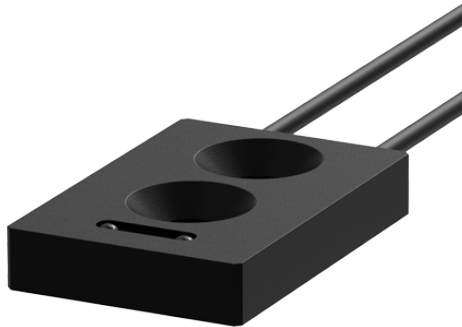


Convergent Reflective Type Fiber Optic Units



FL/GL Series PRODUCT MANUAL

For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.

The specifications, dimensions, etc. are subject to change without notice for product improvement. Some models may be discontinued without notice.

Icon Overview



Standard:
Fiber optic units for general purpose



Heat-resistant:
Fiber optic units for the high-temperature environment (-60 to 250°C)



Vacuum-resistant:
Fiber optic units for the high-temperature (-60 to 350°C) and vacuum environment



Flexible (R1, R2):
Fiber optic units for withstanding repeated flexing

Convergent Reflective Type Line Up

Head shape		Standard	Heat-resistance	Vacuum-resistant	Bending-resistant	Flexible
Flat head (flat view)		Std.				
Flat head (top view)		Std.				

Selection Guide

△ The installation method for the fiber optic units may vary depending on the fiber optic amplifiers. Be sure to refer to the 'Product manual' of amplifier you are using. For detailed information on the fiber optic units, refer to the 'Fiber optic sensor guide'.

00. When using the vacuum-resistant fibers

Be sure to connect with the vacuum-resistant fiber, the fiber optic coupler, and the atmospheric side fiber.

01. Model name

The model name starting with 'F' indicates plastic-type optical fibers, while starting with 'G' indicates glass-type optical fibers.

02. Minimum target size

The minimum detectable target came out with the maximum sensitivity setting of the BF4 series.

03. Sensing distance

The sensing distance of the optical fibers varies depending on the testing environments of each amplifier. Apply 10% of the BF4R□-□ sensing distance to the fiber optic amplifiers BF4G□-□ model.

Errors in the sensing distance may occur due to the sensing environment as below.

- Fiber optic units: Bend radius of cable, condition of cutting surface, amplifier insertion depth, etc

- Detectable objects: Material, shape or inclination, bending, gloss, etc

04. FREE CUT

Be sure to cut the cable using the provided fiber cutter (FC-3) for FREE CUT type models.

05. Adapter

Be sure to connect the provided adapter for Adapter-compatible models.

When checking the product components or ordering the sold separately, refer to the marks below.

●: It is possible to use the Product Components and the adapter (sold separately).

○: Only the adapter included with the product is available and cannot be purchased separately.

-: The adapter is not supported.

06. Dimensions

For detailed information on the drawings and dimensions, follow the Autonics website.




Product Components

- Fiber optic units
- Fiber cutter (for FREE CUT type model)
- Adapter (for Adapter-compatible model)

Sold Separately

- Included items for the vacuum-resistant fiber
 - Fiber optic coupler: FU-VC□
 - Atmospheric side fiber: FU-VA□
- Fiber cutter: FC-3
- Adapter

Flat head (flat view): Standard

Appearance	Model	Cable		Ambient temperature	Min. target size	Sensing distance (unit: mm)				Adapter	
		Length	Bend radius			Amp. Mode	BFX-D1-□	BF5R-□1-□	BF4R□-□ ⁰¹⁾		BF3RX-□ ⁰¹⁾
	FLF-320-05	2 m (FREE CUT)	R15	-30 to 70 °C	Ø 0.1 mm	U-FST	2	5			●
						FAST	4	6			
						STD	6	8			
						LONG	9	9			
						U-LG / MAX.	10	11	5	5	
	FLF-320-10	2 m	R25	-40 to 60 °C	Ø 0.0125 mm	U-FST	4	4			○ ⁰²⁾
						FAST	8	8			
						STD	12	8			
						LONG	20	20			
						U-LG / MAX.	25	25	10	5	
	FLF-320-10A	2 m (FREE CUT)	R20	-30 to 70 °C	Ø 0.08 mm	U-FST	25	30			●
						FAST	40	50			
						STD	65	100			
						LONG	130	180			
						U-LG / MAX.	180	260	70	15	

