



PHOTOELECTRIC SENSOR

## DIGITAL FIBER SENSOR

FX-300 SERIES



Conforming to  
EMC Directive



UL Recognition

Constant advances achieving the highest level of performance in its class



# The FX-300 series of next-generation fiber sensors provides the highest level of sensing performance in its class

'Stable sensing', 'high sensing performance', 'easy operation', 'improved ease of maintenance' and 'preservation of the environment' are the five concepts underlying the new FX-300 series!

June 2004  
FX-301 advances  
even further  
(Refer to p.34 for details)

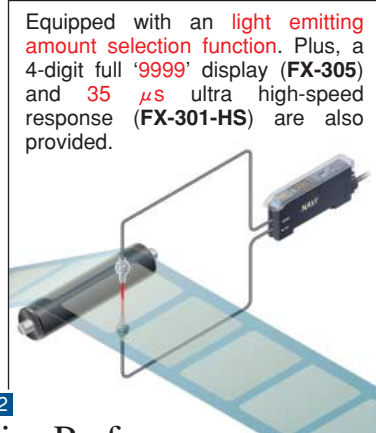




Concept 1

High Stability

## FX-300 SERIES



Concept 2

Superior Performance



Lead-free solder used is gentle on the environment.

Concept 5

Eco-friendly

Concept 5

Concept 3

Easy operation

Only two switches, the large MODE key and the large jog switch, are required for operation.

P.3

P.4

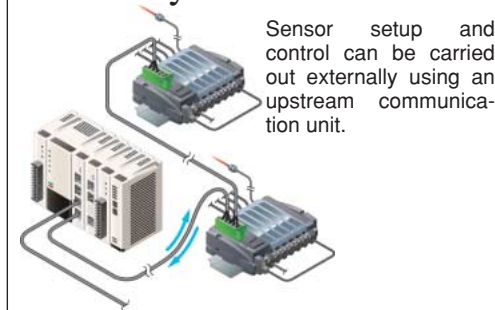
P.8

P.6

P.7

Concept 4

Easy Maintenance



## Full range of fibers

Wide lineup

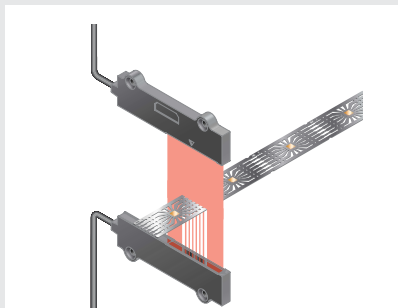
### P.9 Guide for each industry

Description of different fibers and performance for each industry

LCD • Semiconductor / P.9 to P.12



Electronic component • Automatic assembly / P.13 to P.14



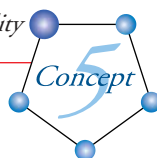
Pharmaceutical • Packaging / P.15



# High Stability

Concept 1

High Stability



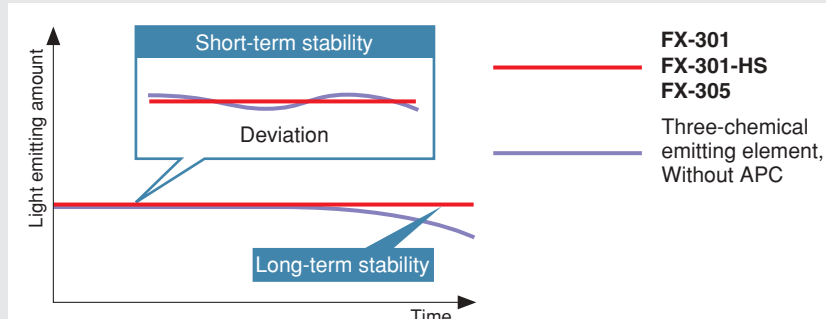
## Stable sensing over long and short periods

Stability enhancement

FX-301 FX-301-HS FX-305

In addition to a 'four-chemical emitting element' which suppresses changes in the light emitting element over time so that a stable level of light emission can be maintained over long periods, a 'APC' (Auto Power Control) circuit' has also been adopted afreshly. The light emitting amount can be controlled in minute degrees so that even changes occurring over very short periods can be handled, allowing stable sensing performance by suppressing deviations in light emitting amounts caused by changes in the ambient environment that could not previously be suppressed.

