Fiber optic sensor

### Ordering information (Fiber optic amplifier)

**BF 5 R D 1 N**
- **N**: NPN open collector output
- **P**: PNP open collector output
- **1**: Standard type
- **D**: Dual display type
- **S**: Single display type
- **R**: Red LED
- **G**: Green LED
- **B**: Blue LED
- **5**: Series
- **BF**: Fiber Sensor

**BF 4 R P E**
- **E**: External synchronization input type
- **R**: Remote sensitivity setting type
- **No mark**: NPN open collector output
- **P**: PNP open collector output
- **R**: Red LED
- **G**: Green LED
- **4**: Series
- **BF**: Fiber Sensor

**BF 3 RX P**
- **RX**: Red LED
- **3**: Series
- **BF**: Fiber Sensor
Ordering information (Fiber optic cable)

- **Option**
  - S: Small hood

- **Cable type**
  - No mark: Standard type (-40 to 70°C)
  - H: Heat-resistance (-40 to 105°C)
  - H1: Heat-resistance (-40 to 150°C)
  - H2: Heat-resistance (-40 to 250°C)
  - R: Flexible type (R1)
  - B: Break-resistant type (R5)

- **Fiber diameter**
  - 05: ø0.5mm
  - 06: ø0.6mm
  - 10: ø1.0mm
  - 13: ø1.3mm
  - 14: ø1.4mm
  - 15: ø1.5mm
  - 20: ø2.0mm
  - F: ø0.5mm, ø0.25mm×4 (coaxial type)
  - F1: ø0.5mm, ø0.25mm×9 (coaxial type)
  - F2: ø1.0mm, ø0.265mm×16 (coaxial type)

- **Cable length**
  - 05: 0.5m
  - 10: 1m
  - 20: 2m
  - 10M: 10m

- **Hood diameter (nut)**
  - 15: ø1.5mm
  - 2: ø2mm (M2)
  - 3: ø3mm (M3)
  - 4: ø4mm (M4)
  - 6: ø6mm (M6)

- **Head form**
  - No mark: Standard type (bolt type)
  - P: Plastic type
  - S: SUS type (SUS length 90mm)
  - S1: SUS type (SUS length 35mm)
  - S2: SUS type (SUS length 45mm)
  - C: Cylinder type
  - CS: Cylinder+SUS type (SUS length 15mm)
  - H: Fire cable protection tube
  - LU: L type/Top view (Height 12.2mm)
  - LU1: L type/Top view (Height 17.2mm)
  - LU2: L type/Top view (Height 22.2mm)
  - F: Flat type/Flat view
  - FN: Flat type/Side view
  - FU: Flat type/Top view (Up)
  - FB: Flat type/Side view + Top view (Bending)

- **Sensing type**
  - T: Through-beam type
  - D: Diffuse reflective type
  - L: Convergent reflective type
  - F: Plastic Fiber cable
  - G: Glass Fiber cable

※Please refer to the 39 to 47 page (Fiber optic cable specification) for exact model name of fiber optic cable, or it might cause wrong model selection not existing in the above ordering information.
### Dual digital display type fiber optic amplifiers [BF5 Series]

#### Specifications

<table>
<thead>
<tr>
<th>Display type</th>
<th>Dual Display type</th>
<th>Single Display type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPN open collector output</td>
<td>BF5R-D1-N</td>
<td>BF5G-D1-N</td>
</tr>
<tr>
<td>PNP open collector output</td>
<td>BF5R-D1-P</td>
<td>BF5G-D1-P</td>
</tr>
</tbody>
</table>

**Appearances**

- Red LED (660nm, modulated)
- Green LED (530nm, modulated)
- Blue LED (470nm, modulated)
- Red LED (660nm, modulated)

**Power supply**

12-24VDC ± 10%

**Current consumption**

Max. 50mA

**Operation mode**

Light ON / Dark ON Selectable

**Control output**

NPN or PNP open collector
- Load voltage: Max. 24VDC
- Load current: Max. 100mA
- Residual voltage - NPN: Max. 1V, PNP: Max. 3V

**Response time**

- Ultra Fast: 50μs (only for dual display type)
- Fast: 150μs
- STD: 500μs
- Long: 4ms

**Power supply**

12-24VDC ± 10%

**Current consumption**

Max. 50mA

**Operation mode**

Light ON / Dark ON Selectable

**Control output**

NPN or PNP open collector
- Load voltage: Max. 24VDC
- Load current: Max. 100mA
- Residual voltage - NPN: Max. 1V, PNP: Max. 3V

**Response time**

- Ultra Fast: 50μs (only for dual display type)
- Fast: 150μs
- STD: 500μs
- Long: 4ms

**Display method**

- Incident light level: Red, 4digit, 7Segment
- SV: Green, 4digit, 7Segment
- Main output indicator: Red LED

**Display function**

- Incident light level / SV display [4,000/10,000 resolution], Percentage display, High/Low peak value display, Normal / Reversed display (only for dual display type)

**Sensitivity setting**

Manual sensitivity setting, teaching sensitivity setting (Auto tuning, 1 point, 2 point teaching, positioning teaching)

**Energy saving**

Normal / Energy saving 1 / Energy saving 2

**Timer**

OFF, OFF Delay, ON Delay, One-shot

**Protection circuit**

Reverse polarity protection, overcurrent protection, surge absorption

**Display method**

- Incident light level: Red, 4digit, 7Segment
- SV: Green, 4digit, 7Segment
- Main output indicator: Red LED

**Display function**

- Incident light level / SV display [4,000/10,000 resolution], Percentage display, High/Low peak value display, Normal / Reversed display (only for dual display type)

**Sensitivity setting**

Manual sensitivity setting, teaching sensitivity setting (Auto tuning)

**Mutual interference prevention**

Max. 8 unit sets (Automatically set regardless of response time)

**Initializing**

Initializing to factory mode

**Energy saving**

Normal / Energy saving 1 / Energy saving 2

**Timer**

OFF, OFF Delay, ON Delay, One-shot

**Insulation resistance**

Min. 20MΩ (at 500VDC megger)

**Dielectric strength**

1,000V/50/60Hz for 1 min.

