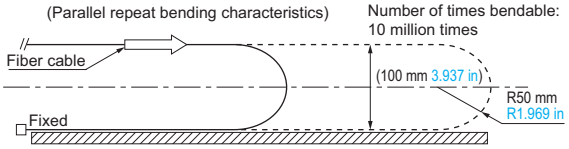
SUPER QUALITY FIBER SPECIFICATIONS

Item \ Type		Thru-beam type	Reflective type
Model No.		**FT-40**, **FT-30**, **FT-S30**, **FT-S20**	**FD-60**, **FD-40**, **FD-30**, **FD-S30**
Variation of fiber head		Within ±10 % (Note 2)	
Beam axis precision		Beam axis position: Within ±150 µm ±5.906 mil, Inclination of beam axis: Within ±2 ° (Note 3)	Beam axis position: Within ±150 µm ±5.906 mil, Inclination of beam axis: Within ±3 ° (Note 3)
Allowable bending radius		R4 mm R0.157 in or more	
Bending durability		10 million times or more (Note 4)	
Ambient temperature		–55 to +80 °C –67 to +176 °F (No dew condensation or icing allowed) (Note 5), Storage: –55 to +80 °C –67 to +176 °F	
Ambient humidity		35 to 85 % RH (Note 5), Storage:35 to 85 % RH	
Material	Fiber core	Acrylic	
	Sheath	Polyethylene	
	Fiber head	Brass (Nickel plated): **FT-30/40**, **FD-40/60**, Stainless steel (SUS303): **FT-S20/S30**, **FD-30/S30**	
	Plug	ABS	
Accessories		All fibers: **FX-AT2** (fiber attachment) 1 pc. Threaded head fibers: Nuts 2 pcs. (thru-beam type: 4 pcs.) and toothed lock washer 1 pc. (thru-beam type: 2 pcs.)	

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) The value is in standard condition [+23 °C +73.4 °F / 50 % RH, no bending fiber (R50 mm R1.969 in or more)].
3) The value is based on outer shape of fiber head.
4) It has a repeat flexibility as below.



5) The ambient temperatures are the values for dry conditions. The ambient temperatures will vary for environments with high humidity.
The ambient temperature for environments with high relative humidity of 85 % RH is –55 to +70 °C –67 to +158 °F.
When the ambient humidity is +80 °C +176 °F, the ambient humidity is 35 to 50 % RH.

NEW STANDARD FIBER SPECIFICATIONS

Item \ Type		Standard		Ultra-small diameter
		Thru-beam type	Reflective type	Thru-beam type
Model No.		**FT-42**, **FT-31**, **FT-S21**	**FD-61**, **FD-41**, **FD-31**, **FD-S31**	**FT-E13**, **FT-E23**
Beam axis precision	Beam axis position (Note 2)	Within ±150 µm 5.906 mil	Within ±150 µm 5.906 mil	Within ±90 µm 3.543 mil
	Inclination of beam axis (Note 2)	Within ±2 °	Within ±3 °	Within ±5 °(Note 3)
Allowable bending radius		R2 mm R0.079 in or more: **FT-31**, **FT-S21**, **FT-E13**, **FT-E23**, **FD-41**, **FD-31**, **FD-S31** R4 mm R0.157 in or more: **FT-42**, **FD-61**		
Bending durability		10 million times or more at R10 mm R0.394 in (Note 4)		
Environmental resistance	Protection	IP67 (IEC)		
	Ambient temperature	–55 to +80 °C –67 to +176 °F (No dew condensation or icing allowed) (Note 5), Storage: –55 to +80 °C –67 to +176 °F		–40 to +70 °C –40 to +131 °F (No dew condensation or icing allowed) (Note 5), Storage: –40 to +70 °C –40 to +131 °F
	Ambient humidity	35 to 85 % RH (Note 5), Storage: 35 to 85 % RH		35 to 85 % RH, Storage: 35 to 85 % RH
Material	Fiber core	Acrylic		
	Sheath	Polyethylene		
	Fiber head	Stainless steel (SUS303)		Stainless steel (SUS303) (Sleeve: SUS304)
Accessories		All fibers: 1 fiber attachment set **FX-CT2** (fiber cutter) 1 pc. Threaded head fibers: Nuts 2 pcs. (thru-beam type: 4 pcs.) and toothed lock washer 1 pc. (thru-beam type: 2 pcs.)		

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) The value is based on outer shape of fiber head.
3) Be careful when handling the fiber as the sleeve is easily bent.
4) When bent back and forth at 180° with 25 g fiber core pulling load (35 g for **FT-42** and **FD-61**)
5) The ambient temperatures are the values for dry conditions. The ambient temperatures will vary for environments with high humidity.
The ambient temperature for environments with high relative humidity of 85 % RH is –55 to +70 °C –67 to +158 °F
(**FT-E13**/**E23**: –40 to +60 °C –40 to +140 °F).
When the ambient humidity is +80 °C +176 °F, the ambient humidity is 35 to 50 % RH.

SPECIFICATIONS

Item \ Type	Standard	Flexible
Model No.	**FT/FD-B8**, **FT/FD-FM□**, **FT/FD-N□**, **FT/FD-R80**, **FT/FD-S□**, **FT/FD-T□**, **FT/FD-V□**	**FT/FD-P□**, **FT-Z□** (excluding tough flexible fiber and chemical-resistant fiber)
Allowable bending radius	R25 mm R0.984 in or more [Sleeve of a head with sleeve: R10 mm R0.394 in or more (Note 2)]	R4 mm R0.157 in or more
Bending durability	———	1 million times or more (at R10 mm R0.394 in, **FT-P40/P2** and **FD-P40/P2**: at R4 mm R0.157 in)
Ambient temperature	–40 to +70 °C –40 to +158 °F (**FT-SFM2SV2**: –20 to +70 °C –4 to +158 °F, **FT-V22**, **FD-SFM2SV2**: –20 to +60 °C –4 to +140 °F, **FT-V41**, **FD-V41**, **FT-V10**: –40 to +60 °C –40 to +140 °F)	–40 to +70 °C –40 to +158 °F (**FT-Z8□**, **FT-P60**, **FT-PS1**, **FD-P60**, **FD-P50**: –40 to +60°C –40 to +140 °F)
Ambient humidity	35 to 85 % RH (No dew condensation or icing allowed)	
Material: Fiber core	Acrylic	
Material: Sheath	Polyethylene (**FT-V22**: Polyolefin)	Vinyl chloride (**FT-PS1**: Polyethylene, **FD-P2**: Vinyl chloride and polyurethane)
Material: Fiber head	Brass (Nickel plated) (**FT-SFM2L/T80/SFM2/SNFM2/SFM2SV2/V22/V41**, **FD-T80/T40/S80/SNFM2/SFM2SV2/V41** and sleeve: Stainless steel (SUS) **FT-FM10L**: ABS, Lens of **FT-FM10L/SFM2L/V10**: Acrylic **FT-V10**: Stainless steel (SUS) and Polycarbonate)	Stainless steel (SUS) (**FT/FD-P80**, **FT-P60**: Brass (Nickel plated) Case of **FT-Z8□**: Polycarbonate Lens of **FT-Z8H/Z8E**, Front film of **FT-Z8**: Polyester)
Accessories (Note 3)	All fibers: 1 fiber attachment set Free-cut type fibers: **FX-CT2** (fiber cutter) 1 pc. Threaded head fibers: Nuts 2 pcs. (thru-beam type: 4 pcs.) and toothed lock washer 1 pc. (thru-beam type: 2 pcs.)	All fibers: 1 fiber attachment set. (excluding **FT-P80** and **FD-P80**) Free-cut type fibers: **FX-CT2** (fiber cutter) 1 pc. (**FT/FD-P80**: **FX-CT1** 1 pc.) Threaded head fibers: Nuts 2 pcs. (thru-beam type: 4 pcs.) and toothed lock washer 1 pc. (thru-beam type: 2pcs.), **FT-Z8□**: 1 set of mounting screw

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) Sleeve part of side-view fiber cannot be bent.
3) The five types of attached fiber attachments (**FX-AT2/AT3/AT4/AT5/AT6**) described in this catalog are for use only with the **FX-100/300/311/410/500** series. Only one of these five fiber attachments is provided with each fiber. Refer to "**Accessories**" on p.70 for details.

Item \ Type	Sharp bending
Model No.	**FT/FD/FR-W□**
Allowable bending radius	R1 mm R0.039 in or more (**FD-WG4/WSG4**: R2 mm R0.079 in or more, Sleeve of **FD-W44**: R10 mm R0.394 in or more)
Ambient temperature	–40 to +60 °C –40 to +140 °F (**FT-WA30/WA8/WKV8**: –40 to +55 °C –40 to +131 °F, **FD-WL48**: –20 to +60 °C –4 to +140 °F, **FR-WKZ11**: –25 to +55 °C –13 to +131 °F)
Ambient humidity	35 to 85 % RH (No dew condensation or icing allowed)
Material: Fiber core	Acrylic
Material: Sheath	Polyethylene
Material: Fiber head	Stainless steel (SUS) (including sleeve) (**FT-W8/W4**, **FD-W8/W44/WG4**: Brass (Nickel plated), Case of **FT-WR80**(**L**): Die-cast zinc alloy (Nickel plated), Case of **FT-WA30/WA8/WZ8□**, **FT/FD-WZ□**(**HB**), Case of **FR-WKZ11**, Case and prism of **FD-WL48**, Lens of **FT-WS8L** and Resin part of **FT-WKV8**: Polycarbonate, Lens of **FT-WA30/WA8**: Norbornene resin, Lens of **FT-WZ8H/WZ8E**, Reflector of **FT-WZ8E**, Prism of **FT-WKV8** and **FT/FD-WZ4/WZ7**: Acrylic, Reflector of **FT-WZ8**: Polycarbonate, Case of **FD-WL41**: Heat-resistant ABS, Front film of **FD-WL41**: Polyester, Lens of **FD-WKZ1**: Optical glass, Lens of **FR-WKZ11**: Crown glass (BK7), Inner pipe of **FT/FD-WZ□**(**HB**): Stainless steel (SUS304).)
Accessories (Note 2)	All fibers: 1 fiber attachment set and **FX-CT2** (fiber cutter) 1 pc. Threaded head fibers: Nuts 2 pcs. (thru-beam type: 4 pcs.) and toothed lock washer 1 pc. (thru-beam type: 2 pcs.) **FT-WA30**: 0.5 × 32 mm 0.020 × 1.260 in seal type slit mask 2 pcs. **FT-WA8**: 0.5 × 12 mm 0.020 × 0.472 in seal type slit mask 2 pcs. and 1 × 12 mm 0.039 × 0.472 in seal type slit mask 2 pcs. **FT-WZ8□**, **FT/FD-WZ4**(**HB**): 1 set of mounting screw **FD-WKZ1**: **MS-FD-2** (fiber mounting bracket) 1 pc. **FR-WKZ11**: **MS-FD-2** (fiber mounting bracket) 1 pc, **RF-13** (reflective tape) 1 pc.