### • Stable sensing comparison

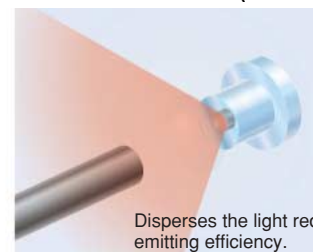


## Even greater sensing range

FX-301/B/G/H FX-301-HS FX-305

Adoption of a 'double coupling lens' that increases emission efficiency to its maximum limits and greatly increases sensing range. Sensing ranges with small diameter fibers and ultra-small diameter fibers, which have become very popular due to the miniaturization of chip components, have been increased by 50 % over previous values achieved with other amplifiers.

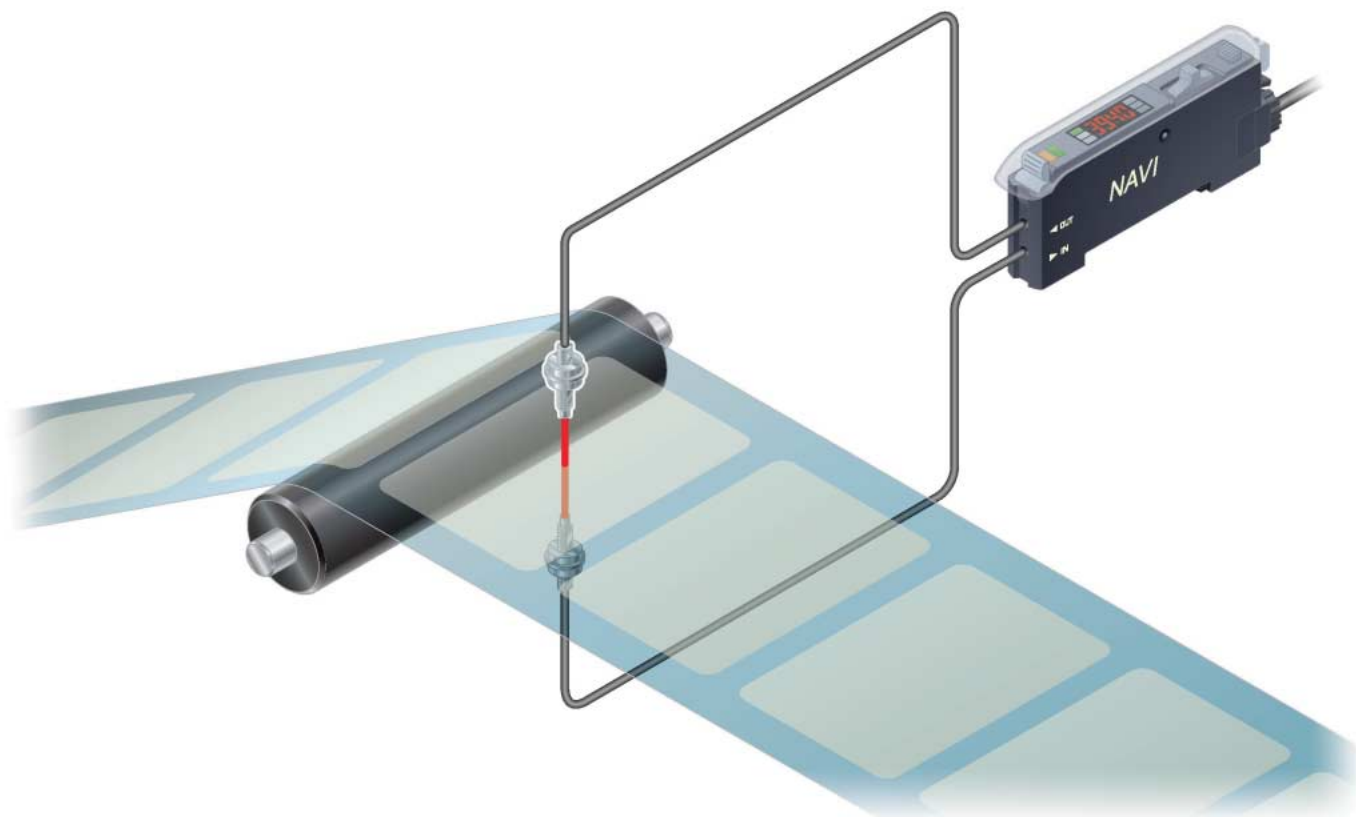
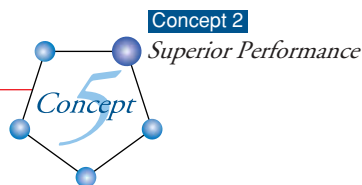
### • Conventional fiber sensors (Without lens)