**Vibration**

1.5mm amplitude at frequency of 10 to 55Hz (for 1 min.) in each X, Y, Z directions for 2 hours

**Shock**

500m/s² (approx. 50G) in each X, Y, Z directions for 3 times

**Protection**

IP40 (IEC standards)

**Material**

Case: PBT, Cover: PC

**Fiber cable tightening torque**

Min. 2kgf

**Accessory**

Connector type wire (Ø4mm, 3-wire, length: 2m)

(AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm), Side connector

**Approval**

CE

**Unit weight**

Approx. 20g

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**Control output diagram**

- **NPN open collector output**

  - Fiber optic sensor circuit
  - Connection

- **PNP open collector output**

  - Fiber optic sensor circuit
  - Connection
## Digital fiber optic amplifier communication converter [BFC Series]

### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>NPN Solid-state input</th>
<th>PNP Solid-state input</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BFC-N</td>
<td>BFC-P</td>
</tr>
<tr>
<td><strong>Appearances</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>12-24VDC ±10%</td>
<td></td>
</tr>
<tr>
<td><strong>Current consumption</strong></td>
<td>Max. 40mA</td>
<td></td>
</tr>
<tr>
<td><strong>SW input (SW1, SW2)</strong></td>
<td>LOW: 0-1V, HIGH: 5-24V</td>
<td>SW1/SW2 - LL: Standby, LH: BANK0, HL: BANK1, HH: BANK2</td>
</tr>
<tr>
<td><strong>Communication function</strong></td>
<td>RS485 communication, serial communication, SW input</td>
<td></td>
</tr>
<tr>
<td><strong>Communication speed</strong></td>
<td>1200, 2400, 4800, 9600, 19200, 38400bps</td>
<td></td>
</tr>
<tr>
<td><strong>Indication</strong></td>
<td>• Parameter: Red 4digit 7 Segment</td>
<td>• Parameter: Red 4digit 7 Segment</td>
</tr>
<tr>
<td></td>
<td>• Set value: Green 4digit 7 Segment</td>
<td>• Set value: Green 4digit 7 Segment</td>
</tr>
<tr>
<td></td>
<td>• Indicator: TX indicator(red), RX indicator(green)</td>
<td>• Indicator: TX indicator(red), RX indicator(green)</td>
</tr>
<tr>
<td><strong>Function</strong></td>
<td>• Real-time monitoring (incident light level, on/off state)</td>
<td>• Real-time monitoring (incident light level, on/off state)</td>
</tr>
<tr>
<td></td>
<td>• Executes every BF5 feature and sets parameter by external device(PC, PLC)</td>
<td>• Executes every BF5 feature and sets parameter by external device(PC, PLC)</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>-10 to 50°C, storage: -20 to 60°C</td>
<td>-10 to 50°C, storage: -20 to 60°C</td>
</tr>
<tr>
<td><strong>Ambient humidity</strong></td>
<td>35 to 85%RH, storage: 35 to 85%RH</td>
<td>35 to 85%RH, storage: 35 to 85%RH</td>
</tr>
<tr>
<td><strong>Vibration</strong></td>
<td>1.5 mm amplitude at frequency of 10 to 55Hz(for 1 min.) in each of X, Y, Z directions for 2 hours</td>
<td>1.5 mm amplitude at frequency of 10 to 55Hz(for 1 min.) in each of X, Y, Z directions for 2 hours</td>
</tr>
<tr>
<td><strong>Shock</strong></td>
<td>500m/s²(approx. 50G) in each of X, Y, Z directions for 3 times</td>
<td>500m/s²(approx. 50G) in each of X, Y, Z directions for 3 times</td>
</tr>
<tr>
<td><strong>Protection</strong></td>
<td>IP40(IEC standard)</td>
<td></td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td>Case: PBT, Cover: PC</td>
<td></td>
</tr>
<tr>
<td><strong>Connector type wire Ø4mm, 3-wire, length: 2m (AWG 22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: ø1.25mm), Side connector</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Approval</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Unit weight</strong></td>
<td>Approx. 15g</td>
<td></td>
</tr>
</tbody>
</table>

※1: Powered by supply voltage of the amplifier unit connected by a side connector.
※Environment resistance is rated at no freezing or condensation.
High reliability of fiber optic amplifier for convenient mounting
[BF4 Series]

Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Appearance</th>
<th>Response frequency</th>
<th>Power supply</th>
<th>Current consumption</th>
<th>Light source (modulated light)</th>
<th>Sensitivity adjustment</th>
<th>Operation mode</th>
<th>Control output</th>
<th>Self-diagnosis output</th>
<th>Protection circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF4RP</td>
<td></td>
<td>Max. 0.5ms(Frequency 1), Max. 0.7ms(Frequency 2)</td>
<td>12-24VDC ±10%(Ripple P-P: Max.10%)</td>
<td>Max. 45mA</td>
<td>Red</td>
<td>Automatic selection of Light ON/Dark ON accordance with button setting</td>
<td>NPN or PNP open collector output</td>
<td>ON state under unstable sensing(When the target stays for 300ms in unstable area), ON state when control output short-circuited</td>
<td>Reverse power, short-circuit(overcurrent) protection circuit</td>
<td></td>
</tr>
<tr>
<td>BF4GP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Green</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BF4R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Red</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BF4G</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Green</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>BF4R-E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Red</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BF4G-E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Green</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BF4R-R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Red</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BF4G-R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Green</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sensitivity adjustment button(ON/OFF)

Operation mode

Automatic selection of Light ON/Dark ON accordance with button setting

Control output

NPN or PNP open collector output

- Load voltage: Max. 30VDC
- Load current: Max. 100mA
- Residual voltage - NPN: Max. 1V(load current:100mA), Max. 0.4V(load current:16mA) / PNP: Max. 2.5V

Self-diagnosis output

ON state under unstable sensing(When the target stays for 300ms in unstable area), ON state when control output short-circuited

- Load voltage: Max. 30VDC
- Load current: Max. 50mA
- Residual voltage - NPN: Max. 1V(load current:50mA), Max. 0.4V(load current:16mA) / PNP: Max. 2.5V

Protection circuit

Reverse power, short-circuit(overcurrent) protection circuit

Indication

Operation indicator: Red LED, Stability indicator: Green LED ON when the target stays in stable sensing level

Input of stop transmission function

Built-in

External synchronization function

Built-in(Gate/Trigger)

Remote sensitivity setting function

Built-in

Interference prevention function

Built-in differential frequency mode (set by frequency 1 or 2 by ON/OFF button)

Timer function

Built-in OFF delay timer, Approx. 40ms fixed

Ambient illumination

Sunlight: Max. 11,000lx, Incandescent lamp: Max. 3,000lx (Receiver illumination)

Noise resistance

±240V the square wave noise(pulse width: 1μs) by the noise simulator

Dielectric strength

1,000VAC 50/60Hz for 1 minute

Insulation resistance

Min. 20MΩ(at 500VDC megger)

Vibration

1.5mm amplitude at frequency of 10 to 55Hz(for 1 min.) in each of X, Y, Z directions for 2 hours

Shock

500m/s²(approx. 50G) in each of X, Y, Z directions for 3 times

Ambient illumination

Sunlight: Max. 11000lx, Incandescent lamp: Max. 3000lx (received illumination)

Ambient temperature

-10 to 50°C, storage: -20 to 70°C

Ambient humidity

35 to 85% RH, storage: 35 to 85% RH

Material

Case: Heat-resistance ABS, Cover: PC

Cable

Ø4mm, 4-wire, Length: 2m (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm)

Ø4mm, 6-wire, Length: 2m (AWG24, Core diameter: 0.08mm, Number of cores: 40, Insulator out diameter: Ø1mm)

Accessory

Mounting bracket, Bolts/nuts

Approval

CE

Unit weight

Approx. 65g

Dimensions

(unit: mm)
High accuracy fiber optic amplifier with twin adjuster [BF3 Series]

■ Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>BF3RX</th>
<th>BF3RX-P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearances</td>
<td>![CE mark]</td>
<td>![CE mark]</td>
</tr>
<tr>
<td>Response time</td>
<td>Max. 1ms</td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>12-24VDC ±10% (Ripple P-P: Max. 10%)</td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>Max. 40mA</td>
<td></td>
</tr>
<tr>
<td>Light source</td>
<td>Red LED (Modulated)</td>
<td></td>
</tr>
<tr>
<td>Sensitivity adjustment</td>
<td>Adjustable VR (Dual adjustment: Coarse adjustment, Fine adjustment)</td>
<td></td>
</tr>
<tr>
<td>Operation mode</td>
<td>Selectable Light ON or Dark ON by control cable</td>
<td></td>
</tr>
</tbody>
</table>
| Control output | NPN or PNP open collector output  
- Load voltage: Max. 30VDC  
- Load current: Max. 200mA,  
- Residual voltage - NPN: Max. 1V, PNP: Max. 2.5V | | |
| Protection circuit | Reverse power polarity, output short-circuit protection circuit | | |
| Indication | Operation indicator: Red LED | | |
| Insulation resistance | Min. 20MΩ (at 500VDC megger) | | |
| Noise resistance | ±240V the square wave noise (pulse width: 1μs) by the noise simulator | | |
| Dielectric strength | 1,000VAC 50/60Hz for 1 minute | | |
| Vibration | 1.5mm amplitude at frequency of 10 to 55Hz (for 1 min.) in each of X, Y, Z directions for 2 hours | | |
Selection Guide

<table>
<thead>
<tr>
<th>Model</th>
<th>BF3RX</th>
<th>BF3RX-P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock</td>
<td>500m/s² (approx. 50G) in each of X, Y, Z directions for 3 times</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient illumination</td>
<td>Sunlight: Max. 11,000lx, Incandescent lamp: Max. 3,000lx (Receiver illumination)</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-10 to 50°C, storage: -25 to 70°C</td>
<td></td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>35 to 85%RH, storage: 35 to 85%RH</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Case: ABS, Cover: PC</td>
<td></td>
</tr>
<tr>
<td>Cable</td>
<td>Ø5mm, 4-wire, Length: 2m (AWG24, Core diameter: 0.08mm, Number of cores: 40, Insulator out diameter: Ø1mm)</td>
<td></td>
</tr>
<tr>
<td>Accessory</td>
<td>VR adjustment driver, Mounting bracket, Bolts/nuts</td>
<td></td>
</tr>
<tr>
<td>Unit weight</td>
<td>Approx. 90g</td>
<td></td>
</tr>
</tbody>
</table>

※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

Connections

- BF3RX

- BF3RX-P

※Enables to use as diffuse reflective type or through-beam type according to the fiber optic cable.