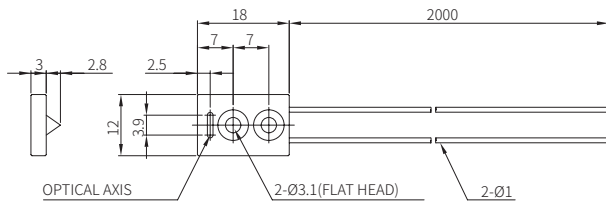
01) When setting the maximum sensitivity for each amplifier.

02) The adapter for this model is not compatible with the separately sold adapter and cannot be purchased separately, so be careful not to lose it.

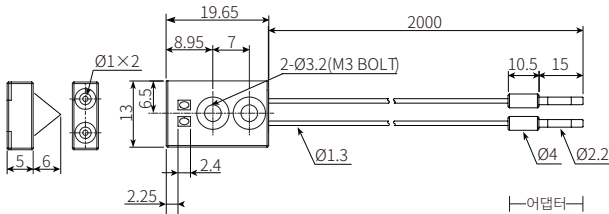
■ Dimensions

• Unit: mm, For the detailed drawings, follow the Autonics website.

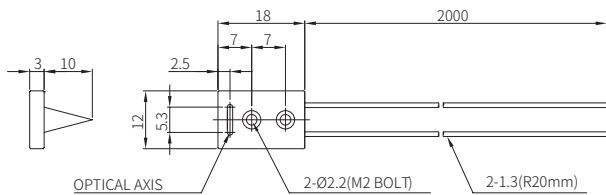
• FLF-320-05





• FLF-320-10



• FLF-320-10A



Flat head (flat view): Heat-resistant

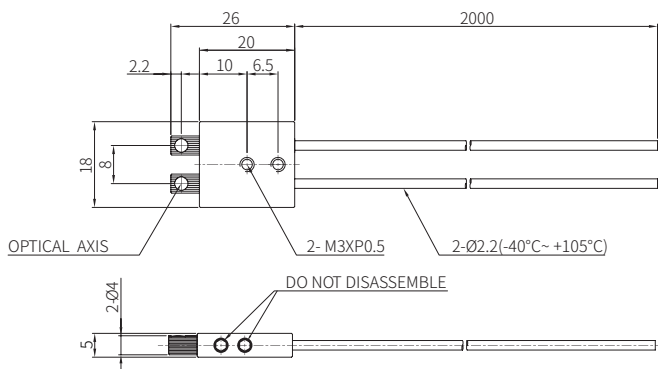
Appearance	Model	Cable		Ambient temperature	Min. target size	Sensing distance (unit: mm)				Adapter	
		Length	Bend radius			Mode \ Amp.	BFX-D1-□	BF5R-□1-□	BF4R□-□ ⁰¹⁾		BF3RX-□ ⁰¹⁾
	FLF-320-10H	2 m (FREE CUT)	R25	-40 to 105 °C	Ø 0.08 mm	U-FST	45	60			-
						FAST	60	80			
						STD	90	130			
						LONG	175	220			
						U-LG / MAX.	240	320	90	80	
	GLF-320-12H2L	2 m	R25	-60 to 250 °C	Ø 0.6 mm	U-FST	35	50			-
						FAST	50	70			
						STD	75	120			
						LONG	160	230			
						U-LG / MAX.	260	340	90	N.A	

01) When setting the maximum sensitivity for each amplifier.

