	R5	2m	Free cut	HPX-AG	HP	500	φ1.5	φ0.005	HPF-T030
						FT	305				
						HPX-EG	nL	310			
						FT	180				
Top	1.5°	Shape B	R15	2m	Free cut	HPX-AG	HP	3,500	φ1.7	φ0.1	HPF-T023
						FT	1,050				
						HPX-EG	nL	730			
						FT	1,200				
Top	2.5°	Shape C	R20	2m	Free cut	HPX-AG	HP	4,100	φ2.1	φ0.1	HPF-T019
						FT	1,200				
						HPX-EG	nL	1,400			
						FT	840				
Side	3°	Shape D	R20	2m	Free cut	HPX-AG	HP	4,500	φ2.6	φ0.1	HPF-T020
						FT	1,310				
						HPX-EG	nL	1,500			
						FT	920				

Diffuse scan

Light emitter	Directional angle (half angle)	Shape	Cable		Scanning distance (mm)			Effective lens diameter	Min. detectable size (mm)	Model No.	
			Bend radius	Length	Amp	Mode	Distance				
Top	—	Shape E	R15	2m	Free cut	HPX-AG	HP	20	—	φ0.005	HPF-D025
						FT	20				
						HPX-EG	nL	20			
						FT	16				

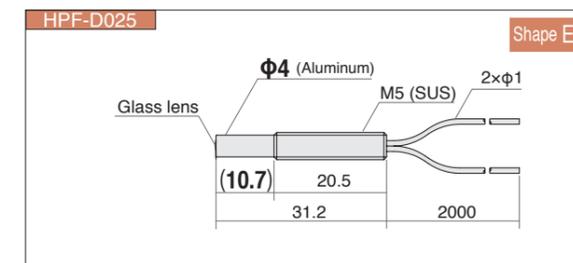
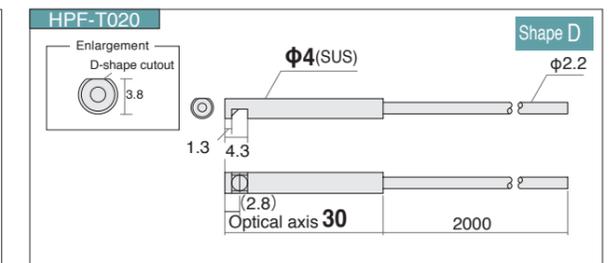
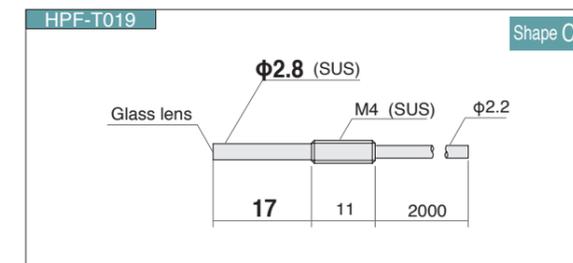
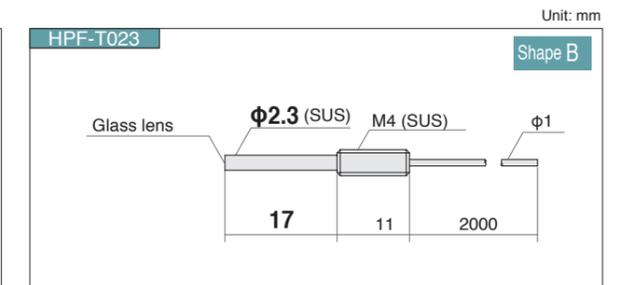
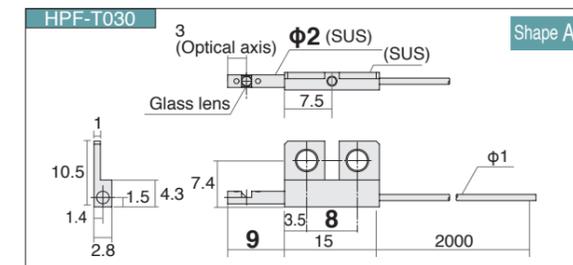
*For scanning distances of the sensing modes, see the Technical Guide (page 51).

*Scanning distances for diffuse scan are obtained with a standard target object (plain white paper).

*Response times for the sensing types: HP 5 ms, nL 1 ms, and FT 250 μs.

*The values shown in the Minimum detectable size column were obtained with optimal scanning distance and sensitivity settings (HPX-AG).

Outer dimensions



NOTEWORTHY

Narrow view types are available also by combination with long-distance lenses and side-view lenses.

(Typical examples)

Optical configuration	Lens unit	Fiber unit	Directional angle (half angle)
Top	FE-PA-L1	HPF-T003	Approx. 3°
Top	HPF-VL06	HPF-T003	Approx. 3°
Side	FE-PA-S1	HPF-T003	Approx. 10°
Side	HPF-VL05	HPF-T003	Approx. 8°

*For lens units, see page 43.



Screw

Cylindrical

Coaxial

Sleeve

Side view

Narrow view

Flat/

Selective reflection

Area

Heatproof

Chemical proof

Vacuum proof

Specialized Use

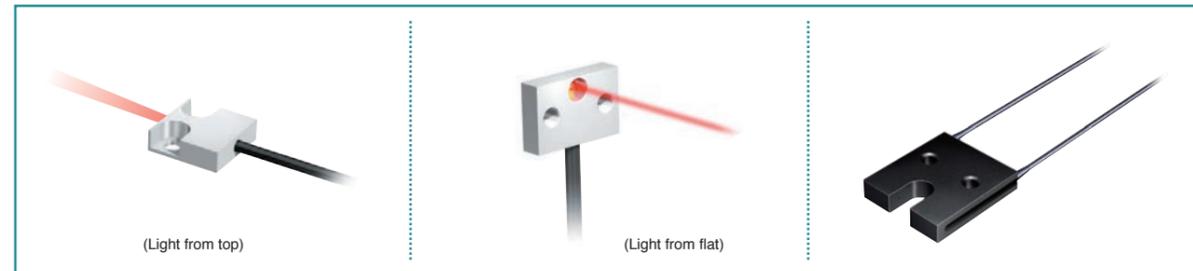
Lens unit

Other accessories

Technical Guide

List of Scanning Distance by Amplifiers Model

Suitable for installation where space is limited.
Attach directly to casing.



Thru scan

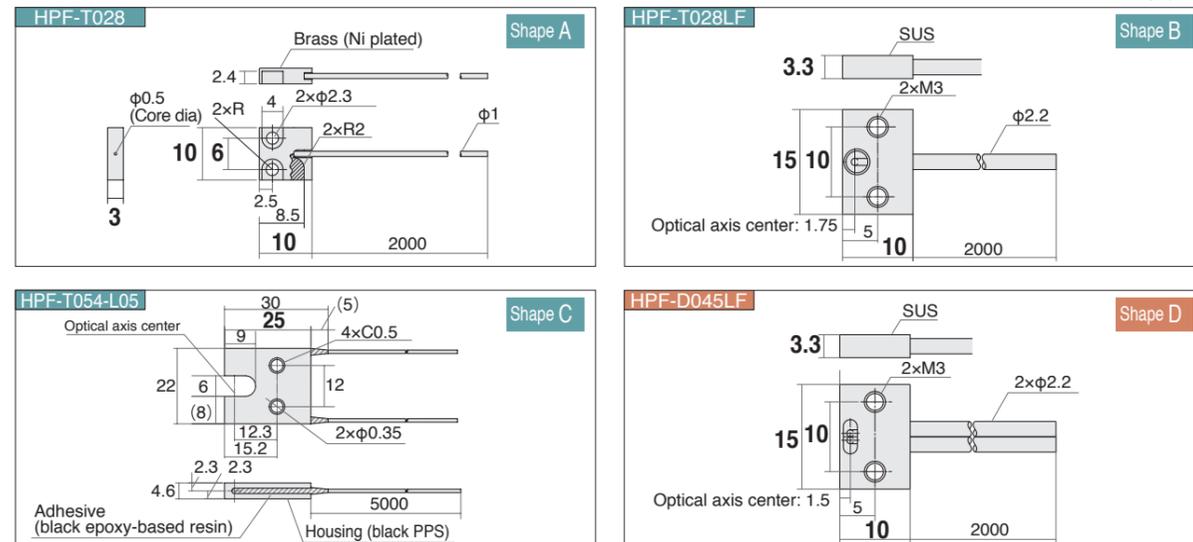
Type	Light emitter	Shape	Cable		Scanning distance (mm)			Core	Min. detectable size (mm)	Model No.
			Bend radius	Length	Amp	Mode	Distance			
Flat	Top	Shape A	R1	2m	HPX-AG	HP	140	φ0.5	φ0.005	HPF-T028
					FT	40				
	HPX-EG	nL			50					
	FT	29								
Flat	Flat	Shape B	R5	2m	HPX-AG	HP	210	φ1.0	φ0.005	HPF-T028LF
					FT	60				
					HPX-EG	nL	80			
					FT	47				
Vane type	-	Shape C	R15	5m	HPX-AG	HP	6	φ0.5	φ0.005	HPF-T054-L05
					FT	6				
					HPX-EG	nL	6			
					FT	6				

Diffuse scan

Type	Light emitter	Shape	Cable		Scanning distance (mm)			Core	Min. detectable size (mm)	Model No.
			Bend radius	Length	Amp	Mode	Distance			
Flat	Flat	Shape D	R2	2m	HPX-AG	HP	93	Receiver and emitter φ1.0	-	HPF-D045LF
					FT	30				
					HPX-EG	nL	37			
					FT	21				
Flat	Flat	Shape D	R2	2m	HPX-AG	HP	35	Receiver and emitter φ1.0	-	HPF-D045LF
					FT	17				
					HPX-EG	nL	35			
					FT	17				

*For scanning distances of the sensing modes, see the Technical Guide (page 51).
*Scanning distances for diffuse scan are obtained with a standard target object (plain white paper).
*Response times for the sensing types: HP 5 ms, nL 1 ms, and FT 250 μs.
*The values shown in the Minimum detectable size column were obtained with optimal scanning distance and sensitivity settings (HPX-AG).

Outer dimensions



Resistant to ambient influences.
Use for target object detection in a limited area.

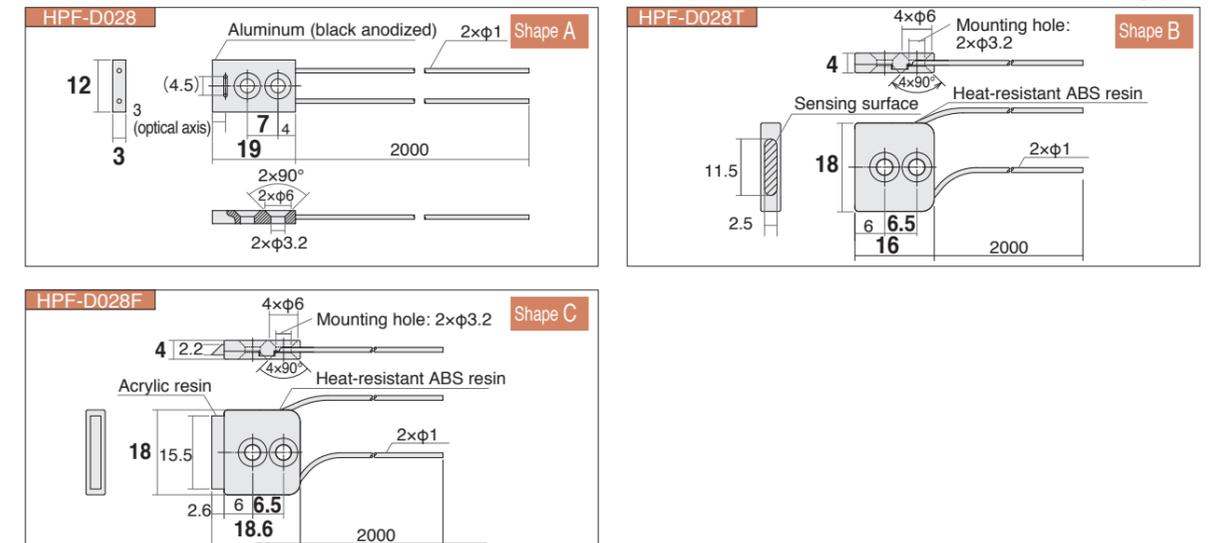


Diffuse scan

Light emitter	Shape	Cable		Scanning distance (mm)			Min. detectable size (mm)	Model No.
		Bend radius	Length	Amp	Mode	Distance		
Top	Shape A	R15	2m	HPX-AG	HP	2.5±0.5	φ0.005	HPF-D028
				nL	2.5±0.5			
	SF			2.5±0.5				
	FT			2.5±0.5				
Top	Shape B	R15	2m	HPX-AG	HP	7.4±1.6	φ0.005	HPF-D028T
				nL	7.4±1.6			
	SF			7.4±1.6				
	FT			7.4±1.6				
Flat	Shape C	R15	2m	HPX-AG	HP	5.2±1.6	φ0.005	HPF-D028F
				nL	5.2±1.6			
	SF			5.2±1.6				
	FT			5.2±1.6				
Flat	Shape C	R15	2m	HPX-EG	nL	7.4±1.2	φ0.005	HPF-D028F
				HPX-EG	nL	5.2±1.0		

*For scanning distances of the sensing modes, see the Technical Guide (page 52).
*Scanning distances for diffuse scan are obtained with a standard target object (plain white paper).
*Response times for the sensing types: HP 5 ms, nL 1 ms, and FT 250 μs.
*The values shown in the Minimum detectable size column were obtained with optimal scanning distance and sensitivity settings (HPX-AG).