※Adapter marked fiber optic cable should be used with adapter( ).

※GT-420-13H2 cannot be used because the length inserted into amp is too short.

Dimensions

[unit: mm]
# Selection Guide

## Fiber Optic Cable

### Specifications (diffuse reflective type)

<table>
<thead>
<tr>
<th>Type</th>
<th>Appearance</th>
<th>Feature</th>
<th>Model</th>
<th>Sensing distance (mm)</th>
<th>Min. sensing target</th>
<th>Allowable bend radius</th>
<th>Cable length (L)</th>
<th>Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line-up</td>
<td>Flat type /Top view</td>
<td>FDFU-210-05R</td>
<td>35</td>
<td>1m</td>
<td>Free cut</td>
<td></td>
<td></td>
<td>-40 to 60°C</td>
</tr>
<tr>
<td></td>
<td>Flat type /Side view</td>
<td>FDFN-210-05R</td>
<td>30</td>
<td>Ø0.0125</td>
<td>R1</td>
<td></td>
<td></td>
<td>-40 to 60°C</td>
</tr>
<tr>
<td></td>
<td>M3 Bolt</td>
<td>FD-320-05R</td>
<td>35</td>
<td>Ø0.0125</td>
<td>R1</td>
<td></td>
<td></td>
<td>-40 to 60°C</td>
</tr>
<tr>
<td></td>
<td>M4 Bolt</td>
<td>FD-420-05R</td>
<td>35</td>
<td>Ø0.0125</td>
<td>R1</td>
<td></td>
<td></td>
<td>-40 to 60°C</td>
</tr>
<tr>
<td></td>
<td>M6 Bolt</td>
<td>FD-620-10R</td>
<td>130</td>
<td>Ø0.04</td>
<td>R1</td>
<td></td>
<td></td>
<td>-40 to 60°C</td>
</tr>
<tr>
<td>Flexible type</td>
<td>Flat type /Flat view</td>
<td>FDF-210-05R</td>
<td>30</td>
<td>Ø0.0125</td>
<td>R1</td>
<td></td>
<td></td>
<td>-40 to 60°C</td>
</tr>
<tr>
<td></td>
<td>M3 Bolt</td>
<td>FD-320-06B</td>
<td>35</td>
<td>Ø0.0125</td>
<td>R1</td>
<td></td>
<td></td>
<td>-40 to 60°C</td>
</tr>
<tr>
<td></td>
<td>M4 Bolt</td>
<td>FD-420-06B</td>
<td>35</td>
<td>Ø0.0125</td>
<td>R1</td>
<td></td>
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<td>-40 to 60°C</td>
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<tr>
<td></td>
<td>M6 Bolt</td>
<td>FD-620-13B</td>
<td>100</td>
<td>Ø0.04</td>
<td>R1</td>
<td></td>
<td></td>
<td>-40 to 60°C</td>
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<tr>
<td>Break-resistant type</td>
<td>Flat type /Flat view</td>
<td>FDC-320-06B</td>
<td>35</td>
<td>Ø0.0125</td>
<td>R1</td>
<td></td>
<td></td>
<td>-40 to 60°C</td>
</tr>
<tr>
<td></td>
<td>M3 Bolt</td>
<td>FD-320-05</td>
<td>35</td>
<td>Ø0.0125</td>
<td>R1</td>
<td></td>
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<td>-40 to 60°C</td>
</tr>
<tr>
<td></td>
<td>M4 Bolt</td>
<td>FD-420-05</td>
<td>35</td>
<td>Ø0.0125</td>
<td>R1</td>
<td></td>
<td></td>
<td>-40 to 60°C</td>
</tr>
<tr>
<td></td>
<td>M6 Bolt</td>
<td>FD-620-10</td>
<td>130</td>
<td>Ø0.04</td>
<td>R1</td>
<td></td>
<td></td>
<td>-40 to 60°C</td>
</tr>
<tr>
<td>Standard type</td>
<td>Ø3 Cylinder type</td>
<td>FDCS-320-05</td>
<td>40</td>
<td>Ø0.03</td>
<td>R15</td>
<td>2m</td>
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<td>-40 to 70°C</td>
</tr>
<tr>
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<td>Ø3 Cylinder type</td>
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<td>Ø0.03</td>
<td>R15</td>
<td>2m</td>
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<td>-40 to 70°C</td>
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<td>R15</td>
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<tr>
<td></td>
<td>M4 Bolt</td>
<td>FD-420-05</td>
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<td>-40 to 70°C</td>
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<tr>
<td></td>
<td>M6 Bolt</td>
<td>FD-620-10</td>
<td>130</td>
<td>Ø0.04</td>
<td>R1</td>
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<tr>
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<td>M6 Bolt</td>
<td>FD-620-10</td>
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<td>R1</td>
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<td>-40 to 70°C</td>
</tr>
<tr>
<td></td>
<td>M6 Bolt</td>
<td>FDS-620-10</td>
<td>130</td>
<td>Ø0.04</td>
<td>R1</td>
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<td>-40 to 70°C</td>
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<tr>
<td></td>
<td>M6 Bolt</td>
<td>FDS-620-10</td>
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<td>Ø0.04</td>
<td>R1</td>
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<tr>
<td></td>
<td>M6 Bolt</td>
<td>FDS2-620-10</td>
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<td>Ø0.04</td>
<td>R1</td>
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<td></td>
<td>M6 Bolt</td>
<td>FDS2-620-10</td>
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<td>Ø0.04</td>
<td>R1</td>
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<tr>
<td></td>
<td>M6 Bolt</td>
<td>FDS2-620-10</td>
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<td>R1</td>
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<td>-40 to 70°C</td>
</tr>
<tr>
<td></td>
<td>Plastic</td>
<td>FDP-320-10</td>
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<td>Ø0.04</td>
<td>R1</td>
<td></td>
<td></td>
<td>-40 to 70°C</td>
</tr>
</tbody>
</table>