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) The five types of attached fiber attachments (**FX-AT2/AT3/AT4/AT5/AT6**) described in this catalog are for use only with the **FX-100/300/311/410/500** series. Only one of these five fiber attachments is provided with each fiber. Refer to "**Accessories**" on p.70 for details.

SPECIFICATIONS

Item \ Type	Special use			
	Wide beam	Array	Narrow beam, Wafer mapping	High precision
Model No.	**FT-A8/A30** **FD-A15** (Note 3)	**FT-AFM2/AFM2E** **FD-AFM2/AFM2E**	**FT-K8/KV8/WKV8** **FT/FR-KV1** **FR-KZ21/KZ21E**	**FD-EG1/EG2/EG3** **FD-G4/G6**
Allowable bending radius	**FT-A30/A8**: R10 mm R0.394 in or more **FD-A15**: R25 mm R0.984 in or more	R25 mm R0.984 in or more	R25 mm R0.984 in or more (**FT/FR-KV1**, **FR-KZ21/ KZ21E**: R10 mm R0.394 in or more)	**FD-EG2/EG3**: R10 mm R0.394 in or more **FD-G4/G6/EG1**: R25 mm R0.984 in or more
Ambient temperature	**FT-A30**, **FD-A15**: –40 to +60 °C –40 to +140 °F **FT-A8**: –40 to +70 °C –40 to +158 °F	–40 to +70 °C –40 to +158 °F	–40 to +60 °C –40 to +140 °F (**FT-WKV8**: –40 to +55 °C –40 to +131 °F)	–20 to +60 °C –4 to +140 °F (**FD-G4**: –40 to +70 °C –40 to +158 °F, **FD-G6**: –40 to +60 °C –40 to +140 °F)
Ambient humidity	35 to 85 % RH (No dew condensation or icing allowed)			
Material: Fiber core	Acrylic			
Material: Sheath	Polyethylene			Polyolefin (**FD-G4/G6**: Polyethylene)
Material: Fiber head	Polycarbonate (Lens of **FT-A8/A30** and **FD-A15**: Norbornene resin)	Brass (Nickel plated) Liquid crystal polymer	Stainless steel (SUS), Polycarbonate (Lens: Norbornene resin Case of **FR-KZ21/KZ21E**: ABS, Prism of **FT-KV8/WKV8** and **FR-KZ21E**: Acrylic)	Brass (Nickel plated) [**FD-G6**: Stainless steel (SUS)]
Accessories (Note 2)	All fibers: 1 fiber attachment set and **FX-CT2** (fiber cutter) 1 pc. **FT-A30**: 0.5 × 32 mm 0.020 × 1.260 in seal type slit mask 2 pcs. **FT-A8**: 0.5 × 12 mm 0.020 × 0.472 in seal type slit mask 2 pcs. and 1 × 12 mm 0.039 × 0.472 in seal type slit mask 2 pcs.	All fibers: 1 fiber attachment set Free-cut type fibers: **FX-CT2** (fiber cutter) 1 pc. Threaded head fibers: Nuts 2 pcs. and toothed lock washer 1 pc. **FR-KV1**: Reflector 1 pc, M1.4 (length: 1.6 mm 0.063 in) stainless steel (SUS) mounting screw 4 pcs. **FR-KZ21/KZ21E**: **RF-003** (reflector) 1 pc, **MS-FD-2** (fiber mounting bracket) 1 pc.		

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) The five types of attached fiber attachments (**FX-AT2/AT3/AT4/AT5/AT6**) described in this catalog are for use only with the **FX-100/300/311/410/500** series. Only one of these five fiber attachments is provided with each fiber. Refer to "**Accessories**" on p.70 for details.
3) The **FT-WA8/WA30** is in the "Sharp bending type" section of the previous page.

Item \ Type	Special use			
	Ultra-small diameter	Convergent reflective	Metal-free	Tough flexible
Model No.	**FT/FD-E12/E22** (Note 4) **FD-EN500S1** **FD-ENM1S1**	**FD-L4□**	**FT-41** **FD-G60** **FD-G40**	**FT/FD-P81X** **FD-G6X**
Allowable bending radius	**FT-E12/E22**: R5 mm R0.197 in or more (Note 2) **FD-E12**: R10 mm R0.394 in or more (Note 2) **FD-E22/EN500S1/ENM1S1**: R25 mm R0.984 in or more (Note 2)	R10 mm R0.394 in or more (**FD-L43/L45/L47**: R4 mm R0.157 in or more, **FD-L45A/L46**: R25 mm R0.984 in or more)	R25 mm R0.984 in or more	R10 mm R0.394 in or more
Ambient temperature	**FT-E12/E22**, **FD-E22**: –40 to +70 °C –40 to +158 °F **FD-E12**: –40 to +60 °C –40 to +140 °F **FD-EN500S1/ENM1S1**: –20 to +60 °C –4 to +140 °F	**FD-L43/L45/L45A**: 0 to +70 °C +32 to +158 °F **FD-L41/L44/L44S/L46**: –40 to +60 °C –40 to +140 °F **FD-L4**: –40 to +70 °C –40 to +158 °F **FD-L47**: –20 to +70 °C –4 to +158 °F	–40 to +70 °C –40 to +140 °F	–40 to +60 °C –40 to +140 °F (**FD-P81X**: –40 to +70 °C –40 to +158 °F)
Ambient humidity	35 to 85 % RH (No dew condensation or icing allowed)			
Material: Fiber core	Acrylic			
Material: Sheath	Polyolefin	Polyethylene		Polyethylene [**FT-P81X**: Vinyl chloride, Protective tube: Stainless steel (SUS)]
Material: Fiber head	Brass (Nickel plated) [Sleeve: Stainless steel (SUS)]	**FD-L41/L43/L45/L45A/L47**: Heat-resistant ABS Case of **FD-L4/L46**: ABS (Case of **FD-L44/L44S**: Polycarbonate, Slit of **FD-L44S**: Stainless steel (SUS304), Lens of **FD-L4/L43/L44/L44S/L45/L45A/L47**: Acrylic, Front film of **FD-L41**: Polyester, Lens of **FD-L46**: Norbornene resin)	PPS (Nut: Polyamide resin, Flat washer: Urethane rubber)	**FT-P81X**, **FD-P81X**: Brass (Nickel plated) **FD-G6X**: Stainless steel (SUS)
Accessories (Note 3)	All fibers: 1 fiber attachment set Threaded head fibers: Nuts 2 pcs. (**FT-E12/E22**: 4 pcs.) and toothed lock washer 1 pc. (**FT-E12/E22**: 2 pcs.)	All fibers: 1 fiber attachment set and **FX-CT2** (fiber cutter) 1 pc. **FD-L4**: M2.6 (length 12 mm 0.472 in) screws with washers 2 pcs. and Nuts 2 pcs.	All fibers: Fiber attachment 1 set. **FX-CT2** (fiber cutter): 1 pc. Nuts 2 pcs. (**FT-41**: 4 pcs.) and flat washers 2 pcs. (**FT-41**: 4 pcs.)	All fibers: 1 fiber attachment set, Nuts 2 pcs. (**FT-P81X**: 4 pcs.) and toothed lock washer 1 pc. (**FT-P81X**: 2 pcs.) **FD-G6X**: **FX-CT2** (fiber cutter) 1 pc.

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) Sleeve part cannot be bent.
3) The five types of attached fiber attachments (**FX-AT2/AT3/AT4/AT5/AT6**) described in this catalog are for use only with the **FX-100/300/311/410/500** series. Only one of these five fiber attachments is provided with each fiber. Refer to "**Accessories**" on p.70 for details.
4) **FT-E13/E23** is described in p.75, "New Standard Fibers".