Outer dimensions



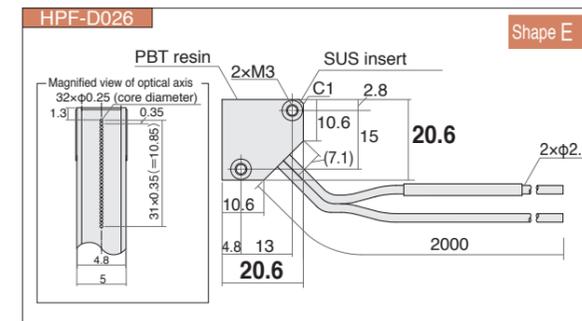
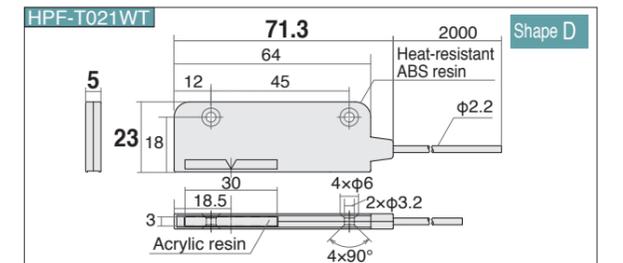
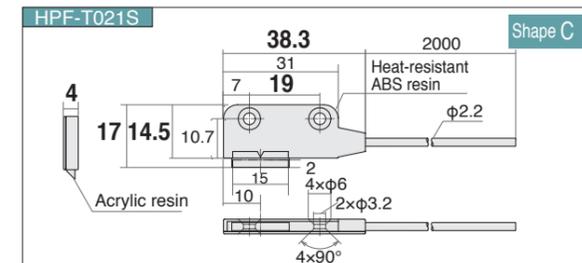
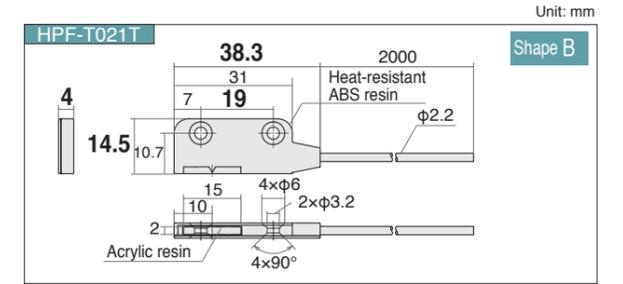
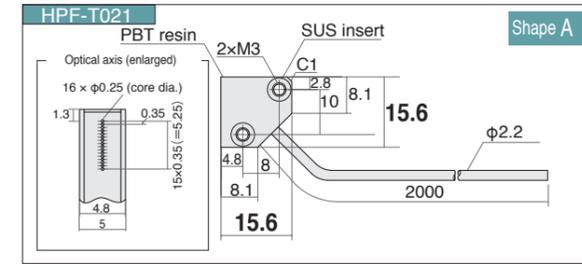
- Screw
- Cylindrical
- Coaxial
- Sleeve
- Side view
- Narrow view
- Flat/Selective reflection
- Area
- Heatproof
- Chemical-proof
- Vacuum-proof
- Specialized Use
- Lens unit
- Other accessories

Wide light beam.
Use for target object with varying detection positions, detection of meandering, etc.



[Related pages]
Small part passage sensing
P33

Outer dimensions



Thru scan

Type	Optical configuration	Area width (mm)	Shape	Cable		Scanning distance (mm)			Min. detectable size (mm)	Model No.
				Bend radius	Length	Amp	Mode	Distance		
Array	Flat	5.25	Shape A	R4	2m	HPX-AG	HP	780	φ0.2	HPF-T021
							FT	225		
							nL	270		
							FT	160		
							HPX-H	250		
HPX-A	125									
Screen	Flat	15	Shape B	R15	2m	HPX-AG	HP	3,600	φ0.2	HPF-T021T
							FT	1,750		
							nL	710		
							FT	710		
							HPX-H	1,200		
	HPX-A	600								
	Flat	30	Shape D	R15	2m	HPX-AG	HP	3,600	φ0.4	HPF-T021WT
							FT	1,750		
							nL	2,000		
							FT	1,100		
HPX-H							2,000			
HPX-A	1,000									
Side	15	Shape C	R15	2m	HPX-AG	HP	3,450	φ0.2	HPF-T021S	
						FT	1,000			
						nL	1,100			
						FT	670			
						HPX-H	1,100			
HPX-A	550									

Diffuse scan

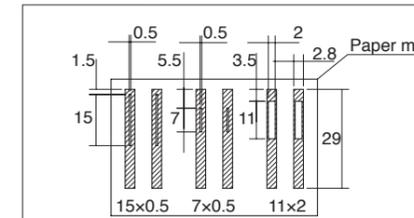
Type	Optical configuration	Area width (mm)	Shape	Cable		Scanning distance (mm)			Min. detectable size (mm)	Model No.
				Bend radius	Length	Amp	Mode	Distance		
Array	Flat	10.85	Shape E	R4	2m	HPX-AG	HP	265	φ0.005	HPF-D026
							FT	85		
							nL	100		
							FT	60		
							HPX-H	100		
							HPX-A	50		

*For scanning distances of the sensing modes, see the Technical Guide (page 51).
 *Scanning distances for diffuse scan are obtained with a standard target object (plain white paper).
 *Response times for the sensing types: HP 5 ms, nL 1 ms, and FT 250 μs.
 *The values shown in the Minimum detectable size column were obtained with optimal scanning distance and sensitivity settings (HPX-AG).

NOTEWORTHY

Type	Features
Array type 	Small diameter fibers are aligned in a row. Smaller and slimmer sensor heads are also available.
Screen type 	Light is collimated using the lens. This increases the scanning range and makes the light uniform.

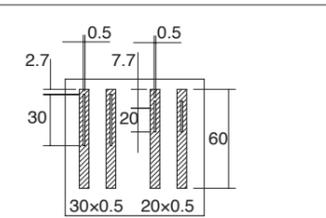
Accessory (HPX-T021T)



Note
Material: Transparent polyester film (black print on back)

HPF-T021T comes with slits. Use the appropriate slit with the unit to achieve the desired scanning distance and resolution. The slits can be bought as parts. Model No.: HPX-PA07

Accessory (HPX-T021WT)



Note
Material: Transparent polyester film (black print on back)

HPF-T021WT comes with slits. Use the appropriate slit with the unit to achieve the desired scanning distance and resolution.



- Screw
- Cylindrical
- Coaxial
- Sleeve
- Side view
- Narrow view
- Flat/Selective reflection
- Area
- Heatproof
- Chemical-proof
- Vacuum-proof
- Specialized Use
- Lens unit
- Other accessories

Resistant to high temperatures.
Use in environments up to 350 °C.



[\[Related pages\]](#)

Compatible lenses

[P45](#)

Thru scan

Heatproof	Size	Shape	Cable		Scanning distance (mm)			Element	Min. detectable size (mm)	Model No.	
			Bend radius	Length	Amp	Mode	Distance				
105°C	Straight	Shape A Lens attachable -30 to +105°C	R25	2m	Free cut	HPX-AG	HP FT	690	φ1.0	φ0.005	HPF-T012* ₁
						HPX-EG	nL FT	240			
						HPX-H	FT	140			
						HPX-A	FT	250			
150°C	Straight	Shape B -60 to +150°C	R35	2m	Free cut	HPX-AG	HP FT	350	φ1.5	φ0.01	HPF-T017* ₁
						HPX-EG	nL FT	410			
						HPX-H	FT	240			
						HPX-A	FT	200			
200°C	Straight	Shape C Lens attachable -30 to +200°C	R15	1m	Free cut	HPX-AG	HP FT	175	φ1.0	φ0.005	HPF-T018
						HPX-EG	nL FT	140			
						HPX-H	FT	80			
						HPX-A	FT	200			
350°C	Straight	Shape D Lens attachable -30 to +350°C	R15	2m	Free cut	HPX-AG	HP FT	190	φ1.0	φ0.005	HPF-T014
						HPX-EG	nL FT	220			
						HPX-H	FT	130			
						HPX-A	FT	250			

Diffuse scan

Heatproof	Size	Shape	Cable		Scanning distance (mm)			Element	Min. detectable size (mm)	Model No.	
			Bend radius	Length	Amp	Mode	Distance				
105°C	Straight	Shape E -30 to +105°C	R25	2m	Free cut	HPX-AG	HP FT	190	Receiver and emitter φ1.0	φ0.005	HPF-D013* ₁
						HPX-EG	nL FT	85			
						HPX-H	FT	100			
						HPX-A	FT	55			
150°C	Straight	Shape F -60 to +150°C	R35	2m	Free cut	HPX-AG	HP FT	400	Receiver and emitter φ1.5	φ0.005	HPF-D022* ₁
						HPX-EG	nL FT	130			
						HPX-H	FT	150			
						HPX-A	FT	90			
200°C	Straight	Shape G -30 to +200°C	R15	1m	Free cut	HPX-AG	HP FT	170	φ1.4	φ0.005	HPF-D023
						HPX-EG	nL FT	55			
						HPX-H	FT	70			
						HPX-A	FT	42			
350°C	Straight	Shape H -30 to +350°C	R25	2m	Free cut	HPX-AG	HP FT	160	φ1.5	φ0.005	HPF-D015
						HPX-EG	nL FT	75			
						HPX-H	FT	85			
						HPX-A	FT	50			

*For scanning distances of the sensing modes, see the Technical Guide (page 51).

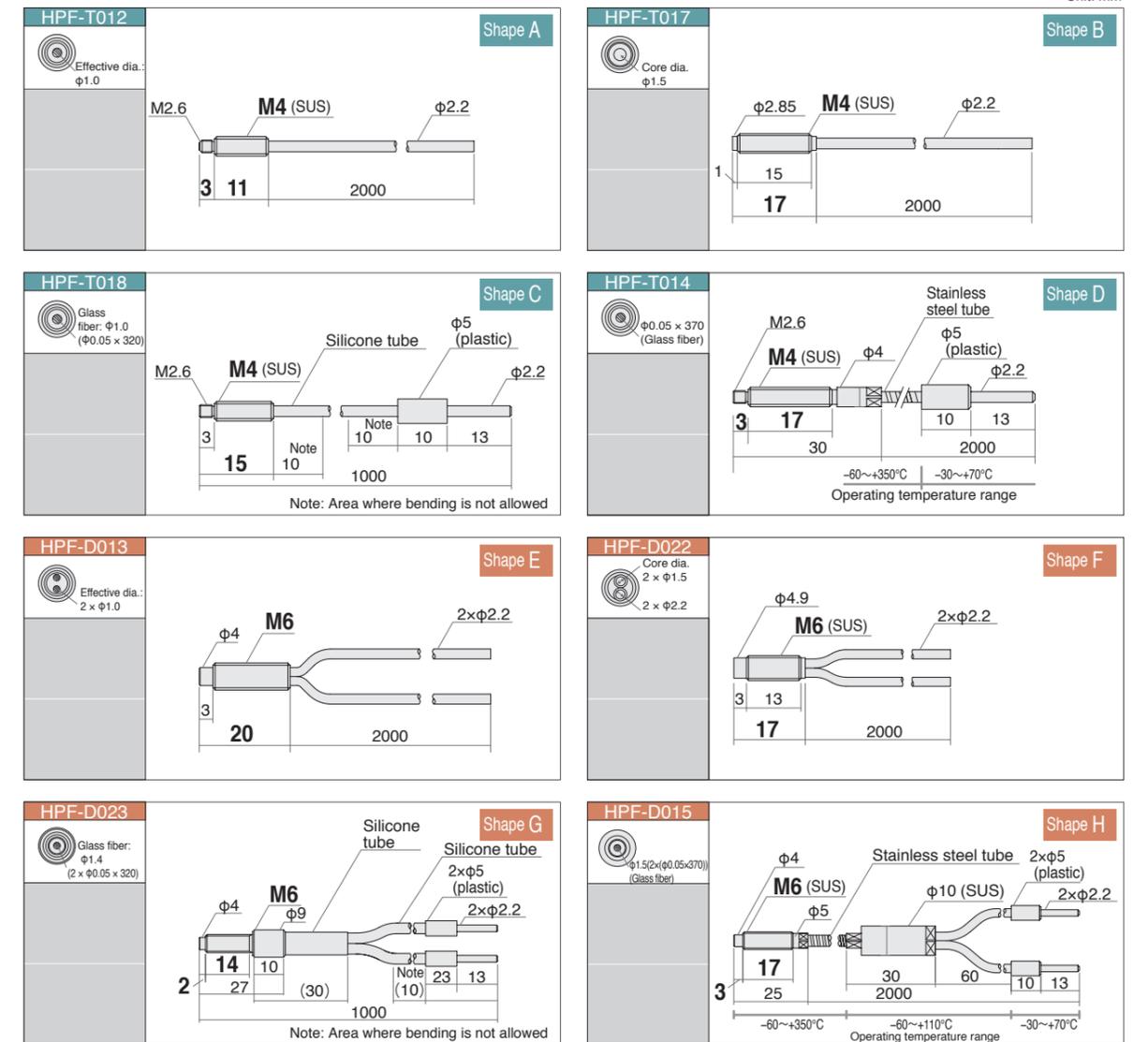
*Scanning distances for diffuse scan are obtained with a standard target object (plain white paper).

*Response times for the sensing types: HP 5 ms, nL 1 ms, and FT 250 μs.

*The values shown in the Minimum detectable size column were obtained with optimal scanning distance and sensitivity settings (HPX-AG).

*1. If a fiber unit is continuously used in an environment where it is at the upper limit of the operating temperature range, the detection distance will decrease. When selecting a fiber unit, be sure to take the ambient temperature into account so that the sensor is not continuously operating near its limits.

Outer dimensions



NOTEWORTHY

Use the lens unit appropriate for your application.
*Select a lens with the desired heat resistance.

Heatproof temp.	Lens	Type	Sensitivity
200°C	FE-PA-L1	Long distance Side	Approx. x6
200°C	FE-PA-S1		—
350°C	HPF-VL06	Long distance Side	Approx. x10
350°C	HPF-VL05		—

*Compatible lens units P. 43

Protected with PFA tubing for excellent chemical resistance.