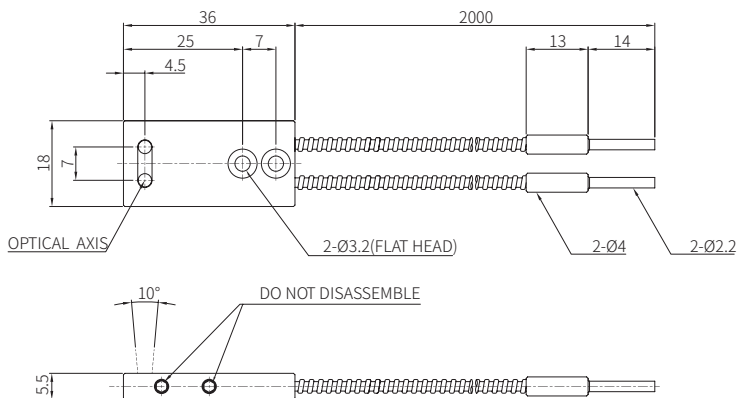
■ Dimensions

• Unit: mm, For the detailed drawings, follow the Autonics website.

• FLF-320-10H







• GLF-320-12H2L



Flat head (flat view): Vacuum-resistant

- Be sure to connect with the vacuum-resistant fiber, the fiber optic coupler, and the atmospheric side fiber.
- The sensing distance of the vacuum-resistant fiber unit is based on the installation of the atmospheric side fiber unit (FU-VA0□, sold separately).

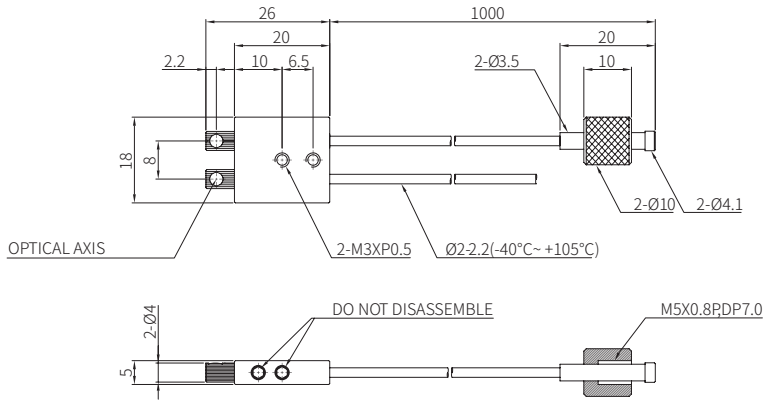
Appearance	Model	Cable		Ambient temperature	Min. target size	Sensing distance (unit: mm)					Adapter	
		Length	Bend radius			Mode \ Amp.	BFX-D1-□	BF5R-□1-□	BF4R-□-□ ⁰¹⁾	BF3RX-□ ⁰¹⁾		
	FLF-310-10V	1 m (FREE CUT)	R25	-30 to 105 °C	Ø 3.4 mm (+ FU-VA01)	U-FST	15	30				
						FAST	20	50				
						STD	30	70				
						LONG	55	120				
						U-LG / MAX.	75	170	35	25		
					Ø 3.9 mm (+ FU-VA02)	U-FST	10	30				
						FAST	15	40				
						STD	20	60				
						LONG	45	100				
						U-LG / MAX.	60	140	25	25		
	GLF-310-12V2	1 m	R25	-60 to 250 °C	Ø 1.8 mm (+ FU-VA01)	U-FST	25	30				
						FAST	40	50				
						STD	55	80				
						LONG	95	140				
						U-LG / MAX.	130	200	40	35		
					Ø 2.0 mm (+ FU-VA02)	U-FST	20	30				
						FAST	30	40				
						STD	45	60				
						LONG	80	100				
						U-LG / MAX.	105	150	30	35		
	GLF-310-12V2L	1 m	R25	-60 to 250 °C	Ø 0.6 mm (+ FU-VA01)	U-FST	20	30				
						FAST	30	50				
						STD	45	80				
						LONG	85	140				
						U-LG / MAX.	120	200	45	45		
					Ø 2.0 mm (+ FU-VA02)	U-FST	20	30				
						FAST	25	40				
						STD	40	60				
						LONG	60	100				
						U-LG / MAX.	80	150	35	35		
	GLF-310-12V3L	1 m	R25	-60 to 350 °C	Ø 0.6 mm (+ FU-VA01)	U-FST	25	30				
						FAST	35	50				
						STD	50	80				
						LONG	85	140				
						U-LG / MAX.	120	200	50	40		
					Ø 1.5 mm (+ FU-VA02)	U-FST	20	30				
						FAST	25	40				
						STD	40	60				
						LONG	65	100				
						U-LG / MAX.	85	140	40	35		

01) When setting the maximum sensitivity for each amplifier.