SPECIFICATIONS

Item \ Type	Special use		
	Leak liquid detection	Liquid detection	
Model No.	**FD-F705** (Note 2)	**FT-F902** (Note 2)	**FD-FA90**
Allowable bending radius	Protective tube: R20 mm R0.787 in or more Fiber cable: R4 mm R0.157 in or more		R10 mm R0.394 in or more
Bending durability	Fiber cable: 1 million times or more (at R4 mm R0.157 in)		———
Ambient temperature	–20 to +50 °C –4 to +122 °F (Note 3)	–20 to +60 °C –4 to +140 °F (Note 3)	–40 to +70 °C –40 to +158 °F (Note 3)
Ambient humidity	35 to 85 % RH (No dew condensation or icing allowed)		
Material: Fiber core	Acrylic		
Material: Sheath	Vinyl chloride (Protective tube: Fluorine resin)		Polyethylene
Material: Fiber head	Outer casing: Fluorine resin, Interior: Heat-resistant ABS, Acrylic, Brass (Nickel plated)	Enclosure: Heat-resistant ABS Lens: Acrylic	Enclosure: ABS
Accessories (Note 4)	1 fiber attachment set, **FX-CT2** (fiber cutter) 1 pc., **MS-FD-F7-1** (SUS mounting bracket) 1 pc., **MS-FD-F7-2** (PVC mounting bracket) 1 pc.	1 fiber attachment set, **FX-CT2** (fiber cutter) 1 pc., Tying band 2 pcs., Anti-slip tube 2 pcs.	1 fiber attachment set, **FX-CT2** (fiber cutter) 1 pc., Tying band 2 pcs., (Max.tying diameter: ø80 mm ø3.150 in)

Item \ Type	Special use			
	Liquid detection			
Model No.	**FD-F8Y**	**FD-HF40Y**	**FD-F41Y**	**FD-F4□, FD-F41**
Allowable bending radius	Protective tube: R40 mm R1.575 in or more Fiber: R15 mm R0.591 in or more	Protective tube: R20 mm R0.787 in or more (Do not bend approx. 17 mm 0.669 in length from the tip) Fiber: R10 mm R0.394 in or more		R10 mm R0.394 in or more
Bending durability	———			
Ambient temperature	–40 to +125 °C –40 to +257 °F (Note 3)	–40 to +105 °C –40 to +221 °F (Note 3) (Note 5)	–40 to +70 °C –40 to +158 °F (Note 3)	–40 to +100 °C –40 to +212 °F (Note 3)
Ambient humidity	35 to 85 % RH (No dew condensation or icing allowed)			
Material: Fiber core	Polycarbonate			
Material: Sheath	Polypropylene (Protective tube: Fluorine resin)	Polyethylene (first sheath) PFA (fluorine resin) (second sheath, **FD-F41Y** only) (Protective tube: Fluorine resin)		Polyethylene
Material: Fiber head				Polyetherimide (Lens: Polycarbonate)
Accessories (Note 4)	1 fiber attachment set **FX-CT2** (fiber cutter) 1 pc.	1 fiber attachment set **FX-CT3** (fiber cutter) 1 pc.		1 fiber attachment set, **FX-CT2** (fiber cutter) 1 pc. Tying band, 4 pcs. Anti-slip tube 2 pcs.

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) For **FD-F705**, use the **FX-500** series or **FX-301-F7**. For **FT-F902**, use the **FX-500** series or **FX-301-F**.
3) Liquid being detected should also be kept within the rated ambient temperature range.
4) The five types of attached fiber attachments (**FX-AT2/AT3/AT4/AT5/AT6**) described in this catalog are for use only with the **FX-100/300/311/410/500** series. Only one of these five fiber attachments is provided with each fiber. Refer to "**Accessories**" on p.70 for details.
5) The ambient temperature is measured in dried condition. If using the products in a high humidity environment, ambient temperature differs. The ambient temperature is −40 to +85 °C −40 to +185 °F when using or storing the products at a high humidity of 85 % RH.

SPECIFICATIONS

Item \ Type		Environment resistant					
		Heat-resistant					
Model No.		**FT/FD-H□**					
		350 °C 662 °F type	300 °C 572 °F type	250 °C 482 °F type	200 °C 392 °F type	180 °C 356 °F type	130 °C 266 °F type
Allowable bending radius		R25 mm R0.984 in or more (**FT-H20W-M1**, Sleeve of a head with sleeve: R10 mm R0.394 in or more, **FT-H20-J□/VJ□**: R18 mm R0.709 in or more)					
Ambient temperature		–60 to +350 °C –76 to +662 °F (Note 2, 3)	–60 to +300 °C –76 to +572 °F (Note 2, 3)	–20 to +250 °C –4 to +158 °F (Ordinary temperature side: –20 to +70 °C –4 to +158 °F) (Note 3)	–60 to +200 °C –76 to +392 °F (Note 3)	–60 to +180 °C –76 to +356 °F (Note 3, 5)	–60 to +130 °C –76 to +266 °F
Ambient humidity		35 to 85 % RH (No dew condensation or icing allowed)					
Material	Fiber core	Multi-component glass (Note 4)				Silicone	Acrylic
	Sheath	Stainless steel (SUS) (Plug of **FD-H25-L43/L45**: Polyamide, Brass)			Silicone (Inside Stainless steel (SUS) spiral tube) (**FT-H20W-M1**: Fluorine resin Heat-resistant part of **FD-H20-21**, **FT-H20-J□/VJ□**: Stainless steel (SUS))	Fluorine resin	
	Fiber head	Stainless steel (SUS) (Enclosure of **FD-H25-L43/L45**: Heat-resistant resin Prism, lens: Crown glass (BK7))			Brass (Nickel plated) (**FD-H20-21**: Stainless steel (SUS) Prism of **FT-H20-VJ□**: Glass Lock nut of **FT-H20-J□/VJ□**: Polybutylene terephthalate)	Stainless steel (SUS)	Brass (Nickel plated)
Accessories (Note 6)		**FD-H25-L43/L45**, **FT-H20-J□/VJ□**, **FT-H20W-M1**, **FD-H18-L31** and **FT-H13-FM2**: 1 fiber attachment set Free-cut type fibers: **FX-CT2** (fiber cutter) 1 pc. Threaded head fibers: Nuts 2 pcs. (thru-beam type: 4 pcs.) and toothed lock washer 1 pc. (thru-beam type: 2 pcs.) **FT-H20-J□/VJ□**: M4 × 0.7 nut (Polycarbonate) 2 pcs. M4 spring washer 2 pcs.					

Item \ Type		Environment resistant	
		Chemical-resistant	Vacuum-resistant
Model No.		**FT-HL80Y/L80Y/V80Y/Z802Y**	**FT/FD-H30-□V**
Allowable bending radius		R30 mm R1.181 in or more (**FT-Z802Y**: R25 mm R0.984 in or more)	R18 mm R0.709 in or more
Ambient temperature		–40 to +70 °C –40 to +158 °F (**FT-Z802Y**: 0 to +60 °C +32 to +76 °F **FT-HL80Y**: –40 to +115 °C –40 to +239 °F)	–30 to +300 °C –22 to +572 °F (Note 3)
Ambient humidity		35 to 85 % RH (No dew condensation or icing allowed)	
Material	Fiber core	Acrylic	Multi-component glass (Note 4)
	Sheath	Protective tube: Fluorine resin Sheath: Polypropylene (Sheath of **FT-Z802Y**: Fluorine resin)	Protection tube: Liner + braid tube [Stainless steel (SUS)] Socket plug: Joint, Mounting cap nut; Stainless steel (SUS)
	Fiber head		Stainless steel (SUS) (Lens of **FD-H30-KZ1V/L32V**: BK7 crown glass)
Accessories (Note 6)		1 fiber attachment set **FX-CT2** (fiber cutter) 1 pc.	**FT-H30-M1V**: Nut 4 pcs., Toothed lock washer 2 pcs. **FD-H30-KZ1V**: **MS-FD-2** (Fiber mounting bracket) 1 pc.

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) If the fiber is used below –30 °C –22 °F, its maximum resistable temperature drops to +200 °C +392 °F. If the side-view lens **FX-SV1** is put on the fiber head, the allowable maximum temperature drops to +300 °C +572 °F. (The ambient temperature range of **FX-SV1** is from –60 to +300 °C –76 to +572 °F.)
3) The ambient temperature of heat-resistant 350 °C 662 °F type, 300 °C 572 °F type, 200 °C 392 °F type and 180 °C 356 °F type fibers are the value in dry condition. In humid environment, the ambient temperature differs. (For a high humidity of 85 % RH, the ambient temperature is 0 to +40 °C +32 to +104 °F.)
4) If the fiber material is quartz glass or multi-component glass, keep it away from vibration or impact.
5) The normal temperature for continuous usage or storage should be –60 to +150 °C –76 to +302 °F.
6) The five types of attached fiber attachments (**FX-AT2/AT3/AT4/AT5/AT6**) described in this catalog are for use only with the **FX-100/300/311/410/1500** series. Only one of these five fiber attachments is provided with each fiber. Refer to "**Accessories**" on p.70 for details.

PRECAUTIONS FOR PROPER USE

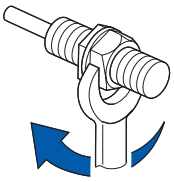
Refer to General precautions.

- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

Mounting

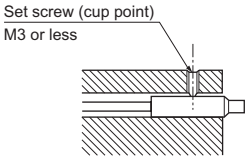
- The tightening torque must not exceed the values given below.

Mounting with a nut (threaded head type)



	Tightening torque
M3	0.39 N·m
M4	0.58 N·m (**FT-41** and **FD-G40**: 0.15 N·m or less, 350 °C 662 °F heat-resistant fiber and **FT-H20W-M1** and **FT-H30-M1V**: 0.98 N·m)
M5 M6	0.98 N·m (**FD-G60**: 0.5 N·m or less, 350 °C 662 °F heat-resistant fiber: 1.96 N·m)
M14	1.47 N·m

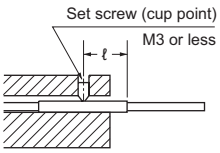
Mounting with a set screw



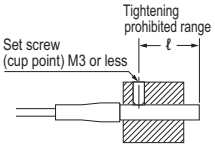
Tightening torque: 0.29 N·m or less
(**FT-SFM2L**: 0.19 N·m
FT-H20W-M1: 0.49 N·m)

- Fibers for which the tightening section has been specified should be fixed at ℓ mm from the tightening section tip.

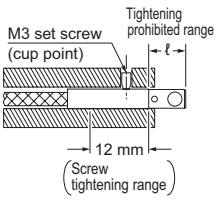
(However, for **FT-K8**, **FT-KV8**, **FT-WKV8**, **FT-V10** and **FT-H20-VJ□** 'ℓ' indicates the range over which tightening cannot be done.)