[Related pages]
 Wet process sensors for level & leak detection
[P35](#) [P37](#) [P39](#)
 Usage notes [P48](#)

Thru scan

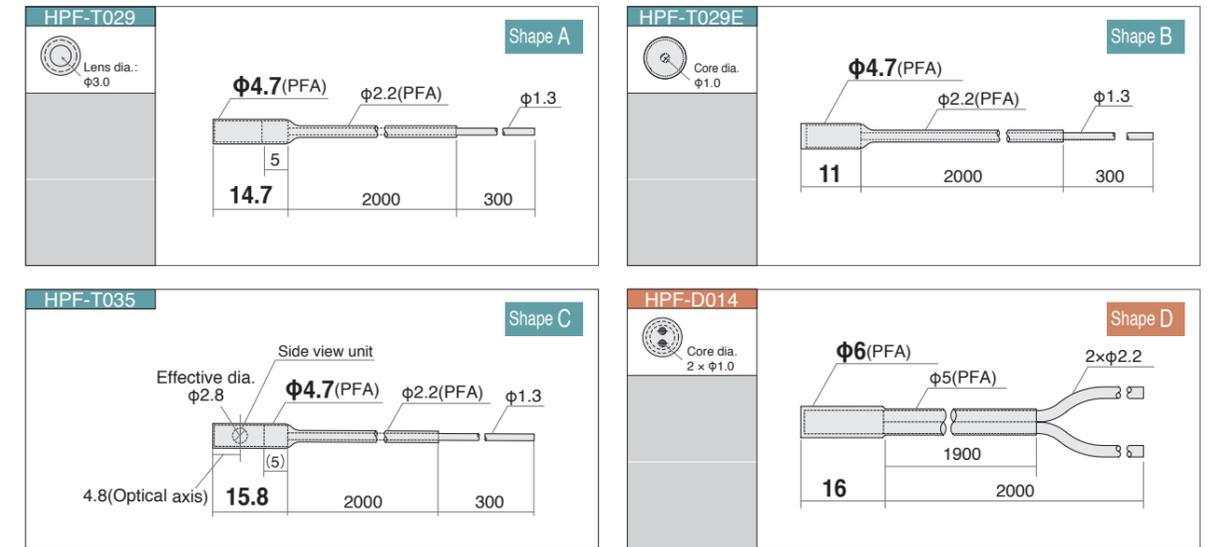
Light emitter	Size	Shape	Cable		Scanning distance (mm)			Min. detectable size (mm)	Model No.	
			Bend radius	Length	Amp	Mode	Distance			
Top	φ4.7	Shape A	R20	2m	HPX-AG	HP	1,310	4,500	φ0.1	HPF-T029
					HPX-EG	nL	1,500	880		
					HPX-H	FT	1,500	750		
					HPX-A	FT	750	750		
Top	φ4.7	Shape B	R20	2m	HPX-AG	HP	240	825	φ0.1	HPF-T029E
					HPX-EG	nL	280	160		
					HPX-H	FT	270	130		
					HPX-A	FT	130	130		
Side	φ4.7	Shape C	R20	2m	HPX-AG	HP	300	1,030	φ0.1	HPF-T035
					HPX-EG	nL	350	210		
					HPX-H	FT	340	170		
					HPX-A	FT	170	170		

Diffuse scan

Light emitter	Size	Shape	Cable		Scanning distance (mm)			Min. detectable size (mm)	Model No.	
			Bend radius	Length	Amp	Mode	Distance			
Top	φ6	Shape D	PFA area: R80 Cable area: R20	2m	HPX-AG	HP	170		-	HPF-D014
					HPX-EG	nL	70	42		
					HPX-H	FT	50	50		
					HPX-A	FT	50	50		

- *For scanning distances of the sensing modes, see the Technical Guide (page 51).
- *Scanning distances for diffuse scan are obtained with a standard target object (plain white paper).
- *Response times for the sensing types: HP 5 ms, nL 1 ms, and FT 250 μs.
- *For chemical resistance of fluorine-resin, see the Technical Guide (page 47).
- *The values shown in the Minimum detectable size column were obtained with optimal scanning distance and sensitivity settings (HPX-AG).

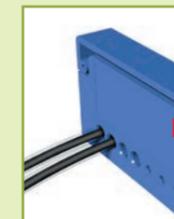
Outer dimensions



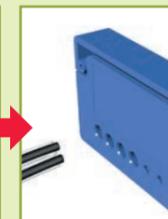
NOTEWORTHY

Installation man-hours greatly reduced

Simply cut the PFA-jacketed cable to length and insert as is into the amplifier.



Simply cut the PFA-jacketed cable.



Conventionally
PFA tube must be stripped off before inserting fiber.



After improvement
Fiber cut with a cutter can be directly connected to an amplifier.

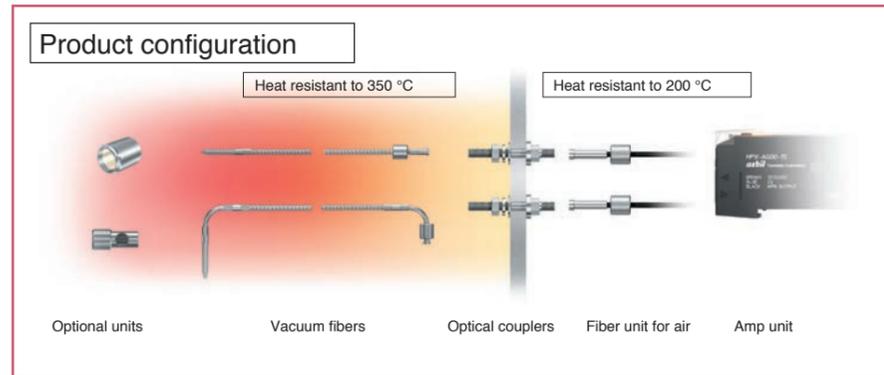
Insert as is into the amplifier. The insertion area requires no PFA working.

Saves space



Tube has small outside diameter of 2.2 mm, which can save considerable space compared with previous models. Bend radius is also greatly improved.

Usable in a vacuum.
Cable length can be specified.



[Related pages]

Usage notes
P48

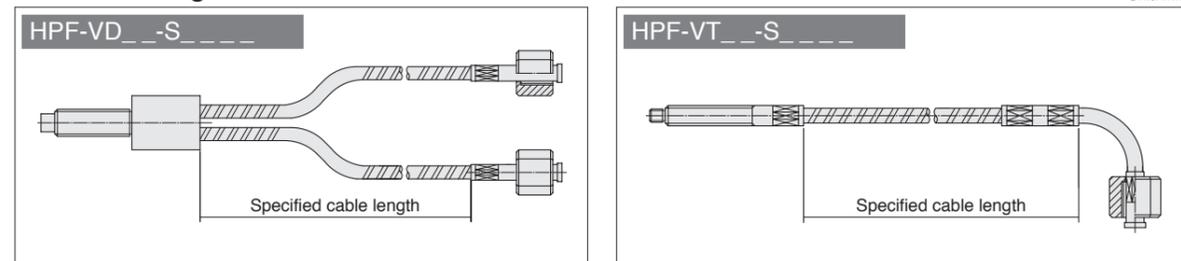
Options for vacuum fiber unit

Product name	Shape	Heatproof	Other specifications	Model No.
Optical coupler (two units)		200°C	—	HPF-VJ03
Fiber unit for air (two units in a pair)		70°C	Cable length: 2 m Bend radius: R20 Free cut	HPF-VA01
Long-distance lens unit (two units)		350°C	Scanning distance: x10	HPF-VL06
Side-view unit (two units)		350°C	—	HPF-VL05

Configuration of vacuum fiber model numbers

HPF	-VT	0	S	-S1000	(Typical examples)
Base model No.	Model	Head shape	Coupler side shape	Cable length	Description
HPF	-VT				Thru scan
	-VD				Diffuse scan
		0			Straight
		1			Elbow (VT type only)
			S		Straight
			E		Elbow
				Cable length	Ordering increment
				-S	25mm to 500mm 25mm
				-S	550mm to 1500mm 50mm
				-S	1600mm to 5000mm 100mm

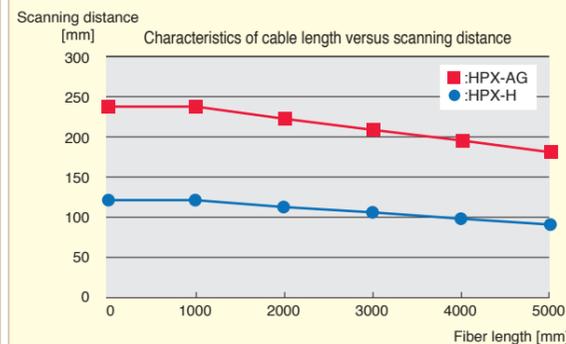
Cable drawing



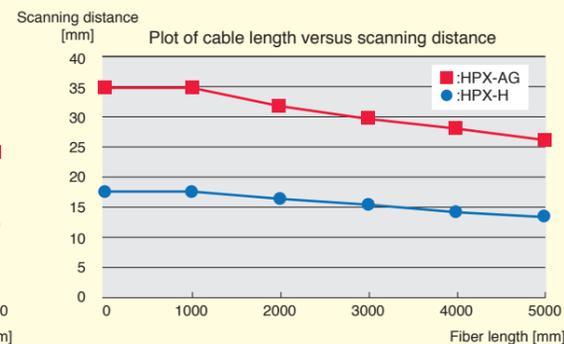
CHART

Scanning distance characteristics

Thru scan

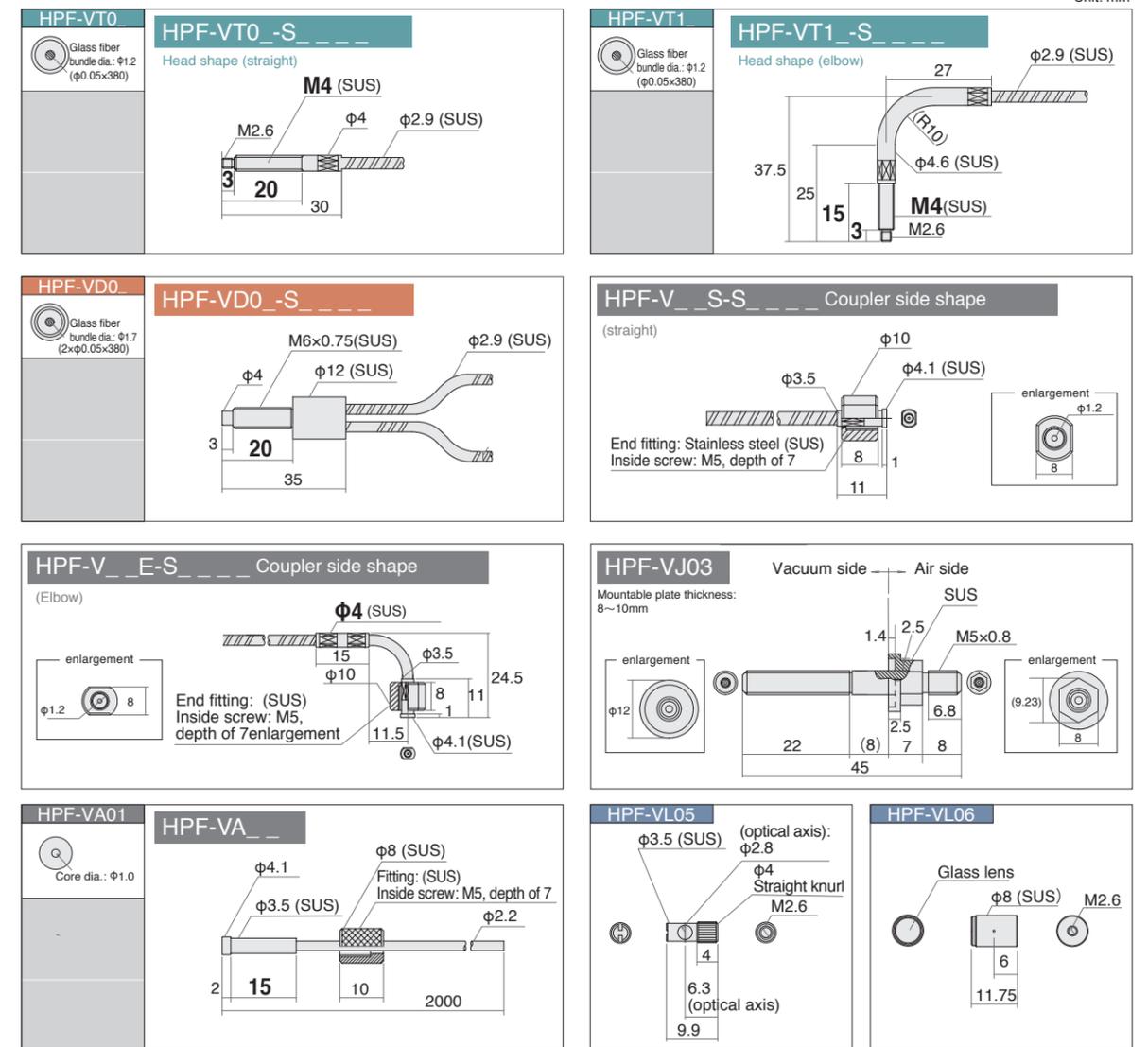


Diffuse scan



*For fiber units for air, HPF-VA01 is used for calculation.
*Scanning distances for diffuse-scan were obtained using a standard target object (plain white paper).
*For calculations, nL was used as the sensing type for HPX-AG.

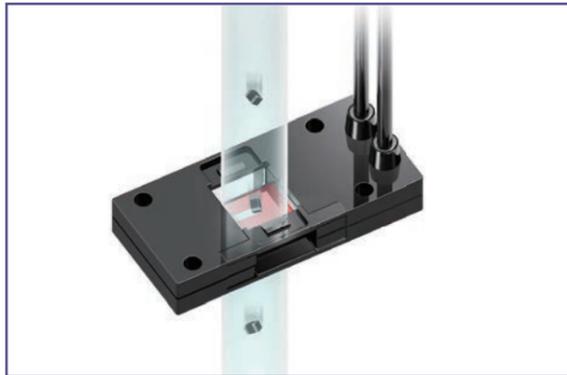
Outer dimensions



Screw
Cylindrical
Coaxial
Sleeve
Side view
Narrow view
Flat
Selective reflection
Area
Heatproof
Chemical
-proof
Vacuum
Specialized
Use
Lens unit
Other accessories

Specialized Use Fiber Units for Small Parts Passage Detection

Reliable detection of small parts moving through the pipe.