### • Double coupling lens

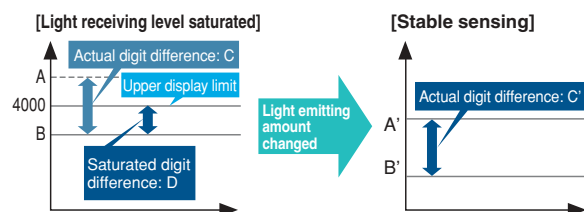


# Superior Performance



## Light-emitting amount selection

If the light receiving level becomes saturated during close-range sensing or when sensing transparent or minute objects, you can adjust the light emitting amount of the sensor to stabilize sensing **without needing to change the response time**. Sensing that previously required the response time or fibers to be changed can now be set much more easily using this function.



FX-301 FX-301-HS FX-305



Light emitting amount can be changed without changing response time

## Large display 9999

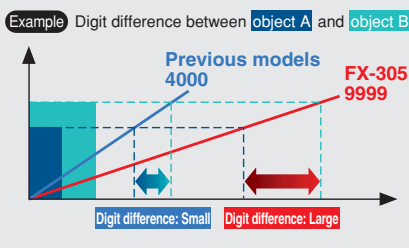
2.5 times previous models

Large display with 4 digits (9999). With a greater difference in digit value than previous models, threshold values can be set in units of 1 digit up to maximum 9999. Threshold setting can now be done more easily and accurately.



(During STDF, LONG and U-LG modes)

### Digit difference comparison

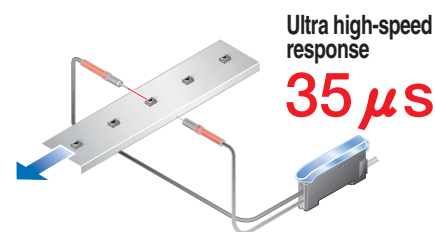


## Ultra high-speed 35 $\mu$ s response

4 times as fast as before

FX-301-HS

Ultra high-speed 35  $\mu$ s response. Even small objects moving at high speeds can be sensed. In addition, at 65  $\mu$ s the FX-301 standard type is also twice as fast as previous models.



### Ultra high-speed type FX-301-HS

(H-SP mode)

35  $\mu$ s

### Standard type FX-301, High-function type FX-305

(H-SP mode)

65  $\mu$ s

### Previous model

150  $\mu$ s

## Simplified systems using new operating modes

FX-305

A window comparator mode and differential sensing mode have been added. These modes make it easy to carry out sensing tasks that previously required multiple sensors or involved complex threshold settings.

### • Window comparator mode



<Sensing ICs in trays>



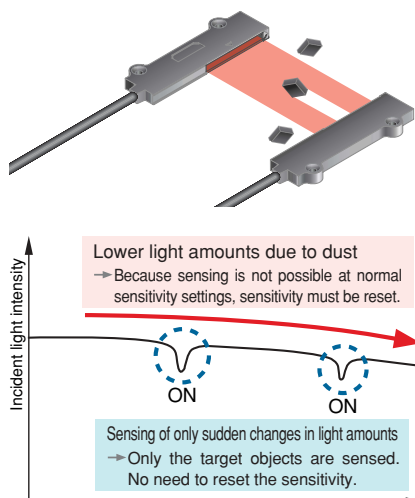
| Tray absent | IC present | Tray present |
|-------------|------------|--------------|
| OFF         | ON         | OFF          |

Upper and lower limits for threshold values can be set so that the incident light intensity can turn on and off within those ranges. Single output is used, so that only one cable is required, and no PLC processing is required either.