<FT-K8, FT-KV8, FT-WKV8, FT-V10>



<FT-H20-VJ□>

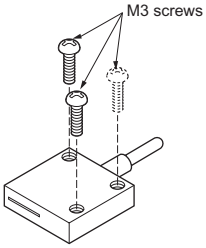


Model No.	ℓ (mm in)	Tightening torque
FD-SNFM2 **FT-WS4** **FT-WS8** **FT-WS8L**	2.5 0.098	0.29 N·m
FT-PS1	3 0.118	0.1 N·m
FD-E12	4 (Note1) 0.157	0.29 N·m
FT-V22 **FT-V41, FD-V41** **FT-SFM2SV2**	10 0.394	0.19 N·m
FD-EG1	10 0.394	0.29 N·m
FT-WV42 **FD-WV42**	15 0.591	0.29 N·m
FD-SFM2SV2	7 0.276	0.34 N·m
FT-KV1	20 0.787	0.19 N·m
FT-KV8, FT-WKV8 **FT-V10**	13 0.512	0.3 N·m
FT-K8	12 0.472	
FT-H20-VJ50 **FT-H20-VJ80**	7.5 0.295	0.29 N·m

Notes: 1) Excluding the sleeve.
2) When installing, make sure to use screws smaller than the fiber diameter.

Mounting array fiber FT/FD-AFM2(E)

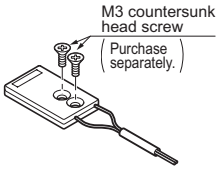
- Using M3 screws, the tightening torque should be 0.58 N·m or less.



Mounting convergent reflective fiber

<FD-L41 / FD-L43 / FD-L45 / FD-L45A / FD-L44 / FD-L44S / FD-WL41>

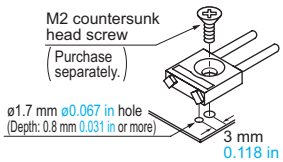
- Mount the fiber head using M3 countersunk head screws (purchase separately). The tightening torque should be 0.3 N·m or less (for **FD-L45A**, the torque should be 0.36 N·m or less, and for **FD-L47**, it should be 0.5 N·m or less).



Note: The upper figure is for **FD-L43**.
The same mounting method can be applied to **FD-L41**, **FD-L44**, **FD-L44S**, **FD-L45**, **FD-L45A**, **FD-L47** and **FD-WL41**.

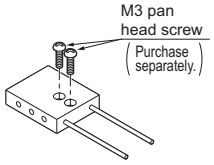
<FD-WL48>

- Mount the fiber head using M2 countersunk head screw (purchase separately). The tightening torque should be 0.15 N·m or less. The hole in which the boss on the bottom face is inserted should be ø1.7 mm ø0.067 in and 0.8 mm 0.031 in or more, deep.

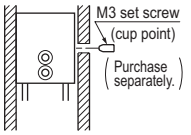


<FD-L46>

- Mount the fiber head using M3 pan head screws (purchase separately). The tightening torque should be 0.5 N·m or less.

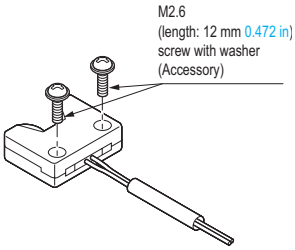


- The fiber head can be mounted by using M3 set screw (purchase separately), as shown in the right figure. The tightening torque should be 0.5 N·m or less.



<FD-L4>

- Mount the fiber head using M2.6 (length: 12 mm 0.472 in) screws with washers (accessory). The tightening torque should be 0.3 N·m or less.



PRECAUTIONS FOR PROPER USE

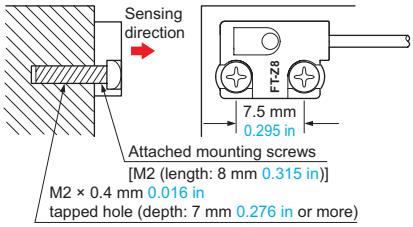
Refer to General precautions.

Mounting FT-Z8□, FT-WZ8□, FT/FD-WZ4(HB), FT/FD-WZ7(HB)

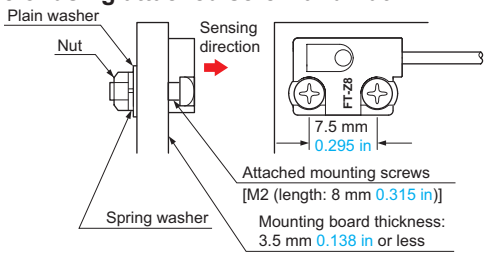
- Mount the fiber head by using the enclosed set of screws. The tightening torque should be 0.15 N·m or less (**FT/FD-WZ7**□: 0.3 N·m or less).
- If the fiber head is mounted in places subject to vibrations or shocks, use a screw-locking adhesive, etc.
- Mount each fiber head as given below.

<FT-Z8 / FT-WZ8 (Front sensing type)>

In case of tapping the mounting section

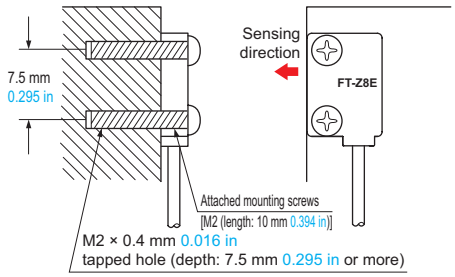


In case of using attached screw and nut

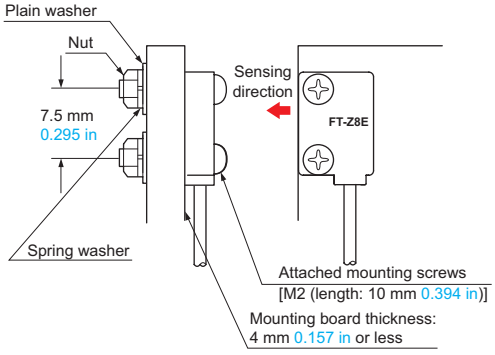


<FT-Z8E / FT-WZ8E (Side sensing type)>

In case of tapping the mounting section

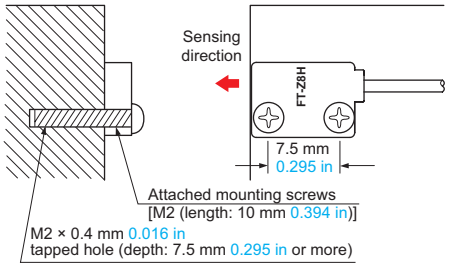


In case of using attached screw and nut

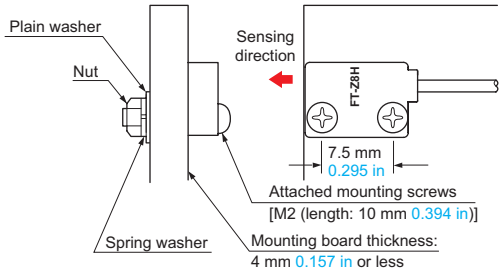


<FT-Z8H / FT-WZ8H (Top sensing type)>

In case of tapping the mounting section

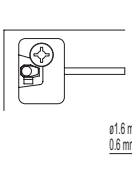


In case of using attached screw and nut

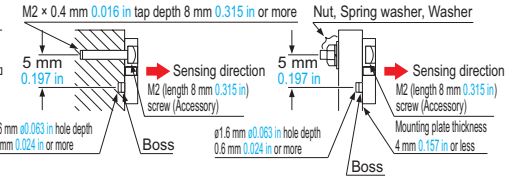


<FT-WZ4 / FD-WZ4 (Front sensing type)>

In case of tapping the mounting section



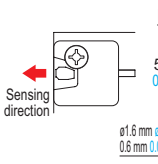
In case of using screw and nut (accessory)



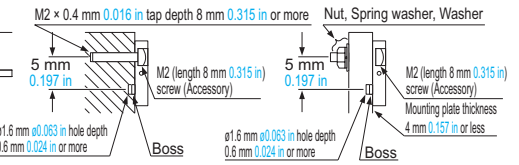
Notes: 1) The upper figure is for **FT-WZ4**. The mounting method of **FD-WZ4** is also the same.
2) Fiber heads of the thru-beam type are the same shape. When mounting, take care of positions of a hole for the M2 screw and a hole for the boss.

<FT-WZ4HB / FD-WZ4HB (Top sensing type)>

In case of tapping the mounting section

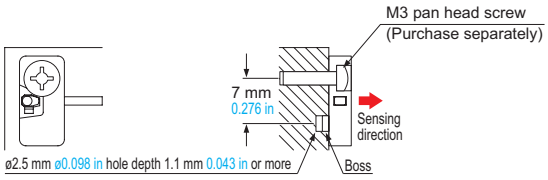


In case of using screw and nut (accessory)



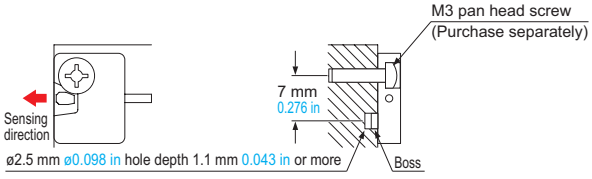
Notes: 1) The upper figure is for **FT-WZ4HB**. The mounting method of **FD-WZ4HB** is also the same.
2) Fiber heads of the thru-beam type are the same shape. When mounting, take care of positions of a hole for the M2 screw and a hole for the boss.

<FT-WZ7 / FD-WZ7 (Front sensing type)>



Notes: 1) The upper figure is for **FT-WZ7**. The mounting method of **FD-WZ7** is also the same.
2) Fiber heads of the thru-beam type are the same shape. When mounting, take care of positions of a hole for the M3 screw and a hole for the boss.

<FT-WZ7HB / FD-WZ7HB (Top sensing type)>



Notes: 1) The upper figure is for **FT-WZ7HB**. The mounting method of **FD-WZ7HB** is also the same.
2) Fiber heads of the thru-beam type are the same shape. When mounting, take care of positions of a hole for the M3 screw and a hole for the boss.