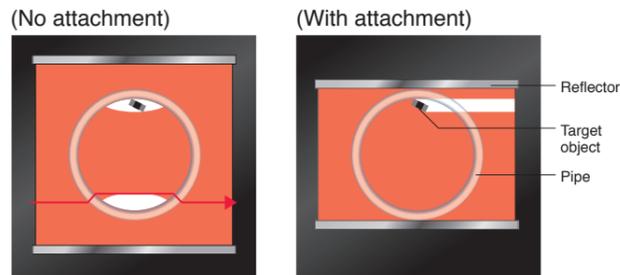
- Reliably detects parts in the pipe.
- Weighs only 12 g.
- For operation inside a moving device, highly bend-tolerant optical fiber cable are used.
- Wire lead-out follows the pipe, allowing a smaller footprint.
- By changing the attachment, the width of the detection area can be adjusted to match the pipe diameter.

Options

Mixing fiber unit	HPF-EU02A1	Attachment for small-diameter pipes	HPF-AU_ _								
		<table border="1"> <thead> <tr> <th>Pipe diameter</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>4 mm</td> <td>HPF-AU04</td> </tr> <tr> <td>6 mm</td> <td>HPF-AU06</td> </tr> <tr> <td>8 mm</td> <td>HPF-AU08</td> </tr> </tbody> </table>		Pipe diameter	Output	4 mm	HPF-AU04	6 mm	HPF-AU06	8 mm	HPF-AU08
Pipe diameter	Output										
4 mm	HPF-AU04										
6 mm	HPF-AU06										
8 mm	HPF-AU08										

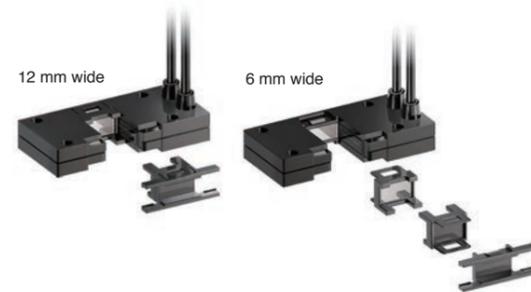
Product features

Attachments suited to different pipe diameters improve detection stability.



There is an area of unreliable detection at the pipe rim due to light refraction.

Use of a reflector matching the pipe diameter achieves reliable detection even at the rim.



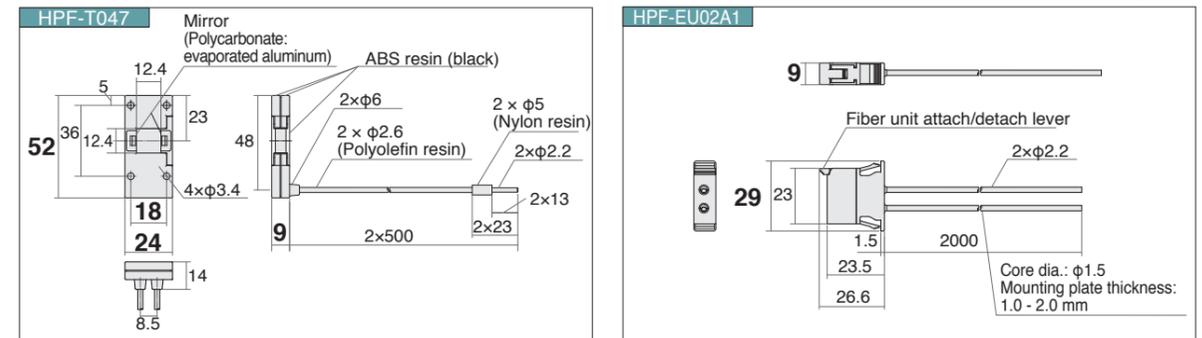
Swapping attachments easily gives the optimal area width.

Thru scan

Area width	Shape	Cable		Model No.	Product name	Shape	Cable		Model No.
		Bend radius	Length				Bend radius	Length	
12mm		R4	0.5m	HPF-T047	Mixed fiber unit		R25	2m	HPF-EU02A1

*Area width can be changed with attachments (sold separately).
 *Use HPF-T047 in combination with HPF-EU02A1.
 *Use HPF-EU02A1 for scanning distances of 50 cm or more.

Outer dimensions



Recommended compatible amplifier unit

HPX-AG08 (differential setting) model

<Exterior view>

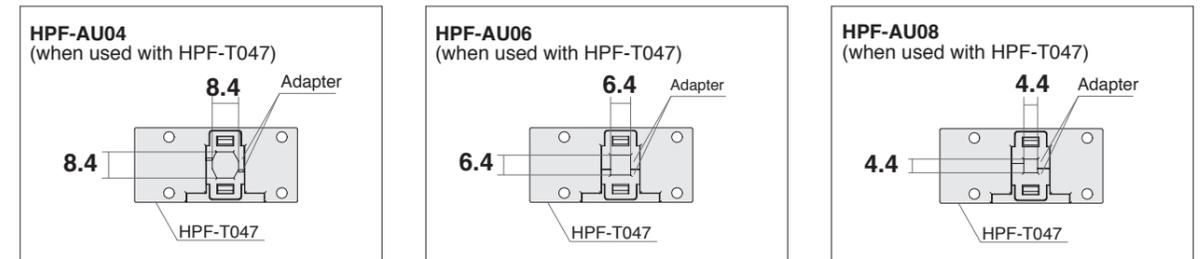
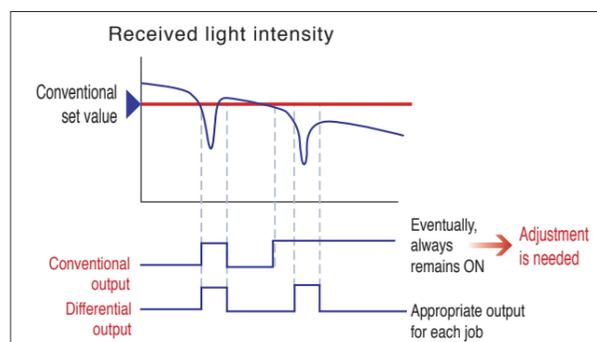


<Operation panel>



Model No.	Output
HPX-AG08-3S	NPN

Unaffected by gradual light-level changes or stain buildup, this model provides stable detection. In addition, since the light level differentiation signal is transmitted as a second output, this model provides advance notice of sensitivity limitations.



- Screw
- Cylindrical
- Coaxial
- Sleeve
- Side view
- Narrow view
- Flat/Selective reflection
- Area
- Heatproof
- Chemical-proof
- Vacuum-proof
- Specialized Use
- Lens unit
- Other accessories

Specialized Use Contact-Type Liquid Level Fiber Units

All-resin structure ensures no metal contamination.



Problems due to liquid accumulation are reduced by Azbil corporation's innovative front end structure.

Product lineup includes a small-diameter model ($\phi 4$) for easier cable routing.

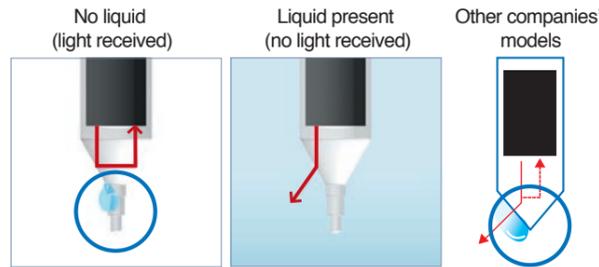
Diffuse scan

Type	Shape	Cable		Model No.
		Bend radius	Length	
$\phi 4$	 -30 to +105°C	PFA area: R30 Cable area: R15	2m Free cut	HPF-D033
$\phi 6$	 -30 to +105°C	PFA area: R40 Cable area: R25	2m Free cut	HPF-D027

Principle of detection

Reliable detection is achieved by the proprietary structure of the fiber tip

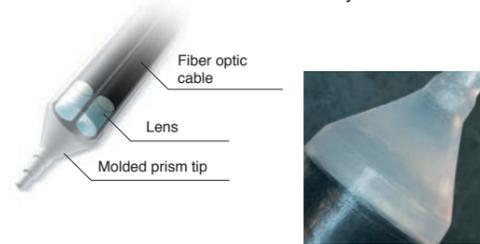
The proprietary structure provided at the tip of the fiber reduces malfunction due to liquid clinging. The lens built into the tip of the fiber ensures a large difference in light quantity between the conditions when liquid is present and absent.



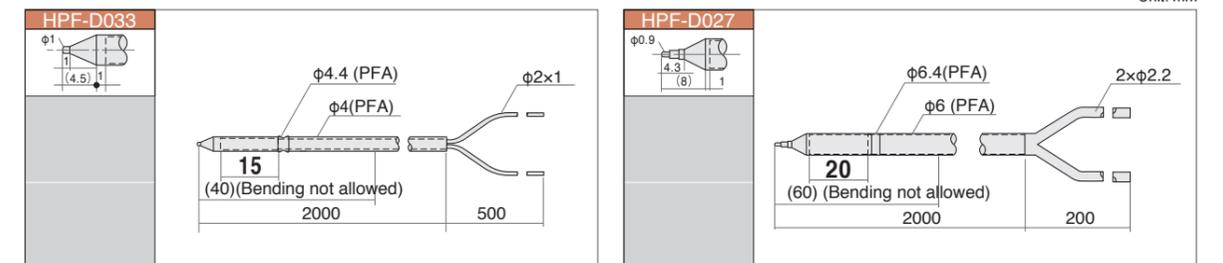
The principle uses the difference in the reflective index due to the presence of liquid.

Tip and internal structure

The molded prism fiber tip readily sheds water drops.



Outer dimensions



Recommended compatible amplifier unit

HPX-EG Series

<Exterior view>



<Operation panel>

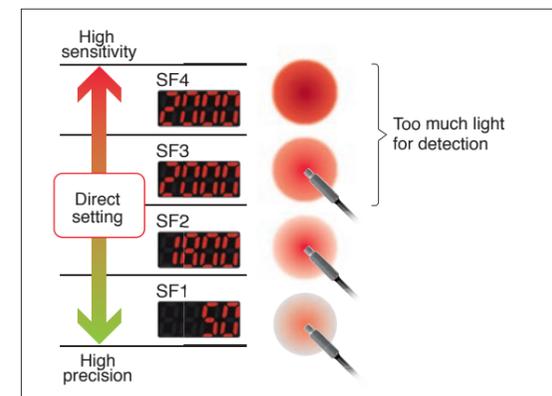


<Typical models>

Model No.	Output
HPX-EG00-1S	NPN
HPX-EG00-2S	PNP

Auto sensitivity switch function

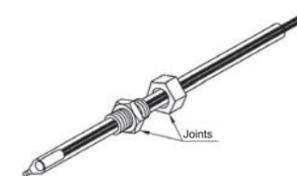
This function automatically optimizes the sensitivity setting during auto tuning, affording easy operation while delivering the highest detection performance.



Usage Notes (type-specific)

Contact-type liquid level detection

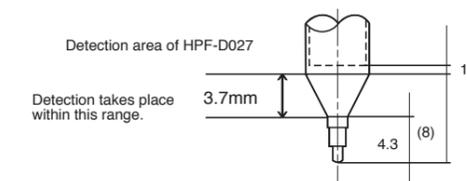
When installing the unit, use commercially available fluorine-resin joint that matches the outside diameter of the PFA tube.



- Be careful not to bump the fiber unit tip (especially the conical part). Operation may be unstable due to scratches on or deformation of the sensing head.
- If chattering occurs due to liquid dripping or bubbles, use a timer.

- Operation may be unstable with the following conditions:
 - ① Air bubbles adhering to the conical part of the sensing head
 - ② Chemical precipitate on the conical part of the sensing head
 - ③ Liquids of high viscosity

- Some liquid properties, such as milky white color, may make the liquid undetectable.



Liquid level detection positions vary depending on the surface tension of the liquid and the wet condition of the fiber unit's detection area.

Specialized Use Pipe-Mounted Liquid Level Fiber Units

A 16-axis array of light beams greatly eliminates interference from water droplets and air bubbles.



- Product lineup includes differing detection methods for fail-safe detection.
- Can be used for pipe diameters of 3 to 19 mm.

Recommended compatible amplifier unit

HPX-AG02 (alarm output) model

<Exterior view>



<Operation panel>



<Typical models>

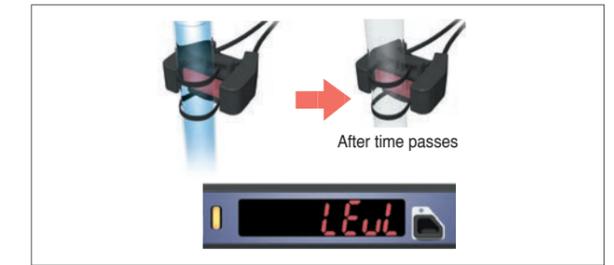
Model No.	Output
HPX-AG02-1S	NPN
HPX-EG02-2S	PNP

Alarm output model (HPX-AG02)

This sensor warns if the scanning conditions are unsuitable by means of a second output (light-level drop alarm output).

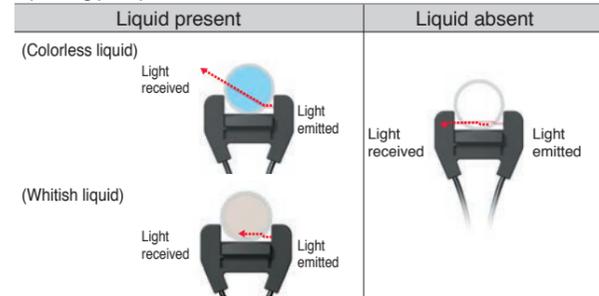
Sample use: surface detection of liquids such as slurry

An alarm signal indicating a drop in the light level is output if the inside wall of the pipe becomes dirty, averting potential problems.



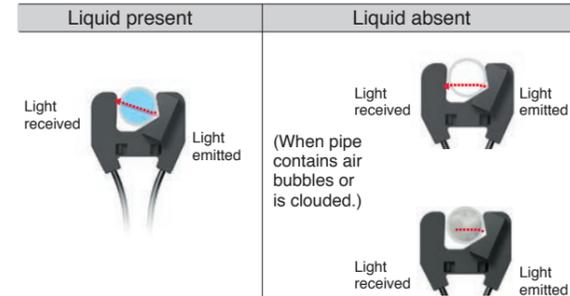
Principle of detection

Operating principle of HPF-T034 and T034E



Light reception is blocked when liquid is present, which prevents false detection due to a change in the liquid's color.