- **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install the many places where are bending areas because the change of the intensity of radiation by bending is small.
- **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.

※1: The sensing distance is a standard for BF5 Series.

※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED. It is applied to 40% of sensing distance for BF3RX.

※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.

※4: Fiber optic cable out of the rated length can be customizable.

※5: **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install the many places where are bending areas because the change of the intensity of radiation by bending is small.

- **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.

※Free cut The sensing distance can be shortened about max. 20% than the normal according to condition of the cable. ([FC-2] should be used for cutting fiber cable.)
### Specifications (diffuse reflective type)

<table>
<thead>
<tr>
<th>Type</th>
<th>Appearance</th>
<th>Feature</th>
<th>Model</th>
<th>Sensing distance (mm)</th>
<th>Min. sensing target※3</th>
<th>Allowable bend radius</th>
<th>Cable length(L)※4</th>
<th>Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coaxial type</td>
<td></td>
<td>M3 Bolt</td>
<td>FD-320-F</td>
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<td>-40 to 70°C</td>
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<tr>
<td></td>
<td></td>
<td>M3 Bolt</td>
<td>FD-320-F1</td>
<td>60※2</td>
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<td>-40 to 10°C</td>
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<td></td>
<td></td>
<td>M6 Bolt</td>
<td>FD-620-F2</td>
<td>120※2</td>
<td>Ø0.03</td>
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<td>Free cut</td>
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<tr>
<td></td>
<td></td>
<td>M6 Bolt</td>
<td>FD-620-10H</td>
<td>160※2</td>
<td>2m</td>
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<td>R30</td>
<td>-40 to 150°C</td>
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<tr>
<td></td>
<td></td>
<td>M6 Bolt</td>
<td>FD-620-15H1</td>
<td>100※2</td>
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<td>-40 to 250°C</td>
</tr>
<tr>
<td></td>
<td>Line-up</td>
<td>Ø3 Cylinder type</td>
<td>FDCSN-320-05</td>
<td>30※1</td>
<td>Ø0.0125</td>
<td>R15</td>
<td>2m</td>
<td>-40 to 60°C</td>
</tr>
<tr>
<td>Heat-resistant type</td>
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<td>M4 Bolt</td>
<td>GD-420-20H2</td>
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<tr>
<td></td>
<td></td>
<td>M4 Bolt</td>
<td>GD-620-20H2</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED.
※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.
※4: Fiber optic cable out of the rated length can be customizable.
※Free cut: The sensing distance can be shortened about max. 20% than the normal according to condition of the cable.

### Specifications (convergent reflective type)

<table>
<thead>
<tr>
<th>Type</th>
<th>Feature</th>
<th>Model</th>
<th>Sensing distance (mm)</th>
<th>Min. sensing target※3</th>
<th>Allowable bend radius</th>
<th>Cable length(L)※4</th>
<th>Temp.</th>
</tr>
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<tbody>
<tr>
<td>Convergent reflective type</td>
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<td>FLF-320-10</td>
<td>8※1</td>
<td>Ø0.0125</td>
<td>R25</td>
<td>2m</td>
<td>-40 to 60°C</td>
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</tbody>
</table>

※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED.
※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.
※4: Fiber optic cable out of the rated length can be customizable.
※Free cut: The sensing distance can be shortened about max. 20% than the normal according to condition of the cable.

[(FC-2) should be used for cutting fiber cable.]
※Glass type is for BF9R, BF4R Series.
### Specifications (through-beam type)

<table>
<thead>
<tr>
<th>Type</th>
<th>Appearance</th>
<th>Feature</th>
<th>Model</th>
<th>Sensing distance (mm)</th>
<th>Min. sensing target</th>
<th>Allowable bend radius</th>
<th>Cable length(L)</th>
<th>Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line-up</td>
<td>Flat type /Top view</td>
<td>FTFU-210-05R</td>
<td>110&lt;sup&gt;1&lt;/sup&gt;</td>
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<td></td>
<td>0.04</td>
<td>1m</td>
<td>-40 to 60°C</td>
</tr>
<tr>
<td>Line-up</td>
<td>Flat type /Side view</td>
<td>FTFN-210-05R</td>
<td>100&lt;sup&gt;1&lt;/sup&gt;</td>
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</tr>
<tr>
<td>Line-up</td>
<td>Flat type /Flat view</td>
<td>FTF-210-05R</td>
<td>110&lt;sup&gt;1&lt;/sup&gt;</td>
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<tr>
<td>Flexible</td>
<td>Flat type /Top+Side view</td>
<td>FTFB-210-05R</td>
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<tr>
<td>Break-resistant</td>
<td>Integrated bracket(L type)</td>
<td>FTLU-310-10R</td>
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<td>FTLU2-310-10R</td>
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<td></td>
<td>FTC-220-05R</td>
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<td></td>
<td>FT-320-05R</td>
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<tr>
<td></td>
<td></td>
<td>FT-320-06B</td>
<td>110&lt;sup&gt;1&lt;/sup&gt;</td>
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<td></td>
<td>FT-420-10R</td>
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<tr>
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<td>FT-420-05R</td>
<td>100&lt;sup&gt;1&lt;/sup&gt;</td>
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<td></td>
<td></td>
<td>FT-420-06B</td>
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<td>FTC-1920-06B</td>
<td>400&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
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<td>0.3</td>
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</tr>
</tbody>
</table>