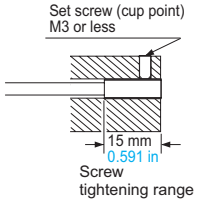
PRECAUTIONS FOR PROPER USE

Refer to General precautions.

Mounting FD-WKZ1/FR-WKZ11

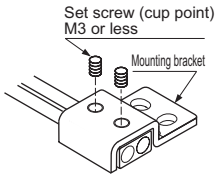
<If not using the attached mounting brackets MS-FD-2>

- Use M3 or less set screws (cup point), and affix the head within 15 mm 0.591 in from the tip of the fiber head. Do not exceed a torque of 0.3 N·m when tightening.



<If using the attached mounting brackets MS-FD-2>

- The head can be affixed even without using the set screws.
- If using the set screws, use M3 set screws (cup point) to affix and do not exceed a torque of 0.05 N·m when tightening.



Mounting FD-A15

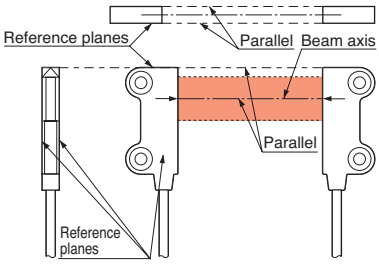
- Using M3 screws, the tightening torque should be 0.3 N·m or less.

Mounting FD-H30-L32 / FD-H18-L31

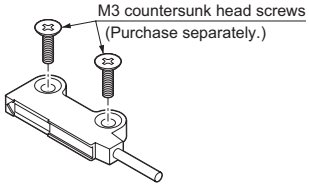
- Using M3 screws, the tightening torque should be 3 N·m or less.

Mounting thru-beam type wide beam fiber FT-A8 / A30, FT-WA8 / WA30

- Take care that, since the aperture angle of this product is very narrow, the beam may not be received depending upon the setting. At the time of installation, determine a reference plane, as shown in the figure below, and taking sufficient care against beam misalignment or tilt, install the beam-emitting and receiving fibers so that they are parallel.



- Install the fiber using M3 countersunk head screws. The tightening torque should be 0.3 N·m or less. Further, when using the fiber at places having intense vibrations, use a screwlocking adhesive, etc.

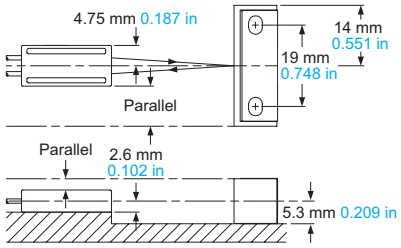


- If mineral oil or solvent containing mineral oil component adheres to the sensing surface, the lens may be deformed. Take sufficient care to handle them.

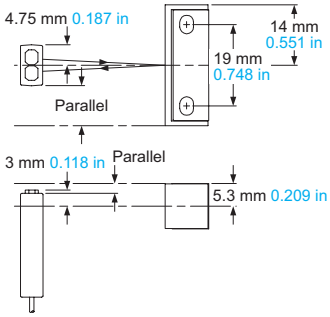
Mounting FR-KZ21 / KZ21E

- Mount this product with the accessory fiber mounting bracket or M3 set screws (cup point).
- Take care that, since the aperture angle of this product is very narrow, the beam may not be received depending upon the mounting condition. Mount so that the center of the fiber head and the reflector are aligned. Take care of beam alignment or tilt.

<Head-ON type / FR-KZ21>

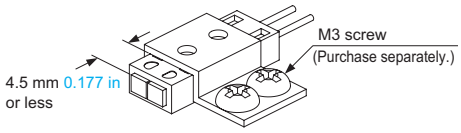


<Side-ON type / FR-KZ21E>



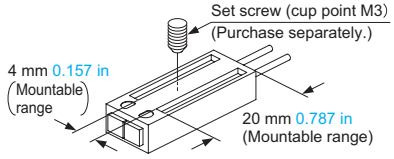
For using fiber mounting bracket (optional)

- When mounting the fiber mounting bracket on a mounting base, use M3 screws (purchase separately) and the tightening torque should be 0.3 N·m or less.
- When mounting the side-ON type sensor to the fiber mounting bracket, take care not to block the sensing part.
- The fiber mounting bracket can be mounted without M3 set screws. When M3 set screws are also used, take care that the tightening torque should be 0.05 N·m or less. An excessive tightening torque may distort the fiber mounting bracket.



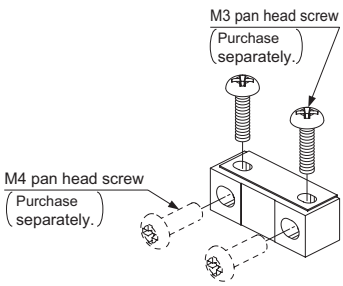
When M3 set screws (cup point) (purchase separately) are used for mounting

- Fix the fiber head with M3 set screws within the mountable area shown in the diagram below. The tightening torque should be 0.1 N·m or less.



For mounting reflector

- Use M3 pan-head screws or M4 pan-head screws (Purchase separately) and the tightening torque should be the following.
  M3 pan head screw: 0.5 N·m or less
  M4 pan head screw: 0.8 N·m or less



<Caution FR-KZ21 / KZ21E>

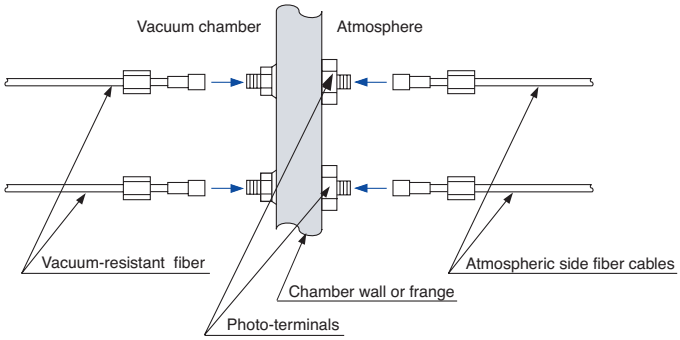
- When detecting transparent objects etc., the range of 0 to 20 mm 0 to 0.031 in from the detecting surface may unstable for detection.

PRECAUTIONS FOR PROPER USE

Refer to General precautions.

Mounting vacuum-resistant fiber FT/FD-H30-□V

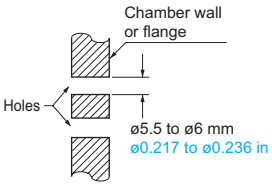
<Configuration vacuum-resistant fiber>



Leakage: 1.33×10^{-10}Pa·m^3/s [He] or less

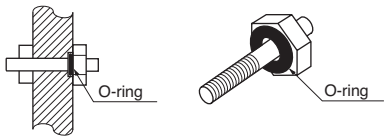
<Mounting>

① Make two holes on the vacuum tank wall (chamber wall or flange).



Note: The hole diameter must be ø5.5 to ø6 mm ø0.217 to ø0.236 in.

② Mount the photo-terminal **FV-BR1** on the vacuum tank wall. When mounting **FV-BR1** on the wall, be sure to mount the attached o-ring, and the side where the o-ring is mounted should be the atomospheric side. The tightening torque should be 0.58 N·m or less.

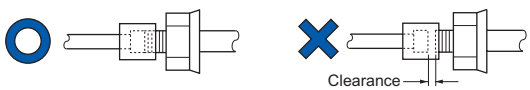


③ Mount the **FT-J8** atmospheric side fibers on the atmopheric side of the photo-terminal **FV-BR1**. The tightening torque should be 0.58 N·m or less.

Note: The fixing nuts must be tightened securely. If not, the sensing range may decrease.

Correct **Incorrect**

④ Mount the vacuum-resistant fiber on the vacuum side of the photo-terminals **FV-BR1**. The tightening torque should be 0.58 N·m or less.



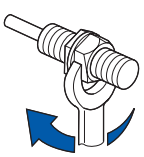
Correct **Incorrect**

Note: The fixing nuts must be tightened securely. If not, the sensing range may decrease.

⑤ Fix the fiber head of the vacuum-resistant fiber.

<FT-H30-M1V>

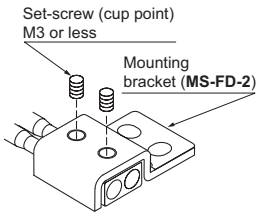
- The tightening torque should be 0.98 N·m or less.



<FT-H30-KZ1V>

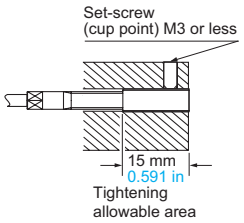
If using the mounting bracket

- Use set-screws (cup point M3 or less) and the tightening torque should be 0.05 N·m or less.
- The fiber head can be fixed even without set-screws if the mounting bracket is fit to the body.



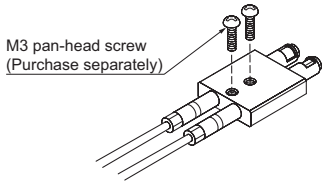
If not using the mounting bracket

- Use set-screws (cup point M3 or less). The fiber should be fixed within 15 mm 0.591 in from the fiber head tip, as shown in the right figure. The tightening torque should be 0.3 N·m or less.



<FT-H30-L32V>

- Use M3 screws (engagement length: 3 mm 0.118 in or more) and the tightening torque should be 2 N·m or less.



<FT-SV2>

- Use M3 screws when installing **FV-SV2** sideview lens. Tighten the screws with a torque of 0.5 N·m or less.
- Fasten securely when installing the vacuum fiber. Performance may decrease if not fastened tightly. Tighten with a torque of 0.4 N·m or less.