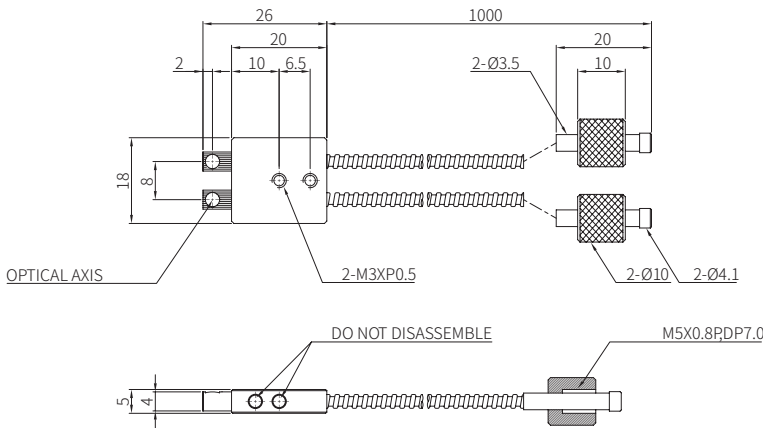
■ **Dimensions**

• Unit: mm, For the detailed drawings, follow the Autonics website.

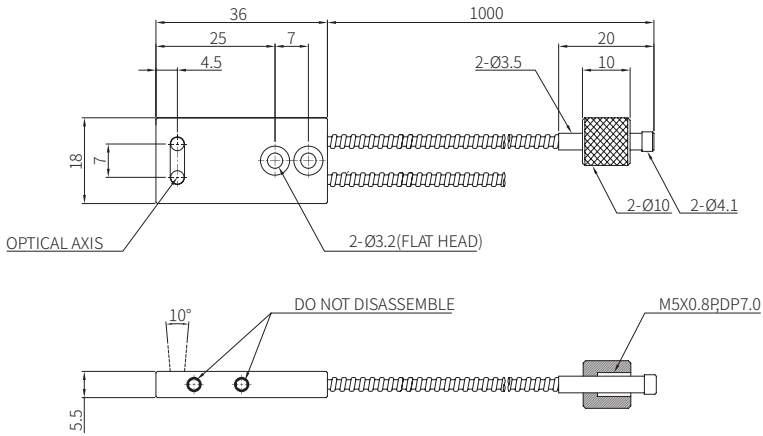
• **FLF-310-10V**



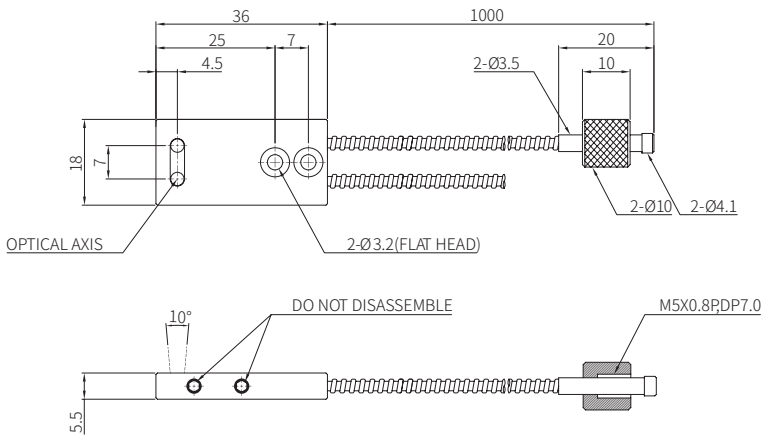
• **GLF-310-12V2**




• **GLF-310-12V2L**



• **GLF-310-12V3L**



Flat head (flat view): Flexible

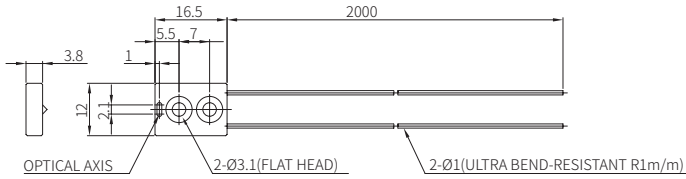
Appearance	Model	Cable		Ambient temperature	Min. target size	Sensing distance (unit: mm)				Adapter	
		Length	Bend radius			Mode \ Amp.	BFX-D1-□	BF5R-□1-□	BF4R□-□ ⁰¹⁾		BF3RX-□ ⁰¹⁾
	FLF-320-05R	2 m (FREE CUT)	R1	-30 to 70 °C	Ø 0.08 mm	U-FST	4	3			●
						FAST	4	5			
						STD	5	7			
						LONG	7	11			
						U-LG / MAX.	12	17	5	5	

01) When setting the maximum sensitivity for each amplifier.


■ Dimensions

• Unit: mm, For the detailed drawings, follow the Autonics website.

• FLF-320-05R



Flat head (top view): Standard

Appearance	Model	Cable		Ambient temperature	Min. target size	Sensing distance (unit: mm)				Adapter	
		Length	Bend radius			Mode \ Amp.	BFX-D1-□	BF5R-□1-□	BF4R□-□ ⁰²⁾		BF3RX-□ ⁰²⁾
	FLFU-320-10WP ⁰¹⁾	2 m (FREE CUT)	R20	-30 to 70 °C	Ø 0.08 mm	U-FST	20	25			-
						FAST	25	30			
						STD	40	80			
						LONG	115	200			
						U-LG / MAX.	190	310	40	20	

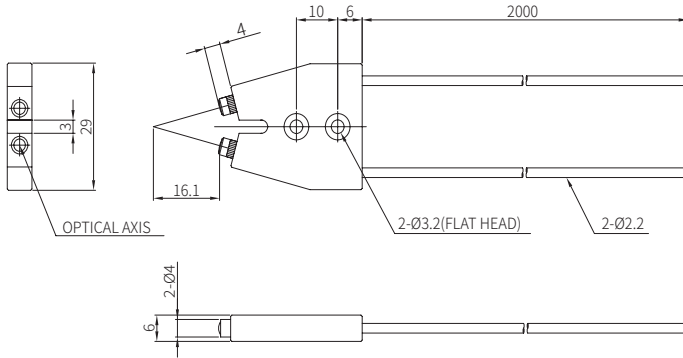