Operating principle of HPF-T032 and T032E



Clouding and bubbles reduce the level of received light, but thanks to the operating principle (light = liquid present) they do not increase the risk of false detection.

Product features

Array of 16 optical axes eliminates the effects of air bubbles and water droplets



Adverse effects from air bubbles and water droplets are reduced, resulting in reliable detection.

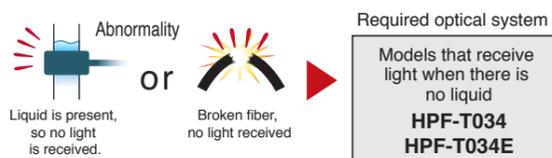
PFA-jacketed optical fiber



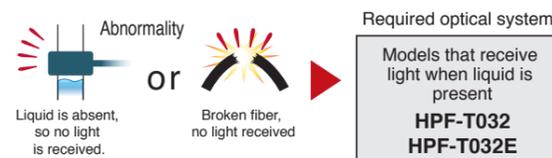
Fiber-optic cables protected by chemical-resistant resin can be run through machines and equipment safely (HPF-T032 and HPF-T034 only).

Fail-safe concept

Upper limit detection



Lower limit detection

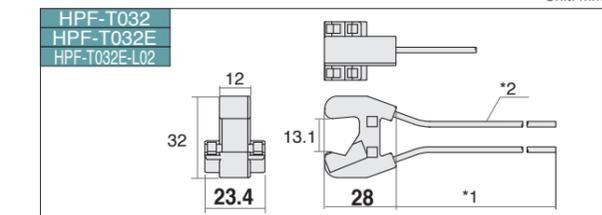
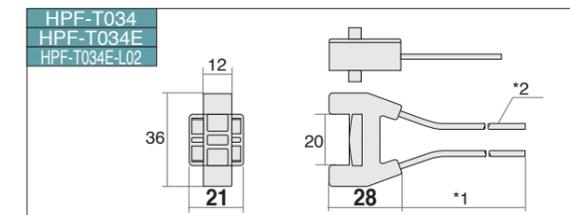


Thru scan (Attached to pipe)

Type	Compatible pipe dia.	Shape	Cable			Model No.
			Bend radius	Length	Coating material	
Liquid-absent received light	φ8~φ19mm (3/4B)		R4	5m Free cut	PFA	HPF-T034
				2m Free cut	Polyethylene	HPF-T034E-L02
Liquid-present received light	φ3~φ13mm		R4	5m Free cut	PFA	HPF-T032
				2m Free cut	Polyethylene	HPF-T032E-L02

Use with PFA transparent pipe with wall thickness of 1 mm. Depending on the pipe actually used, as well as the liquid thru scan and refractive ratios, fiber unit detection may not be reliable, so be sure to test the operation before use. If the fiber unit is used with other than the recommended pipe, material, or wall thickness, please test before use or consult our sales staff.

Outer dimensions



Model No.	Cable length*1	Cable dia.*2
HPF-T034	5000 mm min.	2×φ2.3
HPF-T034E	5000 mm min.	2×φ2.2
HPF-T034E-L02	2000 mm min.	2×φ2.2

Model No.	Cable length*1	Cable dia.*2
HPF-T032	5000 mm min.	2×φ2.3
HPF-T032E	5000 mm min.	2×φ2.2
HPF-T032E-L02	2000 mm min.	2×φ2.2

Usage Notes (type-specific)

■ Pipe-mounted liquid level detection

Attach the unit using the supplied cable ties and non-slip tubes as shown here. Securely fasten both the upper and lower cable ties and cut off any excess. Where additional cable ties are required, use ones which are no more than 2.5 mm wide (dimension A in the figure).



* The supplied cable ties (with non-slip tubing) can also be purchased separately. Model: SZ-A01 (5 sets)



- Screw
- Cylindrical
- Coaxial
- Sleeve
- Side view
- Narrow view
- Flat/Selective reflection
- Area
- Heatproof
- Chemical-proof
- Vacuum-proof
- Specialized Use
- Lens unit
- Other accessories

Specialized Use Liquid Leakage Fiber Units

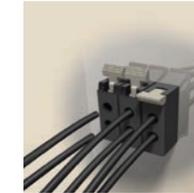
PFA jacket affords outstanding ease of routing.



- Space-saving sensor head height of only 9.9 mm
- Can be used in explosion-proof atmospheres because the cable is optical fiber.

Options

Relay fiber unit **HPF-EU05**



Optical fiber cable can be extended 5 m using the optional relay unit. The relay unit can be mounted in a panel.

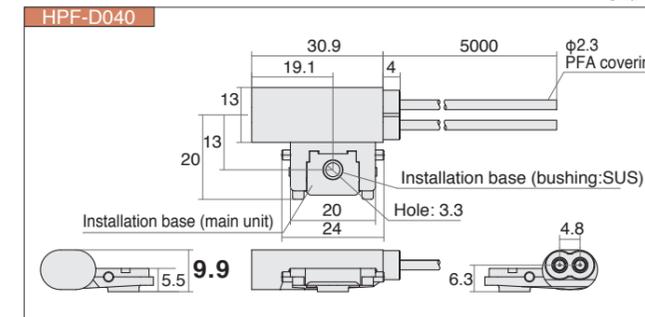
Model No.
HPF-EU05

Diffuse scan

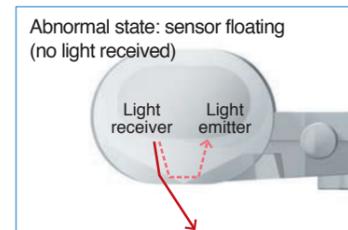
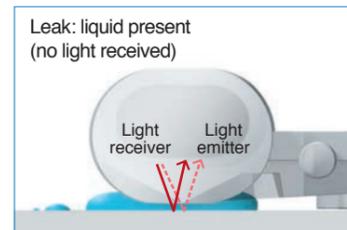
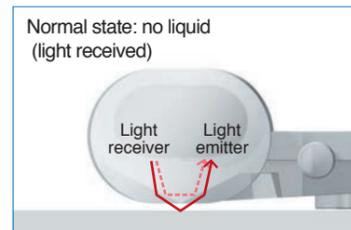
Shape (mm)	Cable		Model No.
	Bend radius	Length	
 -30 to +70°C	R20	5m Free cut	HPF-D040

Outer dimensions

Unit: mm



Principle of detection



When there is a leak, no light reaches the receiver. This is the same result as when the fiber cable breaks or is disconnected, ensuring fail-safe operation. (When using the unit in a pan, remember to secure it with a stud.)

Recommended compatible amplifier unit

HPX-AG04 (advanced function timer) model

<Exterior view>



<Operation panel>



<Typical models>

Model No.	Output
HPX-AG04-3S	NPN
HPX-AG04-4S	PNP

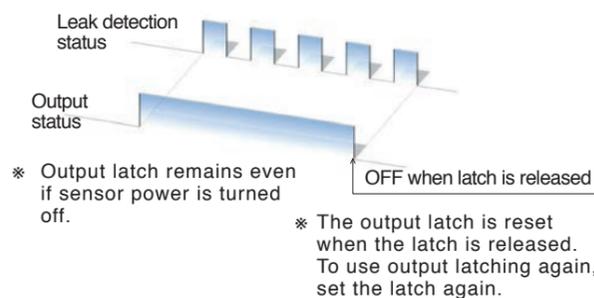
● Output latching function

Using the HPF-D040 and the HPX-AG04 amplifier together, output can be latched. This function is effective in detection of a small leak of volatile liquid and in early detection of a leak's location.

When the output is latched, the display seen below blinks.



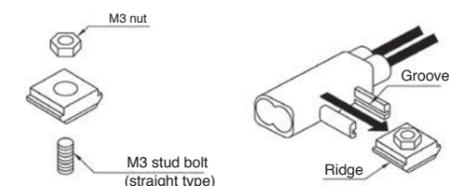
The latch can be released by the operator or by an external input.



Usage Notes (type-specific)

■ Liquid leakage detection

When using an SUS mounting base, insert the welded M3 stud bolt into the base's mounting hole and fasten it with an M3 nut (not supplied). Then put the ridges of the mounting base into the grooves of the fiber unit, and slide the base forward until it is in place.

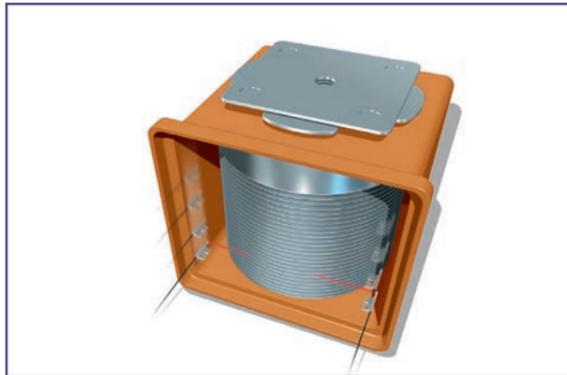


● Chemical resistance of PFA

See the Technical Guide (Page 47).

Specialized Use Wafer-mapping fiber

Detects 300 mm wafers stored in a FOUP or open cassette without fail.



Narrow beam of light has an aperture angle of $\pm 1.5^\circ$ or less

Beam axis is factory-aligned

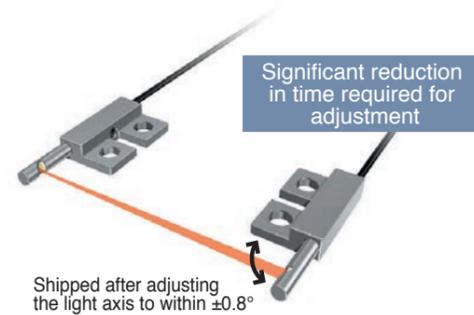
Product features

Light beam aperture angle is $\pm 1.5^\circ$ or less

With an aperture angle of $\pm 1.5^\circ$ or less, the effects of diffraction are insignificant, allowing reliable detection even when mapping 300 mm wafers stored at a 10 mm pitch.

Factory alignment of light beam

Working with a narrow beam of light can involve difficult adjustment of the light axis, requiring significant manpower and man-hours. Therefore, the light axis of the HPF-T030 is factory aligned to within $\pm 0.8^\circ$, greatly reducing adjustment time.



Sensitivity setting (% tuning) without a wafer (workpiece) when using an HPX-AG Series amplifier

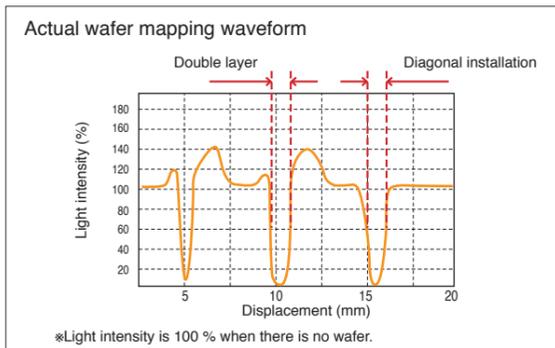
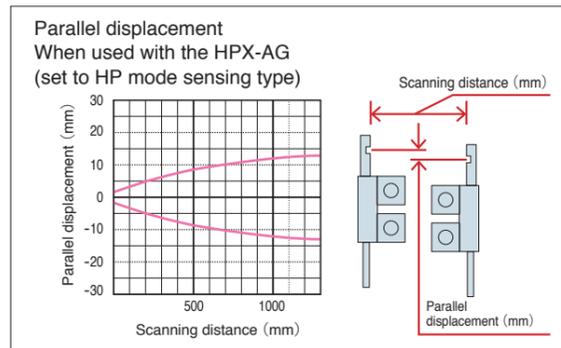
When the received light intensity is 3000 (with no wafer), set the sensitivity by pressing the AUTO button and the + or - button several times. To set a value that is X % of the light level of 3000, you simply need to enter the value of X. If you enter 50 (%), for example, a value of 1500 will be set.

Caution

Before entering a percentage, be sure to check changes in the received light level both when wafers are present and when absent. Once a percentage is determined, the same value can be used as the setting in the future in a similar environment.

How to install the HPF-T030

Caution



Recommended compatible amplifier unit

HPX-AG00 model

<Exterior view>



<Operation panel>

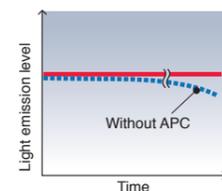


<Typical models>

Model No.	Output
HPX-AG00-1S	NPN
HPX-AG00-2S	PNP

With 4-element LED and APC, light emission is twice as stable

Four-element LEDs shine brightly for longer than conventional ones, and LED brightness is monitored by Auto Power Control (APC), which regulates the current to maintain light emission at a constant level.



Note: APC controls the light emission level of the LED, but does not compensate for a drop in the received light level arising from other factors.

Thru scan

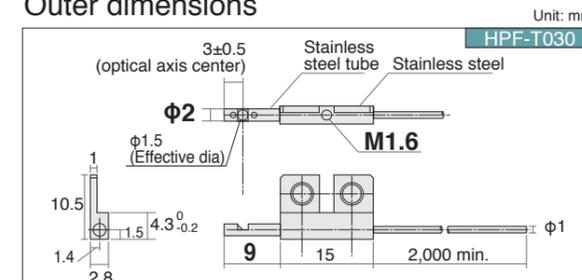
Light emitter	Directional angle (half angle)	Shape	Cable		Scanning distance (mm)		Effective lens diameter	Min. detectable size (mm)	Model No.		
			Bend radius	Length	Amp	Mode					
Side	1.5°		R5	2m	HPX-AG	HP	500	φ1.5	φ0.005	HPF-T030	
						FT	305				
						HPX-EG	nL				310
						FT	180				
					HPX-H	350					
					HPX-A	175					

*For scanning distances of the sensing modes, see the Technical Guide (page 51).

*Response times for the sensing types: HP 5 ms, nL 1 ms, and FT 250 μs.

*The values shown in the Minimum detectable size column were obtained with optimal scanning distance and sensitivity settings (HPX-AG).

Outer dimensions



Screw
Cylindrical
Coaxial
Sleeve
Side view
Narrow view
Flat/Selective reflection
Area
Heatproof
Chemical-proof
Vacuum-proof
Specialized Use
Lens unit
Other accessories

Lens unit Micro-Spot Lens

Lens unit achieving a micro-spot by combination with the coaxial type.
Lenses can be selected according to the target object size.