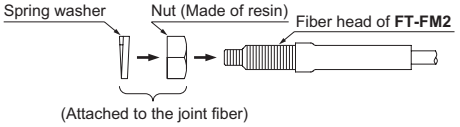
Mounting heat-resistant joint fiber FT-H20-J□/VJ□

<How to connect the joint fiber to the FT-FM2>

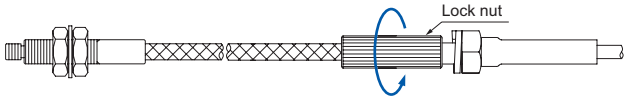
- When connecting the joint fiber to the **FT-FM2**, follow the procedures below.

Procedures

① Mount a nut (made of resin) and a spring washer that are attached to the joint fiber into the back of the fiber head of the **FT-FM2**.



② Mount the joint fiber in the **FT-FM2** by a lock nut. The tightening torque should be 0.1 N·m or less when tightening the lock nut. If it is not tightened enough, a gap between the joint fiber and the **FT-FM2** will appear and that causes the decrease in the sensing range.

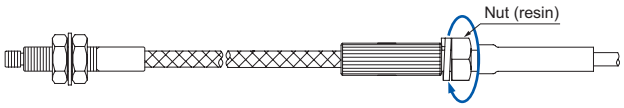


Note: Make sure that the lock nut is not fixed by the nut (made of resin) and the spring washer mounted in the procedure ①.

PRECAUTIONS FOR PROPER USE

Refer to General precautions.

③ Fix the lock nut with the nut (made of resin) which is mounted in the procedure ①, so that the lock nut will not loosen. The tightening torque should be 0.1 N·m or less.

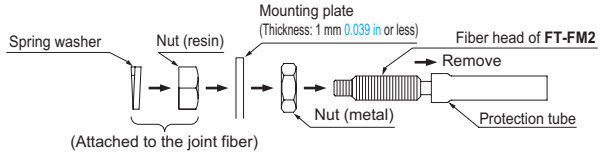


<When fixing an intermediate portion in a mounting plate>

- When fixing an intermediate portion (the connection of the joint fider and the **FT-FM2**) in a mounting plate by the attached nut (made of metal), follow the procedures below.
- The thickness of the mounting plate should be 1 mm 0.039 in or less.

Procedures

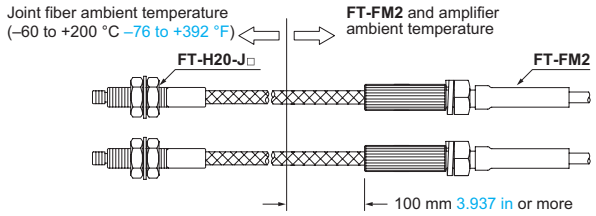
① Remove a protection tube of the **FT-FM2** and mount the attached nut (made of metal), from the fiber head, then move it to the fiber cable.
② Insert the fiber head to the mounting plate.
③ Connect the joint fiber to the **FT-FM2** by following the procedures "**How to connect the joint fiber to the FT-FM2**".
④ Tighten the nut (made of metal) which is mounted in the procedure ① on the mounting plate. The tightening torque should be 0.15 N·m or less.



- The tightening torque should be 0.29 N·m or less when fixing by the set screw.

<Operation temperature>

- Keep the joint fiber of length 100 mm 3.937 in or more under the rated **FT-FM2** and amplifier ambient temperature range.

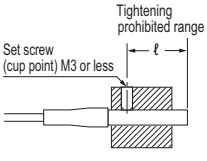


Mounting narrow beam fiber FT / FR-K□

- Take care that, since the aperture angle of this product is very narrow, the beam may not be received depending upon the installation conditions.

<Thru-beam type>

- Install the fiber, using an M3, or smaller, set screw. The tightening torque should be 0.19 N·m or less. (**FT-K8/KV8/WKV8**: 0.3 N·m or less.) Further, do not tighten within ℓ mm from the fiber tip because the fiber will get damaged.

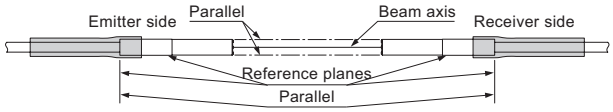


Model No.	ℓ (mm in)	Tightening torque
FT-KV1	No limit	0.19 N·m
FT-K8	12 0.472	0.3 N·m
FT-KV8 **FT-WKV8**	13 0.512	

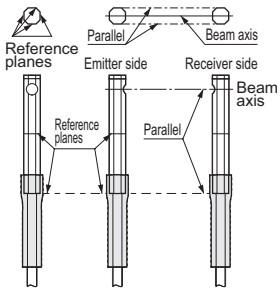
Note: When installing, make sure to use screws smaller than the fiber diameter.

- At the time of installation, determine a reference plane, as shown in the figure below, and taking sufficient care against beam misalignment or tilt, install the emitting and receiving fibers so that they are parallel.

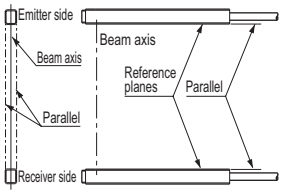
FT-K8



FT-KV8, FT-WKV8

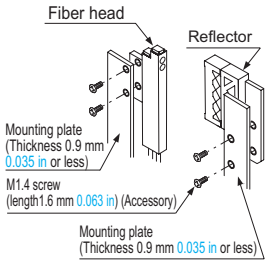


FT-KV1



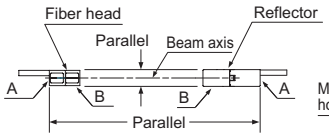
<Retroreflective type>

- For mounting the fiber head and the reflector, use the accessory M1.4 screws (length 1.6 mm 0.063 in), and be sure to mount through the mounting plate (thickness 0.9 mm 0.035 in or less) as shown in the right figure. The tightening torque should be 0.14 N·m or less. Take care that tightening with excessive force may damage the screws.

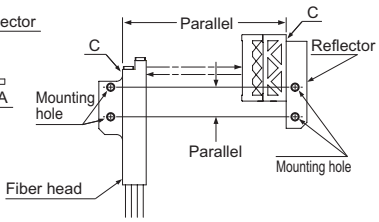


- When the fiber head is mounted in locations where shock / vibration is applied, tighten the screws with the screw lock etc.
- When installing the product, take sufficient care that, the mounting holes of the fiber head and the reflector should be parallel to each other, and also A, B and C, shown in the figure below.

<Top view>



<Side view>

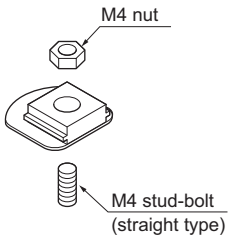


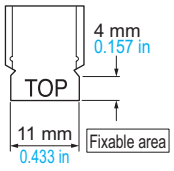
PRECAUTIONS FOR PROPER USE

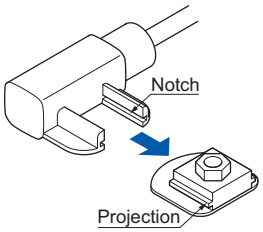
Refer to General precautions.

Mounting leak fiber FD-F705

- In case of using the SUS mounting bracket, insert the M4 stud-bolt (straight type) welded on the customer's facilities into the mounting hole of the mounting bracket and screw with M4 nut (please arrange separately). The tightening torque should be 0.98 N·m or less.
- In case the PVC mounting bracket is used, face the 'TOP' inscribed side up and use adhesive to stick fast the mounting bracket on the mounting surface, Make sure that the adhesive does not stick out from the fixable area as shown in the figure right.
- Match the notch in the sensor body with the projection of the exclusive mounting bracket and slide till a click is felt.

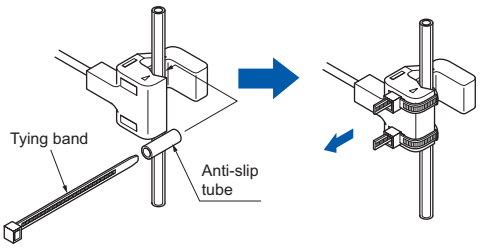




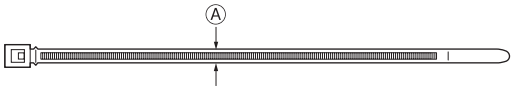


Mounting liquid detection fiber FT-F902

- Mount the fiber on a pipe with the attached tying bands and the anti-slip tubes as shown in the diagrams below. Fasten two tying bands, as shown, and cut off the excess portions.

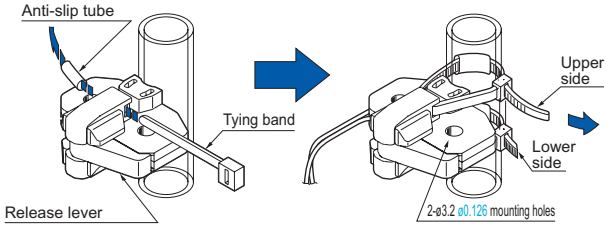


- If other tying bands are to be used, the dimension Ⓐ shown in the figure below should be 2.5 mm 0.098 in or less.

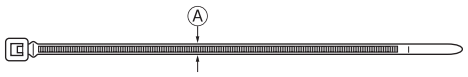


Mounting pipe-mountable liquid detection fiber

- Mount the fiber on a pipe with the attached tying bands and anti-slip tubes as shown in the figure below. Make sure that the release lever is retracted (position as shown in the figure) before mounting. Fasten two tying bands, as shown, and cut off the excess portions.



- If other tying bands are to be used, the dimension Ⓐ shown in the figure below should be 2.5 mm 0.098 in or less.



- In case of mounting using the two mounting holes, use M3 screws, plain washers, and spring washers. The tightening torque should be 0.5 N·m or less. (Purchase the M3 screws, plain washers, and spring washers separately.)

<Position adjustmeut>

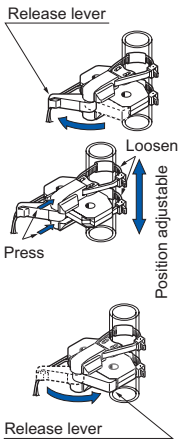
- In case of mounting on the pipe with tying bands, the fiber position can be easily adjusted with the release lever.