01) This model supports water resistance.

02) When setting the maximum sensitivity for each amplifier.

■ Dimensions

• Unit: mm, For the detailed drawings, follow the Autonics website.

• FLFU-320-10WP



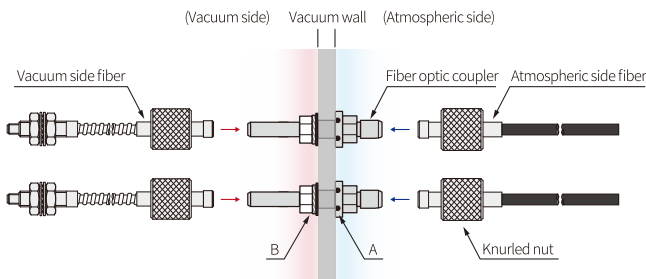
Sold Separately: Fiber Optic Coupler, Atmospheric side fiber

■ Cautions during installation

- When using the vacuum-resistant fibers, be sure to connect with the fiber optic coupler and the atmospheric side fibers.
- The fiber optic coupler is a device that seals the vacuum side and the atmospheric side to transmit light, and it is equipped with an O-ring. Be sure not to blur the glass rod inside by welding on the vacuum wall and weld joints.
- When installing the fiber optic coupler, following the environmental requirements below.
 - Thickness of the installation wall: 8 to 10 mm
 - Diameter of the mounting hole: $\varnothing 5.0 + 0.1, - 0.1$ mm
 - Surface roughness in contact with the O-ring: 1.6 Ry
- Be sure to install the fiber optic coupler and fiber optic units by checking the specified connection points below. Failure to follow this instruction may result in product damage.
 - Vacuum side fibers → Long side of the fiber optic coupler
 - Atmospheric side fibers → Short side of the fiber optic coupler