### • Differential sensing mode



<Sensing of tiny moving objects>

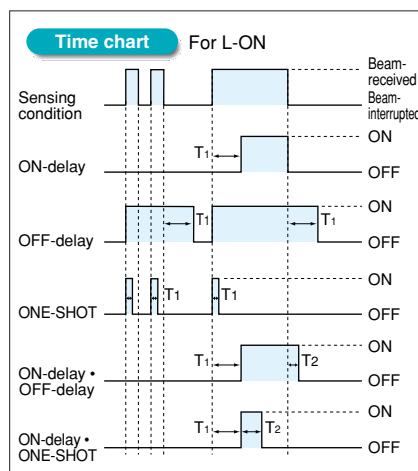


## Equipped with 5 types timers

FX-305

The **FX-305** includes the same ON-delay / OFF-delay / ONE-SHOT timer as the **FX-301(-HS)**, as well as an ON-delay•OFF-delay timer and an ON-delay•ONE-SHOT timer. A wide variety of timer control operations can be carried out by these fiber sensors alone.

Timer period: Output 1 0.5 to 9,999 ms (variable)  
Output 2 0.5 to 500 ms (variable)



## Multi-purpose 2-output

Two independent output channels are provided, so that one sensor can be used for control tasks that previously required two sensors. In addition, the second output channel can be used for simple self-diagnosis and alarm output, so that ease of maintenance is improved.



FX-305

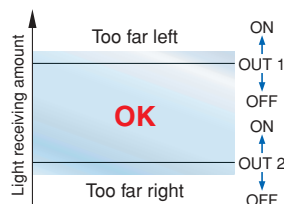
**New Alarm output:** Output 2 is set concurrently with output 1

Drops in light amounts due to problems such as broken fibers or dirty tips are detected and output. When output 1 threshold value teaching is carried out with the **FX-305**, output 2 is set concurrently with the setting shifted by the amount of surplus.

Drops in surplus amounts of light intensity due to dust or other particles can therefore be detected and output.



### • Comparison with previous models Example Sensing meandering of sheets

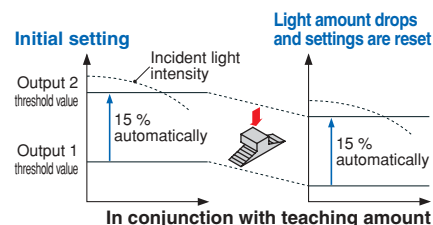
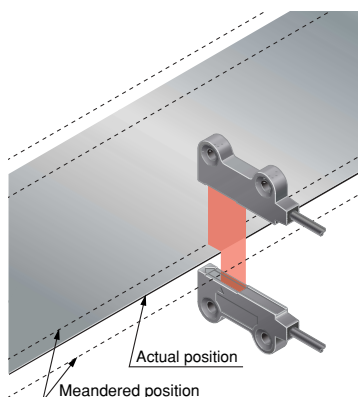


[Previous models]

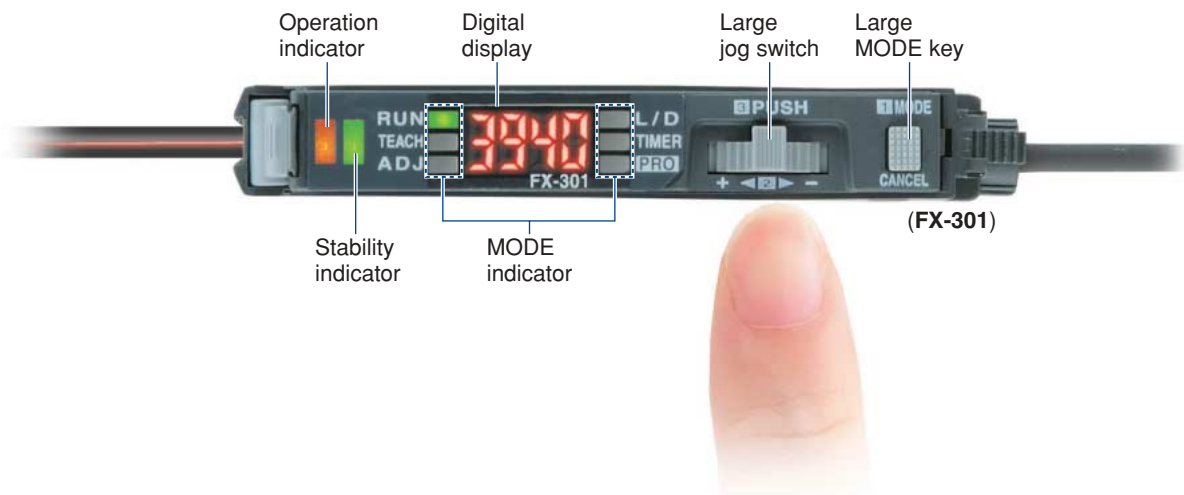
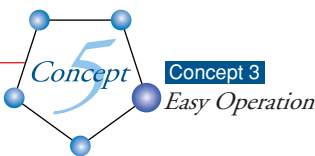
2 sensors needed

[FX-305]

1 sensor is enough!