Adjustment

① Unlock the release lever (in the direction of the arrow).

② Press the movable center holders forward to loosen the tying bands and adjust the position.

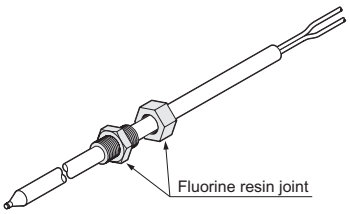
③ Lock the release lever to its original place.



Notes: 1) Whenever the mounting position is changed, adjust the sensitivity again.
2) The lever mechanism must be used only to adjust the position, and not for tightening the tying bands. If tying bands are tightened while the lever is open, and then the lever is locked, the fiber may be damaged.

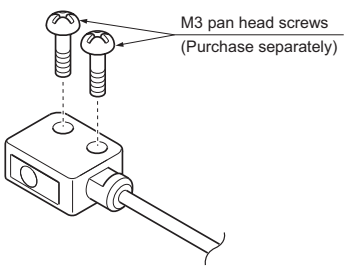
Mounting liquid level detection fiber FD-F8Y

- Use a commercially available fluorine resin joint, etc., to install **FD-F8Y**.



Mounting chemical-resistant rectangular head fiber FT-Z802Y

- Using M3 pan head screws, the tightening torque should be 0.3 N·m or less.



PRECAUTIONS FOR PROPER USE

Refer to General precautions.

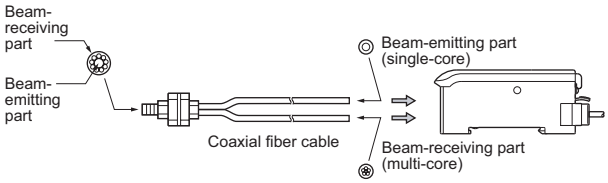
Method of fixing fiber cable

• If fixing the fiber cable in position, make sure that it is set in a manner as shown below, so that no load is applied on the fiber.
(Excluding **FT-H35-M2**, **FT-H35-M2S6**, **FD-H35-M2** and **FD-H35-M2S6**)

Connection with reflective coaxial type fiber

• With reflective coaxial type fiber, insert the center fiber cable (single-core) into the beam-emitting inlet and the outer fiber cable (multi-core) into the beam-receiving inlet.

FD-H35-M2 or **FD-H20-M1** is marked 'P' on the beam-emitting fiber cable and 'D' on the beam-receiving fiber cable. **FD-WG4**, **FD-WSG4** and **FD-G4**, **FD-G6**, **FD-G6X** are composed of beam-emitting and beam-receiving fiber cables that are different in diameter. **FD-EG1**, **FD-EG2**, **FD-EG3**, **FD-E22**, **FD-H20-21** and **FD-ENM1S1** are marked P on the beam-emitting fiber cable.

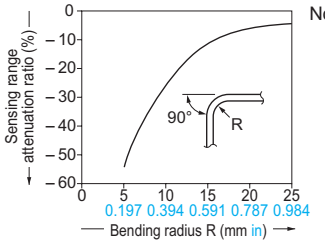


Notes: 1) In case the fiber cables are not inserted to a position where they stop, the sensing range reduces.
2) Before connecting fiber cables to the amplifier, mount the fiber attachments on their ends.

Fiber cable bending radius

• If the fiber cable is bent at a smaller bending radius than allowable bending radius, the sensing range decreases due to beam attenuation.

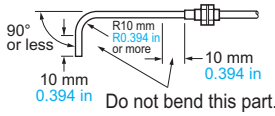
For a allowable bending radius of 25 mm (0.984 in)



Note: Please note that the 350 °C 662°F heat-resistant fibers, vacuum-resistant and chemical-resistant fibers cannot bend less than the allowable bending radius.

How to bend sleeve

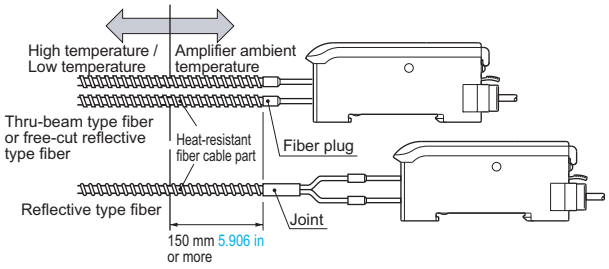
• The bending radius must be R10 mm R0.394 in or more. Please bend gradually using the fiber bender (**FB-1**) or a round bar of ø20 mm ø0.787 in or more.



Note: Do not bend the sleeve of side-view type, narrow beam type, narrow-view type and ultra-small diameter type fiber.

Use of heat-resistant type fiber

• Use by keeping 150 mm 5.906 in, or more, of the heat-resistant fiber cable part at normal temperature.



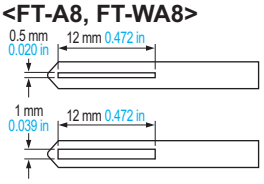
• Protect the amplifier from heat radiation or hot air.
• With the 350 °C 662 °F heat-resistant type fiber, the surface of the fiber head or the spiral may be discolored by heat. However, this does not affect its performance.

Seal type slit mask for FT-WA30/A30, FT-WA8/A8

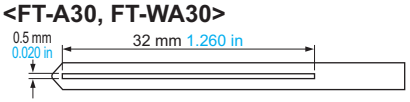
• Two types of slit masks are enclosed. (one type for **FT-A30** and **FT-WA30**) Apply the enclosed slit mask when detecting small objects or as measures not to saturate the emitted light amount for short-range sensing. However, the sensing range is reduced when the slit mask is mounted. As the slit mask is seal type, stick it by aligning the projection of the slit mask with the upper portion of the fiber head, as shown in the figure below.

Slit masks

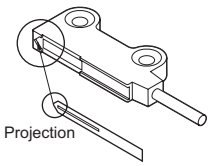
<FT-A8, FT-WA8>



<FT-A30, FT-WA30>



Mounting



Sensing range when mounting slit mask [with FX-301(P)]

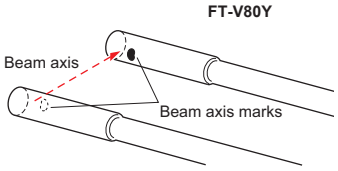
FT-WA30/A30: 2,500 mm 98.425 in (LONG) / 1,000 mm 39.370 in (STD) / 600 mm 23.622 in (FAST) / 200 mm 7.874 in (S-D)
FT-WA8/A8 (0.5 × 12 mm 0.020 × 0.472 in slit mask): 400 mm 15.748 in (LONG) / 200 mm 7.874 in (STD) / 140 mm 5.512 in (FAST) / 70 mm 2.756 in (S-D)
FT-WA8/A8 (1 × 12 mm 0.039 × 0.472 in slit mask): 800 mm 31.496 in (LONG) / 400 mm 15.748 in (STD) / 280 mm 11.024 in (FAST) / 140 mm 5.512 in (S-D)

PRECAUTIONS FOR PROPER USE

Refer to General precautions.

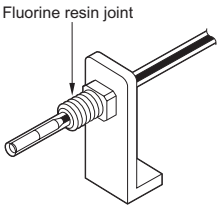
Cautions for FT-HL80Y / L80Y, FT-V80Y chemical-resistant fiber usage

- Do not use the fiber under the environment including the following chemicals.
  Molten alkaline metal (sodium, potassium, lithium, etc.), chemicals which may penetrate PFA, such as Fluorine gas (F_2), ClF_3, OF_2 (also in gas) etc., or chemicals having strong permeability, such as high-temperature fluorine, nitric or chlorine etc.
- The beam axis marks point out the orientation that beam is emitted or received on each fiber tip. Fix both fiber tips as beam axis marks face each other.



Mounting

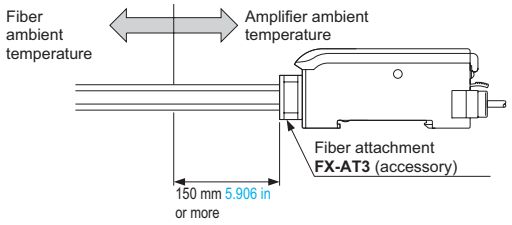
- Use a commercial Fluorine resin joint (penetration type ø6 mm 0.236 in etc.) to mount the fiber.
- The bending radius of the protective jacket should be R30 mm R1.181 in or more. It will be damaged under the value.



- The bending radius of the bear fiber should be R25 mm R0.984 in or more. The sensing range will be shortened under the value.
- Do not subject the fiber under tension.
  (Tensile force is 49.0 N or less.)

Use of heat-resistant 115 ºC 239 °F type (FT-HL80Y)

- Use by keeping 150 mm 5.906 in, or more, of the heat-resistant fiber cable part at normal temperature to protect the amplifier.

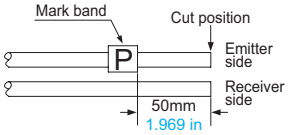


- Protect the amplifier from heat radiation or hot air.

Cautions for FR-KV1

Connecting to amplifier

- The mark band 'P' is fitted on the emitter side fiber (refer to the figure right.) Insert the emitter side fiber having the mark band into the emitting part of the amplifier.

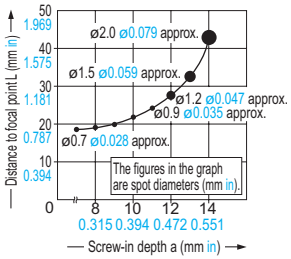


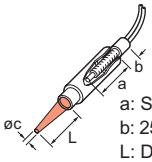
Cautions for cutting fiber

- When cutting the fibers, do not cut them with the mark band 'P' fit on the emitter side fiber. Slide the mark band about 50 mm 1.969 in towards the fiber head from the position where you desire to cut, and then cut the fiber. (refer to the above figure.)