■ Example of usage

01. Insert the fiber optic coupler into the mounting hole of the vacuum wall.
02. From the long side of the fiber optic coupler, insert a flat washer, followed by a spring washer, and then a nut to the direction of the vacuum wall. Tighten the nut to secure the fiber optic coupler.
03. Turn the knurled nuts of the vacuum side and atmospheric side fibers to connect them with the fiber optic coupler.



- A. O-ring
B. An M5 nut + a spring washer + a flat washer

■ Fiber optic coupler

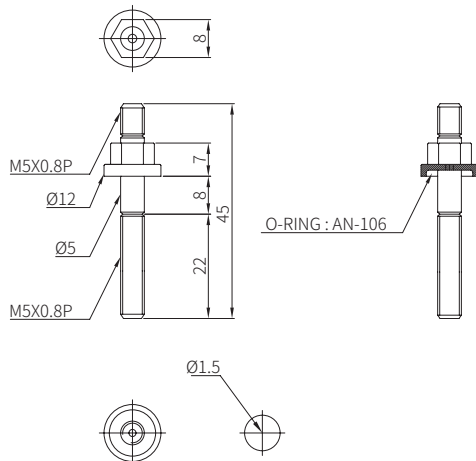
Appearance	Ambient temperature	Applicable cable	Model
	-60 to 200 °C	Vacuum-resistant type, Atmospheric side type	FU-VC01
	-60 to 300 °C	Vacuum-resistant type, Atmospheric side type	FU-VC02

- Helium leak testing: $\leq 10^{-11}$ Pa · m³/s
- Product components: Fiber optic coupler, M5 nut, spring washer, flat washer (each × 2)



■ Dimensions

Unit: mm, For the detailed drawing, follow the Autonics website.

• FU-VC01, FU-VC02



■ Atmospheric side fiber

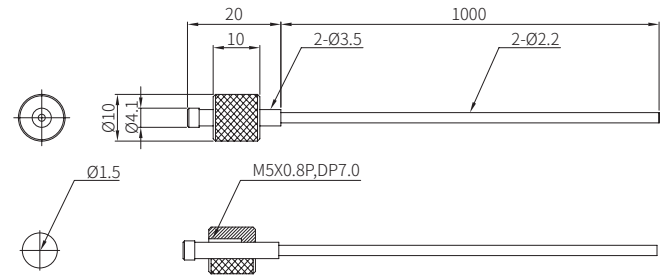
Appearance	Bend radius	Ambient temperature	FREE CUT	Model
	R30	-30 to 70 °C	FREE CUT	FU-VA01
	R20	-30 to 70 °C	FREE CUT	FU-VA02

- Product components: Atmospheric side fiber × 2, Fiber cutter (FC-3) × 1

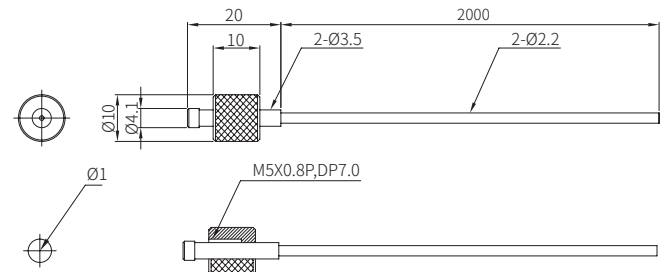
■ Dimensions

Unit: mm, For the detailed drawing, follow the Autonics website.