※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for BF4 Series and 10% of red LED is applied when it is green LED.
※3: It is applied to 40% of sensing distance for BF3RX.
※4: Fiber optic cable out of the rated length can be customizable.
※5: ● Flexible optical fiber (Multi core): A large number of ultra-fine cores are all surrounded by cladding. Easy to install the many places where are bending areas because the change of the intensity of radiation by bending is small.

   ● Break-resistant optical fiber: The fiber units contain a large number of independent fine fibers, ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.

※Free cut: The sensing distance can be shortened about max. 20% than the normal according to condition of the cable. [FC-2] should be used for cutting fiber cable.]
※FT-420-13 was discontinued. FT-420-13B is replacement.
### Specifications (through-beam type)

<table>
<thead>
<tr>
<th>Type</th>
<th>Appearance</th>
<th>Feature</th>
<th>Model</th>
<th>Sensing distance (mm)</th>
<th>Min. sensing target</th>
<th>Allowable bend radius</th>
<th>Cable length(L)</th>
<th>Temp.</th>
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<tbody>
<tr>
<td>Standard type</td>
<td>Line-up</td>
<td>M3 Bolt</td>
<td>FT-320-05</td>
<td>150*2</td>
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<td>R15</td>
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<td></td>
<td>Ø1.5 Cylinder type</td>
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<td>Ø2 Cylinder type</td>
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<td></td>
<td></td>
<td>Ø2 Cylinder type</td>
<td>FTCS-220-05</td>
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<tr>
<td></td>
<td>Standard type</td>
<td>M3 Bolt SUS type (30mm)</td>
<td>FTS-320-05</td>
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<td>R15 (SUS part 10R)</td>
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<td>M3 Bolt SUS type (45mm)</td>
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<td>M4 Bolt</td>
<td>FT-420-10</td>
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<td>Free cut</td>
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<td>Ø3 Cylinder type</td>
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<td>Ø1</td>
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<td>Plastic</td>
<td>FTP-320-10</td>
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<td>M4 Bolt SUS type (30mm)</td>
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<td>R30 (SUS part 10R)</td>
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<td>M4 Bolt SUS type (45mm)</td>
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<tr>
<td>Heat-resistant type</td>
<td>Line-up</td>
<td>M4 Bolt</td>
<td>FT-420-10H</td>
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<td>R30</td>
<td>-40 to 105°C</td>
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</tr>
<tr>
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<td></td>
<td>M4 Bolt</td>
<td>FT-420-15H1</td>
<td>500*2</td>
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<td>R50</td>
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<td>M4 Bolt glass type</td>
<td>GT-420-13H2</td>
<td>400*2</td>
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<td>2m</td>
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<tr>
<td>Side view</td>
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<td>Ø2.47 Cylinder type</td>
<td>FTCSN-2520-05</td>
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<td>Ø0.0125</td>
<td>R15</td>
<td>2m</td>
<td>-40 to 60°C</td>
</tr>
</tbody>
</table>

※1: The sensing distance is a standard for BF5 Series.
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※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.
※4: Fiber optic cable out of the rated length can be customizizable.
※5: The sensing distance can be shortened about max. 20% than the normal according to condition of the cable. [(FC-2) should be used for cutting fiber cable.]
※6: is for BF5R, BF4R Series.
## Dimensions

<table>
<thead>
<tr>
<th>Model</th>
<th>Diffuse reflective type</th>
<th>Model</th>
<th>Diffuse reflective type</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDU-210-05R</td>
<td>M2-D0.5 / ※Hood material: SUS304</td>
<td>FDC-320-06B</td>
<td>M3-D0.6</td>
</tr>
<tr>
<td>FDFN-210-05R</td>
<td>M2-D0.5 / ※Hood material: SUS304</td>
<td>FD-420-06B</td>
<td>M4-D0.6</td>
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<tr>
<td>FDF-210-05R</td>
<td>M2-D0.5 / ※Hood material: SUS304</td>
<td>FD-620-13B</td>
<td>M6-D1.3</td>
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<td>FD-320-05(R)</td>
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<td>FDC-320-05</td>
<td>M3-D0.5</td>
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<td>FD-420-05(R)</td>
<td>M4-D0.5</td>
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<td>Ø3-D0.5 / SUS Ø1.5×15mm</td>
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<tr>
<td>FD-820-10(R)</td>
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<td>M3-D0.5 / SUS Ø1.5×90mm</td>
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<tr>
<td>FD-320-06B</td>
<td>M3-D0.6</td>
<td>FDS2-320-05</td>
<td>M3-D0.5 / SUS Ø1.5×45mm</td>
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※ Hood material: SUS304
## Dimensions