# Easy operation



## Even beginners can quickly learn how to use the MODE NAVI

MODE NAVI uses six indicators to display the amplifier's basic operations. The current operating mode can be confirmed at a glance, so even a first time user can easily operate the amplifier without becoming confused.

|              |  |                                                                                     |
|--------------|--|-------------------------------------------------------------------------------------|
| <b>RUN</b>   |  | <b>RUN→</b>                                                                         |
| <b>TEACH</b> |  | This is the sensing mode. Incident light level is displayed in the digital display. |
| <b>ADJ</b>   |  |                                                                                     |
| <b>RUN</b>   |  | <b>TEACH→</b>                                                                       |
| <b>TEACH</b> |  | This mode is for setting the threshold value.                                       |
| <b>ADJ</b>   |  |                                                                                     |
| <b>RUN</b>   |  | <b>ADJ→</b>                                                                         |
| <b>TEACH</b> |  | In this mode, the threshold value, once set, may be fine-tuned.                     |
| <b>ADJ</b>   |  |                                                                                     |



|                | FX-301/B/G/H                                                                                                                       | FX-301-HS | FX-305 |
|----------------|------------------------------------------------------------------------------------------------------------------------------------|-----------|--------|
| <b>L/D</b>     |                                                                                                                                    |           |        |
| <b>TIMER</b>   |                                                                                                                                    |           |        |
| <b>PRO</b>     |                                                                                                                                    |           |        |
| <b>L/D ON→</b> | This mode allows the selection of output operation as either Light-ON or Dark-ON.                                                  |           |        |
| <b>TIMER→</b>  | This mode permits the choice of using or not using the timer.                                                                      |           |        |
| <b>PRO→</b>    | This mode allows the selection of further advanced functions, such as the copying of individual settings and the memory functions. |           |        |

## The use of only two switches makes for very simple operations

FX-301/B/G/H FX-301-HS FX-305

Only two switches, the large jog switch and the large MODE key, are required for operation. Depressing the large MODE key sets the 'mode selection' and 'mode cancel' functions. The large jog switch is used to select from the detailed functions available within each mode, as well as to change numerical values after the mode has been chosen.

● Large MODE key

1 Pressing the switch selects or cancels the operating mode

● Large jog switch

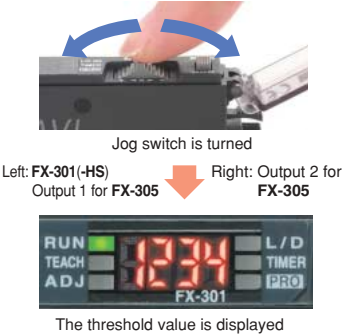
2 Moving the switch from side to side allows items to be selected

3 Pressing the switch then confirms the selected setting

## Easy confirming of threshold value settings

FX-301 FX-301-HS FX-305

The threshold value can be confirmed by turning the jog switch even during RUN mode.



## Improved workability! Data bank switching and teaching can be carried out externally

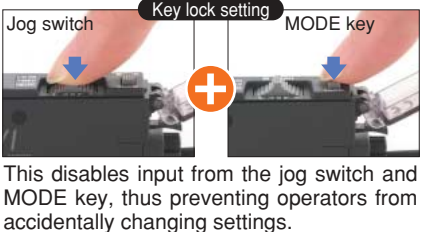
FX-301 FX-305

The **FX-CH2** external input unit (optional) can be used to carry out teaching and data bank switching operations externally without needing to operate the digital fiber sensors directly. This greatly improves ease of workability during setup.



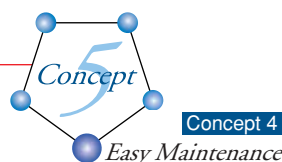
## Key lock function prevents accidental setting changes

FX-301/B/G/H FX-301-HS FX-305



This disables input from the jog switch and MODE key, thus preventing operators from accidentally changing settings.