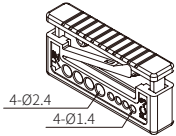
• FU-VA01



• FU-VA02

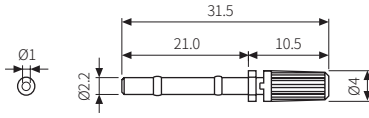
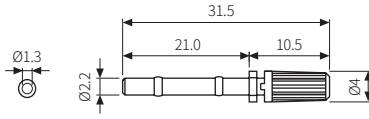


Sold Separately: Fiber Cutter

Model	Hole diameter	Appearance
FC-3	$\varnothing 2.4 \times 4$ $\varnothing 1.4 \times 4$	

Sold Separately: Adapter

The additional adapter for the Adapter-compatible models can be purchased through an authorized distributor of Autonics.

Model	Feature	Dimensions (unit: mm)
B170000047	Inner diameter: $\varnothing 1$ Color: black	
B170000046	Inner diameter: $\varnothing 1.3$ Color: dark gray	

Ordering Information

This is only for reference, the actual product does not support all combinations. For selecting the specified model, follow the Autonics website.

• Example of ordering information: FLF-320-10H □

F	L	F	-	3	20	-	10	H	□
①	②	③	-	④	⑤	-	⑥	⑦	⑧

①	Fiber material	F	Plastic
		G	Glass
②	Sensing type	D	Retroreflective type
		L	Convergent reflective type
		T	Through-beam type
③	Head shape		
		· Threaded head	No mark Standard
	· Cylindrical head	C	Standard
		CS	Cylinder+SUS head (SUS length 15 mm)
		CSN	Cylinder+SUS head (SUS length 15 mm, side view)
	· Flat head	F	Flat view
		FB	Side view+Top view (bending)
		FN	Side view
		FU	Top view (up)
		LU	L-shaped head top view (height 12.2 mm)
		LU1	L-shaped head top view (height 17.2 mm)
	· L-shaped head	LU2	L-shaped head top view (height 22.2 mm)
		L	Standard
		P	Standard
	· Molded plastic head	PF	Flat view
		R	Standard
	· Perpendicular head	RT	Protection tube mounted
		S	SUS length 90 mm
	· SUS head	S1	SUS length 35 mm
		S2	SUS length 45 mm
		U3	Beam width 3 mm
	· U-shaped head	W5	Beam width 5 mm
		· Wide area head	W10
	W10T		Beam width 10 mm, protection tube mounted
	W11		Beam width 11 mm
	· Protection tube	H	Protection tube for fiber cable (sold separately)
		④	Hood diameter
2	∅ 2 mm (M2)		
3	∅ 3 mm (M3)		
4	∅ 4 mm (M4)		
6	∅ 6 mm (M6)		

⑤	Cable length	5	0.5 m	
		10	1 m	
		20	2 m	
		10M	10 m	
⑥	Fiber diameter	2	∅ 0.2 mm	
		5	∅ 0.5 mm	
		6	∅ 0.6 mm	
		10	∅ 1.0 mm	
		12	∅ 1.2 mm	
		13	∅ 1.3 mm	
		14	∅ 1.4 mm	
		15	∅ 1.5 mm	
		17	∅ 1.7 mm	
		20	∅ 2.0 mm	
		F	∅ 0.5 mm, ∅ 0.25 mm×4 (coaxial type)	
		F1	∅ 0.5 mm, ∅ 0.25 mm×9 (coaxial type)	
		F2	∅ 1.0 mm, ∅ 0.265 mm×16 (coaxial type)	
		⑦	Unit type	No mark
B	Bending-resistant (R5)			
R	Flexible (R1, R2)			
H	Heat-resistant (-40 to 105 °C)			
H1	Heat-resistant (-40 to 150 °C)			
H2	Heat-resistant (-60 to 250 °C)			
H3	Heat-resistant (-60 to 350 °C)			
V	Vacuum-resistant (-60 to 100 °C)			
V1	Vacuum-resistant (-60 to 150 °C)			
V2	Vacuum-resistant (-60 to 250 °C)			
V3	Vacuum-resistant (-60 to 350 °C)			
⑧	Convergent reflective type size option	A	R20 / 12×18×3	
		L	Over 30 mm of the product length	
		Waterproof sealing	WP	Water resistance supported