<table>
<thead>
<tr>
<th>Model</th>
<th>Diffuse reflective type</th>
<th>Model</th>
<th>Diffuse reflective type</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDS-420-05</td>
<td>M4-D0.5 / SUS Ø1.5×90mm</td>
<td>FD-320-F1</td>
<td>Co-axial M3 / Ø0.5, Ø0.25×9</td>
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<tr>
<td>FDS2-420-05</td>
<td>M4-D0.5 / SUS Ø1.5×45mm</td>
<td>FD-620-F2</td>
<td>Co-axial M6 / Ø1.0, Ø0.265×16</td>
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<tr>
<td>FDS-620-10</td>
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<td>FD-620-10H</td>
<td>M6-D1.0 / Heat-resistant 105°C</td>
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<tr>
<td>FDS2-620-10</td>
<td>M6-D1.0 / SUS Ø2.5×45mm</td>
<td>FD-620-15H</td>
<td>M6-D1.5 / Heat-resistant 150°C</td>
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<tr>
<td>FDP-320-10</td>
<td>D1.0×2 / Plastic</td>
<td>GD-420-20H2</td>
<td>M4-D0.05×1000 / Heat-resistant 250°C</td>
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<td>FD-320-F</td>
<td>Co-axial M3 / Ø0.5, Ø0.25×4</td>
<td>GD-620-20H2</td>
<td>M6-D0.05×1000 / Heat-resistant 250°C</td>
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<tr>
<td>FDCSN-320-05</td>
<td>Ø3 / SUS Ø1.47×20 / Side view</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Diagram of Dimensions](image)
### Dimensions

<table>
<thead>
<tr>
<th>Model</th>
<th>Convergent reflective type</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLF-320-10</td>
<td>M3-D1.0 / convergent reflective type</td>
</tr>
<tr>
<td>FTU-210-05R</td>
<td>M2-D0.5 / ※Hood material: SUS304</td>
</tr>
<tr>
<td>FTU-210-05R</td>
<td>M3-D0.5</td>
</tr>
<tr>
<td>FTC-220-05R</td>
<td>Ø2-D0.5</td>
</tr>
<tr>
<td>FTC-210-05R</td>
<td>M2-D0.5 / ※Hood material: SUS304</td>
</tr>
<tr>
<td>FTC-320-05R</td>
<td>M3-D0.5</td>
</tr>
<tr>
<td>FTC-420-10R</td>
<td>M4-D1.0</td>
</tr>
<tr>
<td>FTC-320-06B</td>
<td>M3-D0.6</td>
</tr>
<tr>
<td>FTC-1520-06B</td>
<td>Ø1.5-D0.6</td>
</tr>
<tr>
<td>FTU-310-10R</td>
<td>M2-D0.5 / ※Hood material: AL</td>
</tr>
<tr>
<td>FTC-420-13B</td>
<td>M4-D1.3</td>
</tr>
</tbody>
</table>

### Selection Guide

- **Dimensions**
- **Model**
- **Convergent reflective type**
- **FTFU-210-05R**
- **FTFN-210-05R**
- **FTF-210-05R**
- **FTFB-210-05R**
- **FTLU-310-10R**
- **FTLU1-310-10R**
- **FTLU2-310-10R**

### Table

<table>
<thead>
<tr>
<th>Model</th>
<th>L1</th>
<th>L2</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTFU-210-05R</td>
<td>12.2</td>
<td>10</td>
</tr>
<tr>
<td>FTU1-310-10R</td>
<td>17.2</td>
<td>15</td>
</tr>
<tr>
<td>FTU2-310-10R</td>
<td>22.2</td>
<td>20</td>
</tr>
</tbody>
</table>

### Diagram

- **Photo electric sensor**
- **Fiber optic sensor**
- **Door/Area sensor**
- **Proximity sensor**
- **Pressure sensor**
- **Rotary encoder**
- **Connector/Socket**
- **Temp. controller**
- **SSR/Power controller**
- **Counter**
- **Panel meter**
- **Tacho/Speed/Pulse meter**
- **Display unit**
- **Sensor controller**
- **Stepping motor/Driver&Controller**
- **Graphic/Logic panel**
- **Field network device**
# Selection Guide

## Dimensions

<table>
<thead>
<tr>
<th>Model</th>
<th>Through-beam type</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTC-1520-05</td>
<td>Φ1.5-D0.5</td>
<td>Ø1.5-D0.5 / Plastic</td>
</tr>
<tr>
<td>FTP-320-10</td>
<td>D1.0</td>
<td>Ø1.0×15mm</td>
</tr>
<tr>
<td>FTCS-220-05</td>
<td>Φ2-D0.5 / SUS Ø1.0×15mm</td>
<td>Ø2×D0.5 / Plastic</td>
</tr>
<tr>
<td>FTS-320-05</td>
<td>M3-D0.5 / SUS Ø1.0×90mm</td>
<td>M3-D0.5 / SUS Ø1.0×90mm</td>
</tr>
<tr>
<td>FTS1-320-05</td>
<td>M3-D0.5 / SUS Ø1.0×35mm</td>
<td>M3-D0.5 / SUS Ø1.0×35mm</td>
</tr>
<tr>
<td>FTS2-320-05</td>
<td>M3-D0.5 / SUS Ø1.0×45mm</td>
<td>M3-D0.5 / SUS Ø1.0×45mm</td>
</tr>
<tr>
<td>FT-420-10</td>
<td>M4-D1.0</td>
<td>M4-D1.0</td>
</tr>
<tr>
<td>FT-420-10H</td>
<td>M4-D1.0 / Heat-resistant 105℃</td>
<td>M4-D1.0 / Heat-resistant 105℃</td>
</tr>
<tr>
<td>FT-420-15H1</td>
<td>M4-D1.0 / Heat-resistant 150℃</td>
<td>M4-D1.0 / Heat-resistant 150℃</td>
</tr>
<tr>
<td>FTC-320-10</td>
<td>Φ3-D1.0</td>
<td>Φ3-D1.0</td>
</tr>
<tr>
<td>FTCN-2520-05</td>
<td>Ø2.47-D0.5 / SUS Ø0.8×15mm</td>
<td>Ø2.47-D0.5 / SUS Ø0.8×15mm</td>
</tr>
</tbody>
</table>