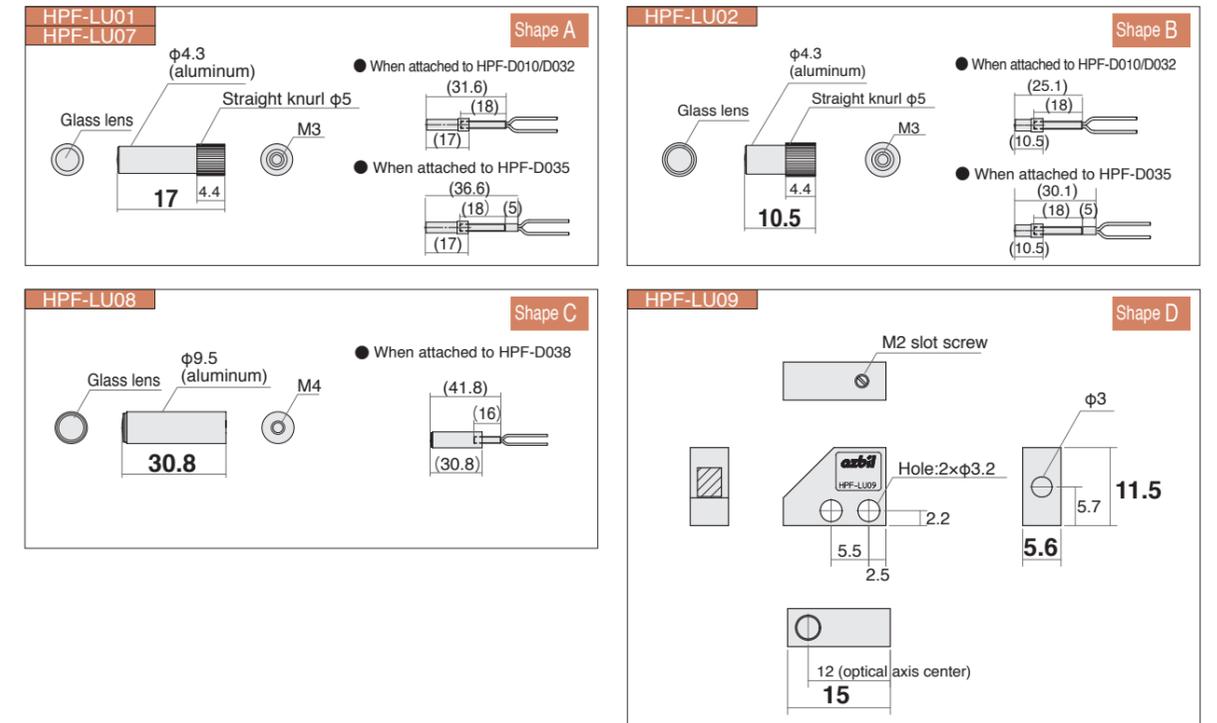


[Related pages]
Compatible fiber units
P15 (Coaxial)

For diffuse scan type

Type	Shape	Minimum spot dia.	Focus distance	Combined fiber		Model No.		
				Model No.	Spot dia.			
Micro-spot	Shape A	Approx. 0.1 mm	4.6 mm ± 0.2 mm	HPF-D034 HPF-D010 HPF-D032 HPF-D035	Approx. 0.1mm Approx. 0.2mm Approx. 0.2mm Approx. 0.2mm	HPF-LU07		
	Shape A	Approx. 0.2 mm	7.0 mm ± 0.5 mm	HPF-D034 HPF-D010 HPF-D032 HPF-D035	Approx. 0.2mm Approx. 0.4mm Approx. 0.4mm Approx. 0.4mm		HPF-LU01	
	Shape B	Approx. 1.0 mm	19 mm ± 1.0 mm	HPF-D034 HPF-D010 HPF-D032 HPF-D035	Approx. 1.0mm Approx. 2.0mm Approx. 2.0mm Approx. 2.0mm			HPF-LU02
	Shape C	Approx. 1.0 mm	33 mm ± 2.0 mm	HPF-D038	Approx. 1.0mm			
Variable spot	Shape D	Approx. 0.4 mm	Fiber insertion depth: 6 mm 7.0 ± 1.0 mm Fiber insertion depth: 9.5 mm 10 ± 1.0 mm	HPF-D035C	φ0.4 to 3.5mm	HPF-LU09		

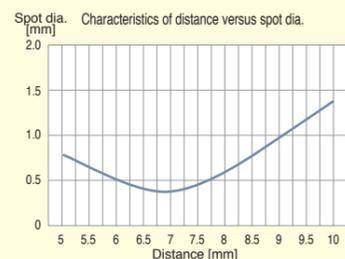
Outer dimensions



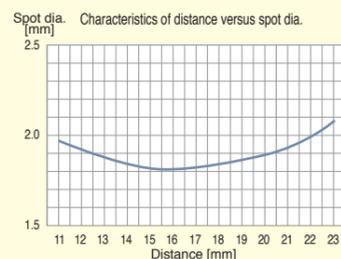
CHART

◇ Characteristics of distance versus spot dia. (typical example)

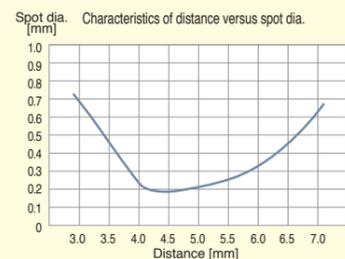
HPF-LU01



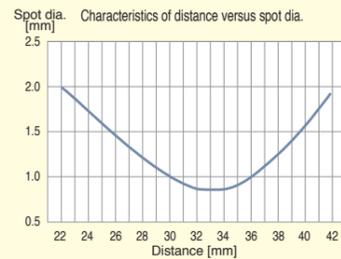
HPF-LU02



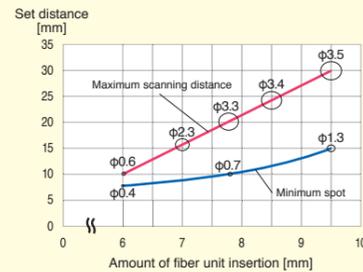
HPF-LU07



HPF-LU08



HPF-LU09



The chart shows the following characteristics in relation to the amount of fiber unit insertion:

- The set distance and spot dia. achieving the minimum spot
- The spot dia. at the maximum scanning distance

*Values are for the lens combined with an HPF-D035 fiber unit.
*Measured values are calculated at 13.5% of the peak light level.
(Only HPF-LU07 is calculated at 50%.)

NOTEWORTHY

Improving detection performance yields many positive results

Because of irregular reflection inside a lens, some light is returned even when no workpiece is present, but it is a small amount compared with the light reflected when there is a workpiece.
In HPF-LU sensors, the internal wall of the lens has a special feature that keeps this internal reflection to a minimum, so there is an increased amount of difference in light level when a workpiece is actually present.

Light actually used for detection



Problems due to scratches on the lens are greatly reduced.

The micro-spot lens is made of hard glass, so problems caused by a drop in light level due to lens scratches made by collisions with workpieces can be greatly reduced.



- Screw
- Cylindrical
- Coaxial
- Sleeve
- Side view
- Narrow view
- Flat/Selective reflection
- Area
- Heatproof
- Chemical-proof
- Vacuum-proof
- Specialized Use
- Lens unit
- Other accessories
- Technical Guide
- List of Scanning Distance by Amplifiers Model

Longer distances and alternate optical configurations are available by combination with thru-scan sensors.

Use in combination with various fiber units.



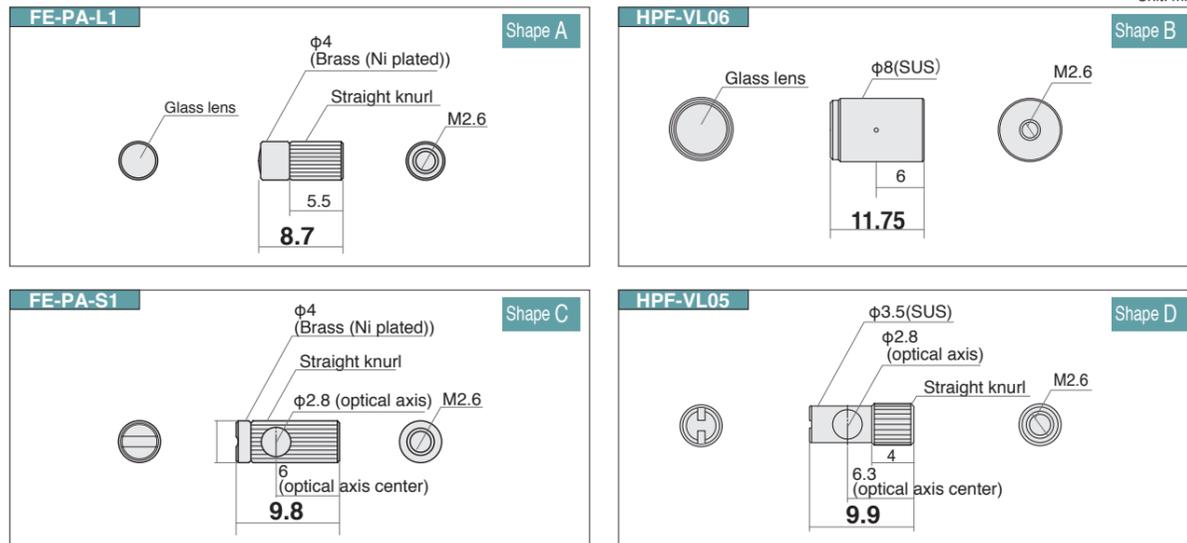
[Related pages]
 For combined fibers:
P9 (screw)
P13 (cylindrical)
P27 (heatproof)
P31 (vacuum proof)

For use with thru scan

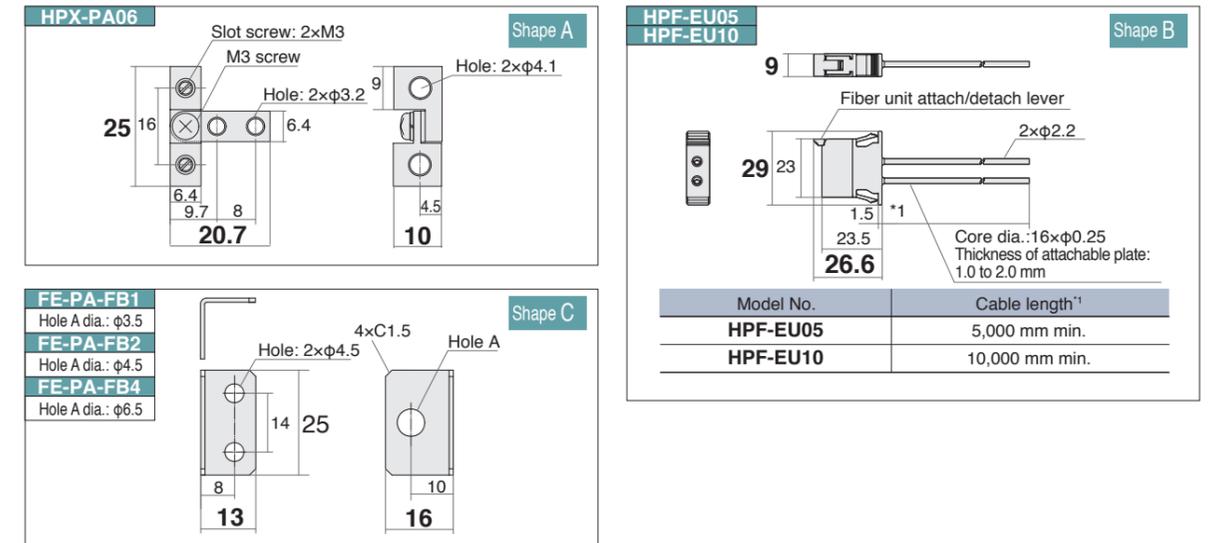
Type	Shape	Scaling	Directional angle (half angle)	Fiber unit		Scanning distance (mm)				Model No.	
				Model No.	Element type	HPX-AG	HPX-EG	HPX-H	HPX-A		
Long-distance lens	Shape A	x6	3°	HPF-T003	Standard	7,200	2,040	2,400	1,200	FE-PA-L1	
				HPF-T018	Heatproof	3,690	690	900	600		
				HPF-T024	Unbreakable	840	240	300	150		
Long-distance lens	Shape B	x10	3°	HPF-T003	Standard	12,000	3,400	4,000	2,000	HPF-VL06	
				HPF-T018	Heatproof	6,150	1,150	1,500	1,000		
				HPF-T024	Unbreakable	1,400	410	500	250		
Side view	Shape C	—	10°	HPF-T003	Standard	1,200	340	400	200	FE-PA-S1	
				HPF-T018	Heatproof	615	115	150	100		
				HPF-T024	Unbreakable	140	41	50	25		
	Side view	Shape D	—	8°	HPF-T003	Standard	1,200	340	400	200	HPF-VL05
					HPF-T018	Heatproof	615	115	150	100	
					HPF-T024	Unbreakable	140	41	50	25	

The scanning distances shown are nominal values. The actual scanning distances are limited by the fiber length (approx. 2 m × 2 ≈ 4 m in the case of standard type).
 For HPX-AG, the scanning distance shown is for HP mode (response time: 5 ms).
 For HPX-EG, the scanning distance shown is for nL mode (response time: 1 ms).
 The directional angles shown are typical examples obtained when the lens is combined with an HPF-T003.

Outer dimensions



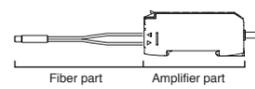
Outer dimensions



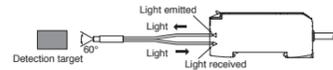
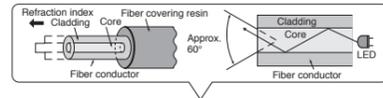
Screw
 Cylindrical
 Coaxial
 Sleeve
 Side view
 Narrow view
 Flat/Selective reflection
 Area
 Heatproof
 Chemical-proof
 Vacuum-proof
 Specialized Use
 Lens unit
 Other accessories
 Technical Guide
 List of Scanning Distance by Amplifiers Model

Detection Method

Optical fiber sensor



A fiber is composed of a central core and circumferential cladding where the refraction index is low. Light travels inside the core, with repeated total reflection along the boundaries between the core and the cladding. Light emerging from the fiber is emitted and spreads out at an angle of approximately 60°.