Cautions for FX-MR2 zoom lens usage

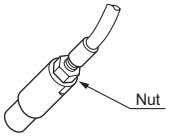
- The spot diameter and the sensing range are adjustable by the screw-in depth as follows.



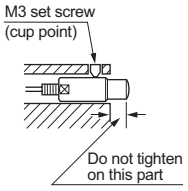


a: Screw-in depth
b: 25-a
L: Distance to focal point
øc: Spot diameter

- After **FX-MR2** is set on the fiber head at the desired depth, tighten the attached nut securely.

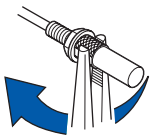


- To mount **FX-MR2** with a set screw, use a M3 set screw (cup point). The tightening torque should be 0.29 N·m or less.



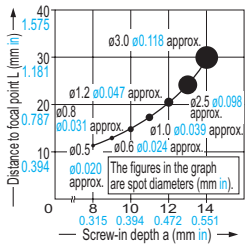
Caution for FX-MR3, FX-MR6 finest spot lens usage

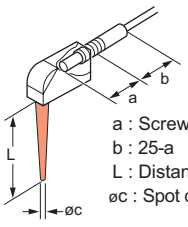
- Screw **FX-MR3, FX-MR6** on the fiber head until the fiber is fully inserted. The tightening torque should be 0.29 N·m or less.



Cautions for FX-MR5 side-view zoom lens usage

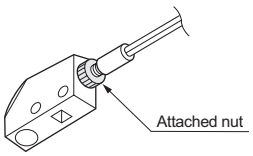
- The spot diameter and the sensing range are adjustable by the screw-in depth as follows.





a : Screw-in depth
b : 25-a
L : Distance to focal point
øc : Spot diameter

- After **FX-MR5** is set on the fiber head at the desired depth, tighten the attached nut **NT-FX-MR5** securely.



- The tightening torque should be 0.5 N·m or less when tightening **FX-MR5** with a screw.

PRECAUTIONS FOR PROPER USE

Refer to General precautions.

Fitting protective tube

- The threaded head free-cut fiber can be fitted with a protective tube.

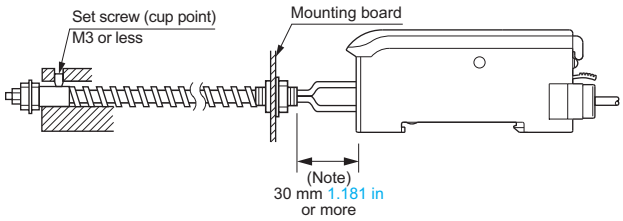
Fitting

① Insert the fiber cable into the protective tube from the sleeve side.

② Turn the fiber head to screw it on the inner thread of the sleeve.

Mounting

- The maximum tightening torque should be as given below.



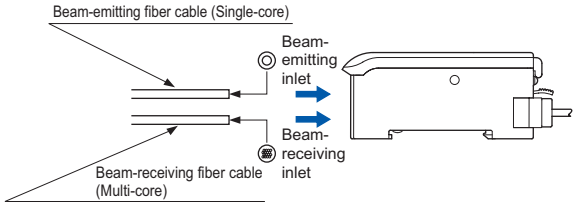
<Sleeve part>
Tightening torque: 0.58 N·m or less

<Threaded part>
Tightening torque: 0.58 N·m or less

Note: The fiber cable must be longer than the protective tube by 30 mm 1.181 in or more to connect it to the amplifier. Make sure to measure the length required before cutting.

Cautions for convergent reflective fiber

- Please note that the **FD-L43** and **FD-L45/L45A** may not perform stable detection of objects that have received special processing and do not reflect light regularly.
- Avoid areas prone to vapor or dust as well as corrosive gas environments. Do not expose the fiber directly to water or chemicals.
- In case of **FD-L45A**, slowly insert the beam-emitting fiber cable (single-core) into the beam-emitting inlet and the beam-receiving fiber cable (multi-core) into the beam-receiving inlet, till they stop. If the fiber cables are inserted the other way around, correct sensing performance cannot be obtained.



Cautions for liquid / leak / liquid level / chemical-resistant fibers

- When conducting maintenance of **FD-F705** after operation, wipe all liquid from the sensor head and the mounting bracket with a soft cloth. Further, take sufficient care against dew condensation on the sensing surface.
- Take care that shortening the fiber cable of **FD-F705** and **FT-F902** excessively may result in loss of reliable detection due to an insufficient light intensity difference. (As a reference of **FD-F705**, adjust the length of the fiber cable to 2 m 6.562 ft and when mounted on the exclusive bracket, the displayed digit value of the amplifier in liquid absent condition should be 4,000 or less. As a reference of **FT-F902**, adjust the length of the fiber cable at 1 m 3.281 ft and when mounted on the pipe, the displayed digit value of the amplifier in liquid absent condition should be 3,500 or less.)
- Make sure to use the exclusive mounting bracket when installing **FD-F705** to avoid human error. Reliable detection cannot be guaranteed when this mounting bracket is not used. However, in case the PVC mounting bracket is mounted on the dark and mat surface, human error may not be detected. Make sure to check it prior to use.
- Take care not to scratch the fiber sheath while cutting the protective tube of **FD-F705** and **FT-F902**.
- Make sure to adjust the sensitivity of **FD-F705** after mounting the fiber head in the exclusive mounting bracket with no-liquid condition, completing layout and wiring the fiber cable in actual working conditions. Changes in layout or installation after completing sensitivity adjustment may result in the loss of reliable detection due to the change of incident light intensity. In case of re-mounting the fiber to the pipe or change in layout, adjust the sensitivity of the amplifier again.
- Note that the light intensity may decrease when used **FD-F705** and **FT-F902** under high temperature and high humidity for long period.
- A liquid having poor affinity to the material of the sensor head of **FD-F705** (PFA) may create air bubbles, and if those are drawn in the sensing part, it takes some time for sensing to stabilize, or sensing may even become unstable. Make sure to check whether the sensing liquid has an affinity ti the material of the fiber head.
- Confirm that there are no scratches, dirt, or distortions to the dedicated installation bracket during **FD-F705** maintenance.
- Since a water drop on the sensing surface of **FT-F902** and **FT-Z802Y** can affect the sensing performance, avoid using this fiber head at a place where water splashes. Further, take sufficient care against dew condensation etc. on the pipe's outside wall.
- In case of using **FT-F902** and **FD-F4/F41** unclear or highly viscous liquid may not be stably detected.
- In case of using **FT-F902** and **FD-F4/F41** the detection result may vary greatly if the sensor is not firmly secured. Use the attached anti-slip tube to firmly secure it to the pipe so that it does not move.
- Make sure to adjust the sensitivity of the amplifier after mounting the fiber in liquid absent condition in the pipe for stable detection with **FT-F902**. In case of re-mounting the fiber to the pipe or change in layout, adjust the sensitivity of the amplifier again.
- **FD-F4/F41** cannot perform correct sensing with opaque pipes.
- Fit the fiber head of **FD-F4/F41** to the pipe securely, otherwise the operation may be erroneous.
- Neither **FD-F4/F41** is waterproof or chemical-resistant. Installation should be avoided at any place where it could come in direct contact with water or chemicals.
- In case of **FD-F4/F41**, take care that no dew condenses on the pipe's sensing surface or the pipe's inside wall and that no bubble attaches on the pipe's inside wall, since it can affect the operation. If a liquid drop flows down across the sensing point or an air bubble sticks on the wall at the sensing point, the operation may be erroneous. Make sure that no bubble arises in the liquid, and that no dew or liquid drop is present on either surface of the pipe wall.
- Take care that unclear liquid may not be sensed stably in case of **FD-F8Y**.
- Take care that the tube may stretch by maximum 2 % of the total length if it is used at a high temperature in case of **FD-F8Y**.

PRECAUTIONS FOR PROPER USE

Refer to General precautions.

Cautions for vacuum-resistant fiber

- When installing **FT/FD-H30-□V**, take care that oil from palms etc. is not transferred to the product.
- The bending radius of **FT/FD-H30-□V** should be R18 mm R0.709 in or more. If the fiber is to be mounted on a movable part, the bending radius should be R20 mm R0.787 in or more.
- Keep the sensing surface of **FT/FD-H30-□V** and the cable joint intact. If they are scratched, the detectability deteriorates.

Cautions for narrow beam fiber

- Do not apply excessive tensile force to the fiber cable.

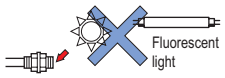
FT/FR-KV1: Tensile force 5.0 N or less
FT-WKV8: Tensile force 30 N or less

Common precautions

- Wipe a dirt on the fiber head surface with a moist soft cloth. However, do not use any organic solvents.
- If the outer cover of the emitting-side fiber has printed white dots (**FD-L43**, **FD-L45**, **FD-L45A**) or white lines (**FD-L44**, **FD-L44S**, **FD-F705**, **FT-F902**) on it, make sure to attach fibers with white dots or white lines on them to the amplifiers.
- Do not use the fiber at places having intense vibration, as this can cause malfunction.
- Keep the fiber head surface intact. If it is scratched or spoiled, the detectability will deteriorate.

- Do not expose the fiber to any organic solvents. (excluding chemical-resistant fiber)

- Do not use the fiber head surface in places where it may come in direct contact with water. A water drop on the fiber head surface deteriorates the sensing.
- Ensure that any strong extraneous light is not incident on the receiving face of the fiber head.
- Do not apply excessive tensile force to the fiber cable.
- Take care that the sensor is not directly exposed to fluorescent light from a rapid starter-lamp, a high frequency lighting device or sunlight, as it may affect the sensing performance.



- Since the sensing portion of wide beam or narrow beam fiber is concave shaped, take care that dust or dirt does not collect on it. In case it does collect, wipe it with a dry soft cloth.