- Free cut
- Adapter

---

*Autonics*
**Lens unit for long distance detection (sold separately)**

- **Model:** FTL-M26
  - ![Lens unit](image1)
  - ![Mounting at cable](image2)

- **Mounting of lens**
  Mount the lens unit on the 3mm projecting point of the front hood.

- **Ambient temperature range of lens unit**
  It should be used within -40 to 100°C (not over 100°C.)

- **Applicable fiber optic cable and max. mounting distance**
  - FT-420-10: 2500mm
  - FT-420-10H: 1500mm

- **Dimensions**
  - ![Dimensions diagram](image3)
  - M2.6×0.45
  - Depth: 4mm

**Micro spot fiber optic cable and lens unit (sold separately)**

- **Model**
  - Fiber optic cable: FDC-320-F
  - Micro spot lens: FDC-2

- **Feature data**
  - **Measuring method**
    - ![Graph](image4)
  - **Beam spot characteristic**

- **Application**
  - Protect cable from impact or cutting
  - ![Application](image5)

**Protection tube for fiber optic cable (sold separately)**

- **Application**
  - Protect cable from impact or cutting
  - ![Application](image6)

- **Accessory**
  - **Fiber cutter**
    - Applications: Cutting fiber optic cable, free cut type
    - ![Fiber cutter](image7)
  - **Adapter**
    - ![Adapter](image8)
    - Adapter marked fiber optic cable should be used with adapter
    - ![Adapter](image9)

- **Lens for long distance detection (sold separately)**
  - ![Lens unit](image10)
  - ![Mounting at cable](image11)

- **Mounting of lens**
  Mount the lens unit on the 3mm projecting point of the front hood.

- **Ambient temperature range of lens unit**
  It should be used within -40 to 100°C (not over 100°C.)

- **Dimensions**
  - ![Dimensions diagram](image12)

- **Micro spot fiber optic cable and lens unit (sold separately)**
  - ![Micro spot fiber optic cable and lens unit](image13)

- **Feature data**
  - **Measuring method**
    - ![Graph](image14)
  - **Beam spot characteristic**

- **Protection tube for fiber optic cable (sold separately)**
  - ![Protection tube for fiber optic cable](image15)

- **Application**
  - Protect cable from impact or cutting
  - ![Application](image16)

- **Accessory**
  - **Fiber cutter**
    - Applications: Cutting fiber optic cable, free cut type
    - ![Fiber cutter](image17)
  - **Adapter**
    - ![Adapter](image18)
    - Adapter marked fiber optic cable should be used with adapter
    - ![Adapter](image19)

- **Lens for long distance detection (sold separately)**
  - ![Lens unit](image20)
  - ![Mounting at cable](image21)

- **Mounting of lens**
  Mount the lens unit on the 3mm projecting point of the front hood.

- **Ambient temperature range of lens unit**
  It should be used within -40 to 100°C (not over 100°C.)

- **Dimensions**
  - ![Dimensions diagram](image22)

- **Micro spot fiber optic cable and lens unit (sold separately)**
  - ![Micro spot fiber optic cable and lens unit](image23)

- **Feature data**
  - **Measuring method**
    - ![Graph](image24)
  - **Beam spot characteristic**

- **Protection tube for fiber optic cable (sold separately)**
  - ![Protection tube for fiber optic cable](image25)

- **Application**
  - Protect cable from impact or cutting
  - ![Application](image26)

- **Accessory**
  - **Fiber cutter**
    - Applications: Cutting fiber optic cable, free cut type
    - ![Fiber cutter](image27)
  - **Adapter**
    - ![Adapter](image28)
    - Adapter marked fiber optic cable should be used with adapter
    - ![Adapter](image29)

- **Lens for long distance detection (sold separately)**
  - ![Lens unit](image30)
  - ![Mounting at cable](image31)

- **Mounting of lens**
  Mount the lens unit on the 3mm projecting point of the front hood.

- **Ambient temperature range of lens unit**
  It should be used within -40 to 100°C (not over 100°C.)

- **Dimensions**
  - ![Dimensions diagram](image32)

- **Micro spot fiber optic cable and lens unit (sold separately)**
  - ![Micro spot fiber optic cable and lens unit](image33)

- **Feature data**
  - **Measuring method**
    - ![Graph](image34)
  - **Beam spot characteristic**

- **Protection tube for fiber optic cable (sold separately)**
  - ![Protection tube for fiber optic cable](image35)

- **Application**
  - Protect cable from impact or cutting
  - ![Application](image36)

- **Accessory**
  - **Fiber cutter**
    - Applications: Cutting fiber optic cable, free cut type
    - ![Fiber cutter](image37)
  - **Adapter**
    - ![Adapter](image38)
    - Adapter marked fiber optic cable should be used with adapter
    - ![Adapter](image39)