- The optical fiber does not have any electrical properties and so is excellent in an environment where reduced electrical noise is required.
- Different fiber variations allow for various applications.

Optical Fiber Types and Characteristics

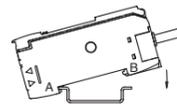
	Stationary bend type (multi-core)	Standard type (single core)	Bend-tolerant type (bundle)
Cross-section			
Structure	 (The inner elements are grouped into one.)		 (The internal elements are not attached to each other.)
Features	<ul style="list-style-type: none"> • Bending causes a small variation in the light level. • Allowable bend radius: 1 or 2 mm 	<ul style="list-style-type: none"> • Good light transmission efficiency (relatively long scanning distance) • Allowable bend radius: 10 or 20 mm 	<ul style="list-style-type: none"> • Good bend tolerance • Bend repetition of one million times or more (typical) • Allowable bend radius: 4 mm
Useful applications	Comparison with the previous standard type: <ul style="list-style-type: none"> • Soft and capable of cabling like electric wires • No worries about bend radius • Touching the fiber does not affect the light level. 	Used frequently for general purposes. Low price.	Resistant to break even when used in a moving environment
Typical model number	Thru scan: HPF-T025 Diffuse scan: HPF-D030	Thru scan: HPF-T003 Diffuse scan: HPF-D002	Thru scan: HPF-T008 Diffuse scan: HPF-D037

Usage Notes (general)

How to attach the amplifier unit

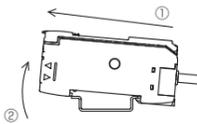
Attach the amplifier unit to the dedicated bracket (HPX-PA04, supplied or sold separately) or to the DIN rail.

- 1 Insert one rail of the bracket or DIN rail into the slot at point A.
- 2 Push the unit downwards until the second rail clicks into place at point B. When attaching the amplifier to a DIN rail, be sure to secure both ends with the end plate (HPX-PA03, sold separately).



How to remove the amplifier unit

Push the amplifier forward firmly (1) so that the front lock releases. Lift the unit as shown in the figure (2) to remove the unit.

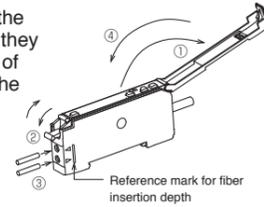


Expansion unit attachment to the main unit for reduced-wiring models (HPX-AG/EG series)

- 1 Remove the stickers affixed to the connectors of the units to be attached.
- 2 Mount the expansion units side by side on the DIN rail.
- 3 Slide the expansion units together so that the connectors connect.
- 4 Use end plates (HPX-PA03, sold separately) to hold the expansion units in place. To remove expansion units, slide off one by one.

Attaching the fiber unit to an amplifier

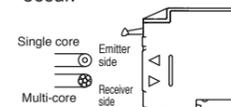
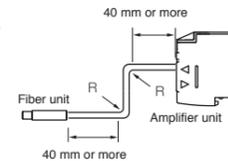
- 1 Open the cover.
- 2 Tilt the fiber clamp lever forwards to the release position.
- 3 Firmly insert the fiber tips into the holes in the amplifier as far as they will go. For the insertion depth of the fiber, refer to the mark on the side of the unit.
- 4 Close the cover.



Caution

- if the fiber is thin, first insert it into the thin fiber adapter so that the fiber projects approximately 0.5 to 1 mm from the top of the adapter. Then insert the adapter into the hole in the amplifier as far as it will go, and then fix it firmly.

- Because a cable break tends to easily occur around the fiber unit's sensing head and junction with the amplifier unit, do not bend the cable within 40 mm (10 mm for a thin fiber unit). In other cabling areas, use the fiber cable at the allowed bending radius or more specified for each product. If the cable is bent beyond the allowed bend radius, the rated scanning distance may be unavailable or a cable break may occur.



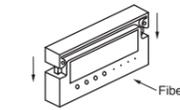
When attaching a coaxial diffuse scan fiber unit to a main unit, attach the single-core fiber cable to the insertion hole's emitter side, and attach the multi-core fiber cable to the receiver side.

Scanning distances and display readouts may differ depending on variations in individual unit characteristics, installation states and fiber unit types.

Cutting of fibers

To cut a fiber, use the dedicated cutter (supplied with the fiber unit). Note that cold-proof and heatproof fibers cannot be cut.

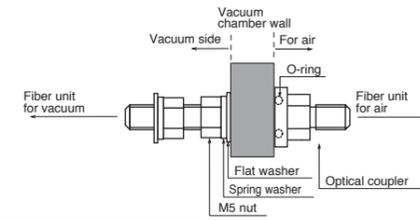
- 1 Insert the fiber into the cutter hole and set the fiber to the specified length.
 - 2 Press the blade straight down in a strong smooth motion.
 - 3 Cut one fiber cable at a time and do not reuse the blade on another optical fiber.
- When the detecting surface of the fiber unit gets dirty, gently wipe it with a soft clean cloth. Do not use organic solvents such as benzene or thinner.
 - The scanning distance may be reduced approximately 20% depending on how the fiber is inserted into the amplifier unit and how the fiber is cut.
 - For specifications, usage notes and other information for the fiber unit, see the product specifications.



Use Cautions (type specific)

Vacuum fiber

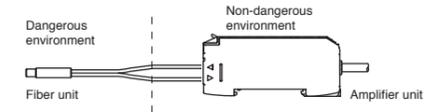
- Vacuum fiber HPF-V series
The flange, fibers for vacuum and the lens unit are cleaned with IPA, but baking treatment etc. should be carried out before use.
- Cautions for attaching the optical coupler
The optical coupler uses an O-ring as shown below. Do not weld it to the vacuum chamber wall, as this may cloud the inside glass rod.



Attachable plate thickness: 8 to 10 mm
Recommended mounting hole: 5 dia. ±0.1 mm
Recommended surface roughness for O-ring's contact area: 1.6 Ry

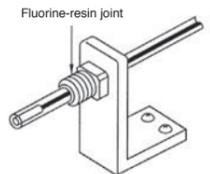
Use under explosion-proof atmospheres

Generally, the fiber unit is structured only to transmit light and so cannot cause electrical explosions or ignite fires. Therefore, the fiber and amplifier units can be used with the fiber unit placed in a dangerous place, and the amplifier unit in a non-dangerous place. Nevertheless, check the explosion-proof regulations required for the equipment used before using the sensor.



Chemical proof

- When installing the unit, use commercially-available fluorine-resin joint that matches the outside diameter of the PFA tube.
- The bend radius of the protective tube must be greater than the bend radius specified for each fiber unit. If the bend radius is below the specified value, the fiber unit may break.
- Do not apply excessive tension to the fiber-optic cable.



PFA Chemical Proof

Substance	PFA chemical proof	Substance	PFA chemical proof
Heavy oils A/B/C	OK	Light oil	OK
Aniline	C ₆ H ₅ NH ₂ OK	Paraffinum liquidum	OK
Acrylonitrile	C ₂ H ₃ CN OK	Sodium dichromate	Na ₂ Cr ₂ O ₇ OK
Asphalt	OK	Barium nitrate	Ba(NO ₃) ₂ OK
Acetone	(CH ₃) ₂ CO OK	Silicone oil	OK
Methanol	CH ₃ OH OK	Plant oil	OK
Ammonia	NH ₃ OK	Thinner	OK
Isooctane	i-C ₈ H ₁₈ OK	Barium hydroxide	Ba(OH) ₂ OK
Isobutyl alcohol	i-C ₄ H ₉ OH OK	Phenol	C ₆ H ₅ OH OK
Isobutyl methyl ketone	C ₄ H ₉ COCH ₃ OK	Turbine oil	OK
Ethanol	C ₂ H ₅ OH OK	Sodium carbonate	Na ₂ CO ₃ OK
Ether	(CH ₃) ₂ O OK	Turpentine	OK
Ethylene glycol	C ₂ H ₄ (OH) ₂ OK	Natural volatile oil	OK
Enamel paint	OK	Kerosine petroleum	OK
Ammonium chloride	NH ₄ Cl OK	Trichloroethane	C ₂ H ₃ Cl ₃ OK
Calcium chloride	CaCl ₂ OK	Trichlorethylene	C ₂ HCl ₃ OK
Sodium chloride	NaCl OK	Toluene	C ₆ H ₅ CH ₃ OK
Barium chloride	BaCl ₂ OK	Naphtha	C ₇ H ₁₆ OK
Chlorine	Cl ₂ OK	Acidum lacticum	OK
Gasoline	OK	Nitrobenzene	C ₆ H ₅ NO ₂ OK
Glass ingredients	OK	Hydrofluoric acid (hydrogen fluoride)	HF *
Dilute hydrochloric acid	HCl OK	Ferrosilicon	OK
Dilute sodium hydroxide	NaOH OK	Freon 11	FCCl ₃ OK
Dilute acetic acid	CH ₃ COOH OK	Propyl alcohol	C ₃ H ₅ (OH) ₃ OK
Dilute nitric acid	HNO ₃ OK	Propylene glycol	C ₃ H ₂ (OH) ₂ OK
Dilute sulfuric acid	H ₂ SO ₄ OK	Benzene	C ₆ H ₆ OK
Citric acid	C ₃ H ₄ (OH)(COOH) ₃ OK	Methyl violet	OK
Glycerin	C ₃ H ₅ (OH) ₃ OK	Water	H ₂ O OK
Cresol	C ₆ H ₄ (OH)(CH ₃) OK	Carbon tetrachloride	CCl ₄ OK
Chloroform	CH ₃ Cl OK	Ammonium sulfate	(NH ₄) ₂ SO ₄ OK

*For information on hydrofluoric acid, contact our sales staff.

Additional Notes

- The above table is not a guarantee that the product can be used with the indicated substance.
- Substances such as strong acids and ammonia may penetrate PFA (fluororesin).

Fiber Length vs. Scanning Distance Characteristics

Note that extending fiber length reduces scanning distance.

Standard fiber element

Element type		Distance change ratio for each element length						
Core dia.	Bend radius	2 m	5 m	10 m	15 m	20 m	25 m	30 m
0.25	R4	100%	62%	28%	12%	Unavailable	Unavailable	Unavailable
	R1	100%	66%	33%	17%	Unavailable	Unavailable	Unavailable
0.5	R15	100%	85%	64%	49%	37%	28%	21%
	R2	100%	76%	48%	30%	19%	12%	Unavailable
1	R5	100%	50%	16%	Unavailable	Unavailable	Unavailable	Unavailable
	R20	100%	85%	64%	49%	37%	28%	21%

Heatproof fiber element

Element type		Distance change ratio for each element length						
Heatproof	1 m	2 m	5 m	10 m	15 m	20 m	25 m	30 m
105°C	-	100%	57%	22%	Unavailable	Unavailable	Unavailable	Unavailable
150°C	-	100%	50%	16%	Unavailable	Unavailable	Unavailable	Unavailable
200°C	100%	93%	76%	54%	38%	27%	19%	13%
350°C	-	100%	81%	58%	41%	29%	20%	14%

Characteristics of Scanning Distance by Combination with Fiber Extender (typical values)



Thru scan

Type	Model No.	Scanning distance and cable length when combined with fiber extender: HPX-AG (HP mode: 5 ms in response time)*1		
		No extender	HPF-EU05(5m)	HPF-EU10(10m)
Standard fiber	HPF-T003 Related pages P9	1200mm	580mm	440mm
		Cable length: 2m 100%	Cable length: 7m 49%	Cable length: 12m 37%
Heatproof	HPF-T018 Related pages P27	615mm	250mm	195mm
		Cable length: 1m 100%	Cable length: 6m 42%	Cable length: 11m 32%
Area	HPF-T021T Related pages P25	3600mm	1510mm	1150mm
		Cable length: 2m 100%	Cable length: 7m 42%	Cable length: 12m 32%
Unbreakable fiber	HPF-T024 Related pages P9	140mm	37mm	28mm
		Cable length: 2m 100%	Cable length: 7m 27%	Cable length: 12m 20%
Pipe-mounted liquid level	HPF-T032, T032E HPF-T034, T034E Related pages P37	Available*2	Available*2	Unavailable
		Cable length: 5m	Cable length: 10m	Cable length: 15m

Diffuse scan

Type	Model No.	Scanning distance and cable length when combined with fiber extender: HPX-AG (HP mode: 5 ms in response time)*1		
		No extender	HPF-EU05(5m)	HPF-EU10(10m)
Standard fiber	HPF-D002 Related pages P11	400mm	170mm	125mm
		Cable length: 2m 100%	Cable length: 7m 43%	Cable length: 12m 32%
Heatproof	HPF-D023 Related pages P27	170mm	47mm	35mm
		Cable length: 1m 100%	Cable length: 6m 28%	Cable length: 11m 21%
Unbreakable fiber	HPF-D029 Related pages P11	25mm	8mm	6mm
		Cable length: 2m 100%	Cable length: 7m 33%	Cable length: 12m 25%
Liquid leakage	HPF-D040 Related pages P39	Available*2	Available*2	Unavailable
		Cable length: 5m	Cable length: 10m	Cable length: 15m
Contact liquid level	HPF-D027 Related pages P35	Available*2	Available*2	Unavailable
		Cable length: 5m	Cable length: 10m	Cable length: 15m

*1 For combinations other than with HPX-AG, please contact us.

*2 Even where availability is indicated, detection may not be possible depending on the liquid. Please check operation before use.

List of scanning Distance by Amplifiers Model

Thru scan



Model No.	Scanning distance (mm)											Page
	HPX-AG						HPX-EG			HPX-H	HPX-A	
	HP	nL	SF	FT	HS	SH	nL	SF	FT	—	—	
HPF-T001	2,175	1,450	1,160	630	360	500	770	650	450	800	400	P9
HPF-T002	2,175	1,450	1,160	630	360	500	770	650	450	800	400	P13
HPF-T003	1,200	800	640	350	200	280	410	350	240	400	200	P9
HPF-T004	1,200	800	640	350	200	280	410	350	240	400	200	P13
HPF-T005	1,200	800	640	350	200	280	410	350	240	400	200	P17
HPF-T006	1,200	800	640	350	200	280	410	350	240	400	200	P17
HPF-T007	165	110	88	48	27	38	55	48	33	60	30	P19
HPF-T008	180	120	96	52	30	42	60	50	38	100	40	P9
HPF-T009	180	120	96	52	30	42	60	50	38	100	40	P13
HPF-T010	855	570	455	245	140	195	300	250	170	300	150	P9
HPF-T012	690	460	365	200	115	160	240	200	140	250	120	P27
HPF-T014	660	440	350	190	110	150	220	190	130	250	120	P27
HPF-T015	37	25	20	10	6	8	12	10	7	12	6	P17
HPF-T017	1,200	800	640	350	200	280	410	350	240	400	200	P27
HPF-T018	615	410	325	175	100	140	140	120	80	200	100	P27
HPF-T019	4,140	2,760	2,200	1,200	690	965	1,400	1,200	840	1,500	750	P21
HPF-T020	4,500	3,000	2,400	1,310	750	1,050	1,500	1,300	920	1,600	800	P21
HPF-T021	780	520	415	225	130	180	270	220	160	250	125	P25
HPF-T021S	3,450	2300	1,840	1,000	575	800	1,100	960	670	1,100	550	P25
HPF-T021T	3,600	2400	1,920	1,050	600	840	1,200	1,000	710	1,200	600	P25
HPF-T021WT	3,600	3600	3,200	1,750	1,000	1,400	2,000	1,600	1,100	2,000	1,000	P25
HPF-T023	3,600	2,400	1,920	1,050	600	840	1,200	1,000	730	1,200	600	P21
HPF-T024	140	95	75	40	23	33	50	42	29	50	25	P9
HPF-T025	900	600	480	260	150	210	310	260	180	300	150	P9
HPF-T025B	900	600	480	260	150	210	310	260	180	300	150	P9
HPF-T026	52	35	28	15	8	12	20	16	11	20	10	P19
HPF-T028	140	95	75	40	23	33	50	42	29	50	25	P23
HPF-T028LF	210	140	110	60	35	49	80	65	47	80	40	P23
HPF-T029	4,500	3,000	2,400	1,310	750	1,050	1,500	1,200	880	1,500	750	P29
HPF-T029E	825	550	440	240	135	190	280	230	160	270	130	P29
HPF-T030	500	500	500	305	175	245	310	260	180	350	175	P21,41
HPF-T031	900	600	480	260	150	210	310	260	180	300	150	P13
HPF-T032	—	—	—	—	—	—	—	—	—	—	—	P37
HPF-T032E	—	—	—	—	—	—	—	—	—	—	—	P37
HPF-T033	900	600	480	260	150	210	280	240	160	265	130	P9
HPF-T034	—	—	—	—	—	—	—	—	—	—	—	P37
HPF-T034E	—	—	—	—	—	—	—	—	—	—	—	P37
HPF-T035	1,030	690	550	300	170	240	350	300	210	340	170	P29
HPF-T036	18	12	9	5	3	4	6	5	3	6	3	P13
HPF-T037	52	35	28	15	8	12	20	16	11	20	10	P19
HPF-T038	37	25	20	10	6	8	12	10	7	12	6	P13
HPF-T039	18	12	9	5	3	4	5	4	3	6	3	P17
HPF-T042	660	440	350	190	110	150	220	190	130	240	120	P19
HPF-T043	300	200	160	85	50	70	100	80	55	100	50	P13
HPF-T044	675	450	360	195	110	155	220	190	130	220	110	P9
HPF-T046	180	120	96	52	30	42	60	50	38	100	40	P13
HPF-T047	—	—	—	—	—	—	—	—	—	—	—	P33
HPF-T054-L05	6	6	6	6	6	6	6	6	6	6	6	P17

Diffuse scan



Model No.	Scanning distance (mm)											Page
	HPX-AG						HPX-EG			HPX-H	HPX-A	
	HP	nL	SF	FT	HS	SH	nL	SF	FT	—	—	
HPF-D001	530	400	320	170	85	130	210	180	120	230	120	P11
HPF-D002	400	300	240	130	65	100	150	130	90	150	80	P11
HPF-D003	400	300	240	130	65	100	150	130	90	150	80	P17
HPF-D004	105	80	64	34	17	26	43	36	25	40	20	P11
HPF-D005	105	80	64	34	17	26	43	36	25	40	20	P13
HPF-D006	105	80	64	34	17	26	43	36	25	40	20	P17
HPF-D009	400	300	240	130	65	100	150	130	90	150	80	P15
HPF-D010	86	65	52	28	14	21	35	30	21	40	20	P15
HPF-D011	40	30	24	13	6	10	17	14	10	15	8	P19
HPF-D012	250	190	150	80	40	60	100	80	55	100	50	P11
HPF-D013	190	190	160	85	43	65	100	80	55	100	50	P27
HPF-D014	170	130	100	55	28	43	70	60	42	50	50	P29
HPF-D015	160	160	140	75	39	60	85	70	50	90	30	P27
HPF-D018	200	150	120	65	32	50	75	65	46	80	40	P11
HPF-D019	20	16	12	6	2	4	4	3	2	4	2	P17
HPF-D021	86	65	52	28	14	21	35	30	21	40	20	P17
HPF-D022	400	300	240	130	65	100	150	130	90	150	80	P27
HPF-D023	170	130	100	55	28	43	70	60	42	50	50	P27
HPF-D025	20	20	20	20	20	20	20	20	16	20	20	P21
HPF-D026	265	200	160	85	43	65	100	90	60	100	50	P25
HPF-D027	—	—	—	—	—	—	—	—	—	—	—	P35
HPF-D028	2.5±0.5	2.5±0.5	2.5±0.5	2.5±0.5	—	—	—	—	—	2.5±0.5	2.5±0.5	P24
HPF-D028F	5.2±1.6	5.2±1.6	5.2±1.6	—	—	—	5.2±1.0	—	—	—	—	P24
HPF-D028T	7.4±1.6	7.4±1.6	7.4±1.6	—	—	—	7.4±1.2	—	—	—	—	P24
HPF-D029	25	19	15	8	4	6	10	8	5	10	5	P11
HPF-D030	210	160	125	69	34	53	85	70	50	80	40	P11
HPF-D032	46	35	28	15	7	11	18	15	10	18	10	P15
HPF-D032B	46	35	28	15	7	11	18	15	10	18	10	P15
HPF-D033	—	—	—	—	—	—	—	—	—	—	—	P35
HPF-D034	60	45	36	19	9	15	25	21	15	25	13	P15
HPF-D035	95	95	80	43	21	33	50	42	29	50	25	P15
HPF-D035C	95	95	80	43	21	33	50	42	29	50	25	P15
HPF-D036	20	15	12	6	3	5	8	7	5	8	4	P13
HPF-D037	20	15	12	6	3	5	8	7	5	8	4	P11
HPF-D038	95	95	80	43	21	33	50	42	29	50	25	P15
HPF-D039	20	16	12	6	2	4	4	3	2	4	2	P17
HPF-D040	—	—	—	—	—	—	—	—	—	—	—	P39
HPF-D041	40	30	24	13	6	10	17	14	10	15	8	P19
HPF-D042	86	65	52	28	14	21	35	30	21	40	20	P15
HPF-D043	160	120	96	52	25	40	65	55	40	50	32	P19
HPF-D045LF	93	70	56	30	15	23	37	31	21	35	17	P23
HPF-D049	160	120	100	55	27	42	60	55	38	60	34	P15

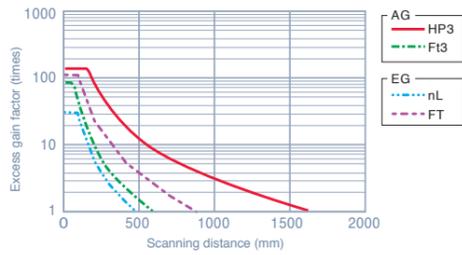
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Coaxial
Sleeve
Side view
Narrow view
Flat/
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Heatproof
Chemical
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-proof
Specialized
Use
Lens unit
Other
accessories

Characteristics diagrams (typical examples)

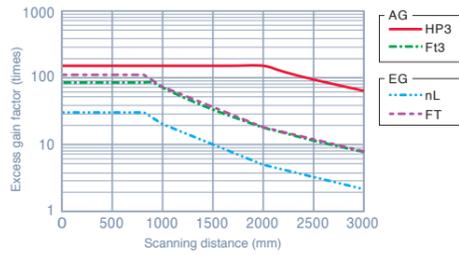
Excess gain



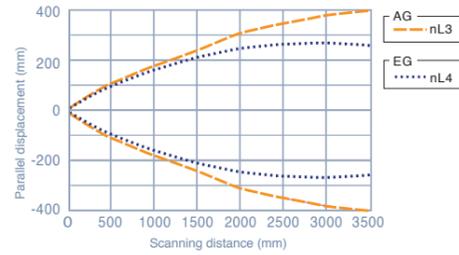
HPF-T003
Related pages [P9](#)



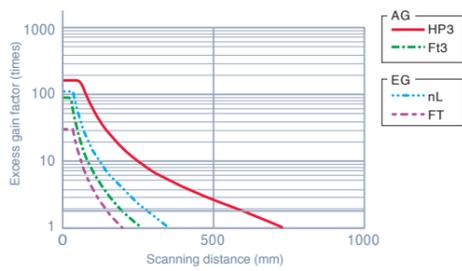
HPF-T003 / FE-PA-L1
Related pages [P9](#), [P45](#)



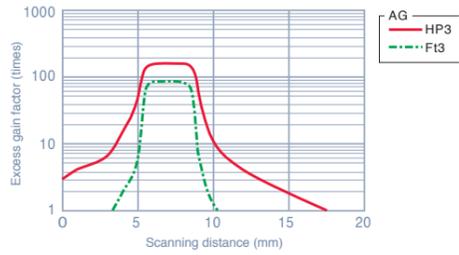
HPF-T029
Related pages [P29](#)



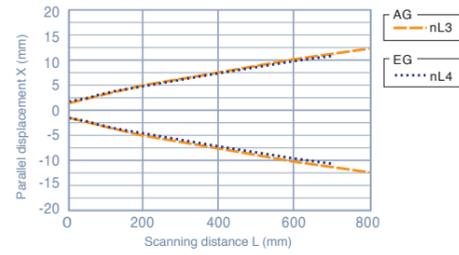
HPF-D002
Related pages [P11](#)



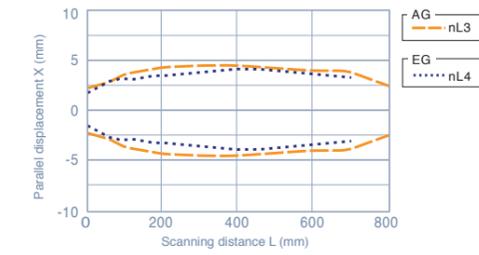
HPF-D028T
Related pages [P24](#)



HPF-T030
(Right and left detection)
Related pages [P21](#)



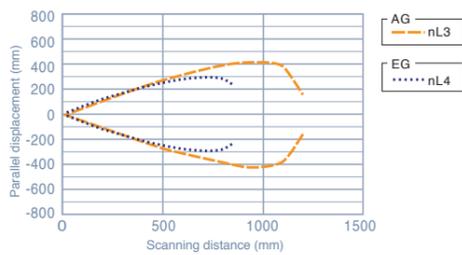
HPF-T030
(Up and down detection)
Related pages [P21](#)



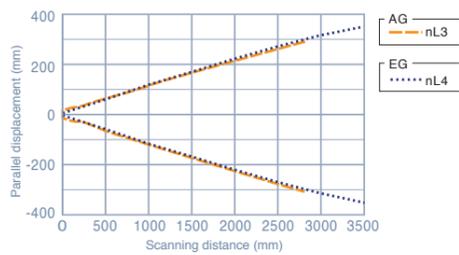
Parallel displacement



HPF-T003
Related pages [P9](#)



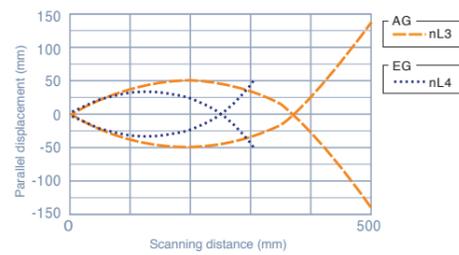
HPF-T003 / FE-PA-L1
Related pages [P9](#), [P45](#)



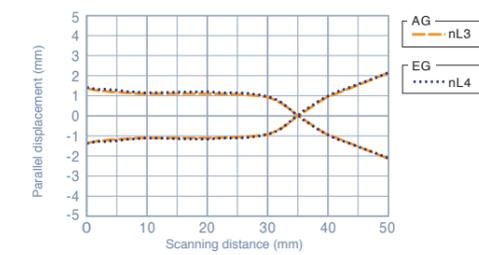
Detection area characteristics



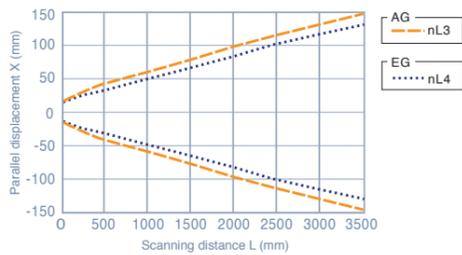
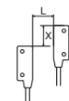
HPF-D002
Related pages [P11](#)



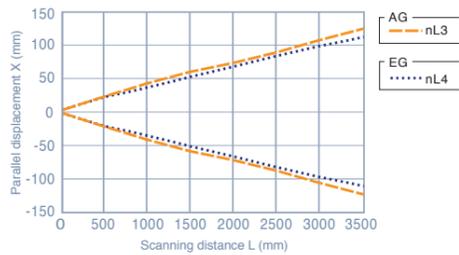
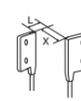
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HPF-T021T
(Up and down detection)
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- Screw
- Cylindrical
- Coaxial
- Sleeve
- Side view
- Narrow view
- Flat/ Selective reflection
- Area
- Heatproof
- Chemical -proof
- Vacuum -proof
- Specialized
- Lens unit
- Other accessories