# Easy Maintenance



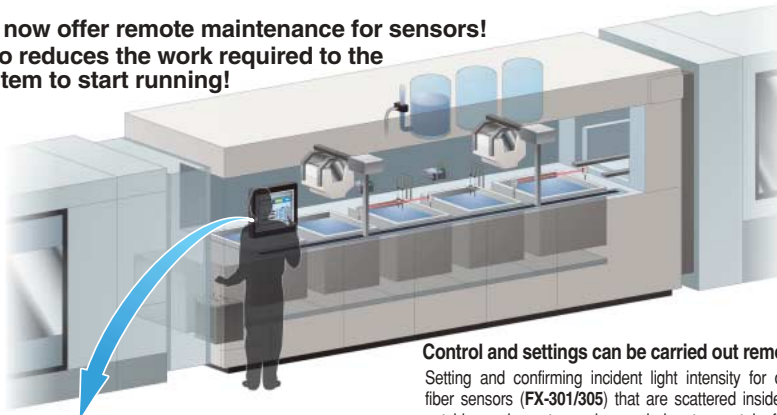
## Communication unit improves equipment starting up and maintenance

### upstream communication unit SC-GU1-485

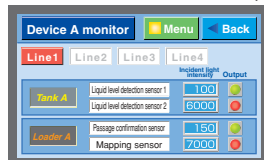
FX-301 FX-305

The communication unit enables inputs to the digital fiber sensors (such as teaching and data bank switching) to be carried out via a PLC, and also allows confirming of the incident light intensity an output status for the fiber sensors. This greatly improves workability during equipment starting up and maintenance.

**We now offer remote maintenance for sensors!  
Also reduces the work required to the system to start running!**



<Touch screen monitor example>



[Communicable commands]

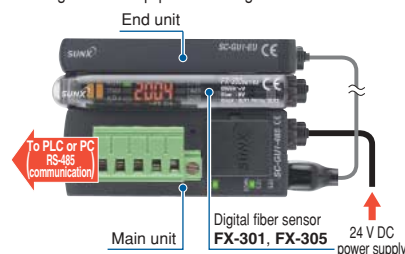
- Sensor incident light intensity
- Sensor settings verification
- Sensor output status
- Threshold value settings, etc.

The sensor settings and operation can be checked on the touch screen, greatly improving ease of operation!

Ideal for workplaces such as semiconductor and LCD manufacturing lines where there are restrictions on operators entering and exiting.

**Control and settings can be carried out remotely**

Setting and confirming incident light intensity for digital fiber sensors (FX-301/305) that are scattered inside and outside equipment can be carried out remotely for all sensors by using the SC-GU1-485, which greatly improves ease of operations such as monitoring equipment that is running and also equipment starting and maintenance.



### External input unit FX-CH2

FX-301 FX-305

Teaching and data bank switching for up to a maximum of 16 digital fiber sensors (FX-301 and FX-305) can be carried out all at once using an external device such as a PLC, touch screen or switch.

**Support for stable sensing and smooth setup changes!**

#### ■ Setup changes (external automatic teaching / data bank switching)

Digital fiber sensor settings can be changed using input from a touch screen or switch, so that production line setup changes can be carried out more easily.

#### ● External teaching

Full-auto teaching is recommended for teaching when the sensing object is changed without stopping the line.

#### ● Data bank switching

Settings such as output operations (L-ON / D-ON) and timer operations can be recorded in the digital fiber sensor's data bank and switching can be carried out externally.

※ Up to 3 files can be stored.

#### ■ FX-CH2 function list

##### Teaching input

The following types of external teaching can be carried out.

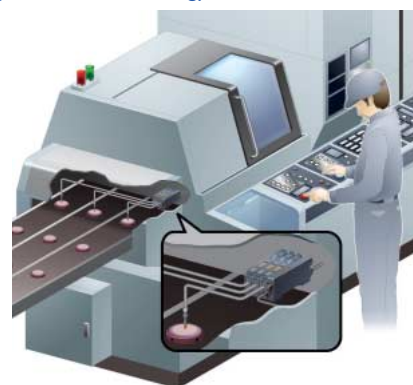
- Full-auto teaching
- Limit teaching '—'
- Limit teaching '+'
- 2-level teaching

##### Data bank switching input

Switching between 3 channels of data banks and loading and saving of all channels at once can be carried out.

##### Key lock setting input

The key lock function that prevents incorrect operations by operators can be set on and off.

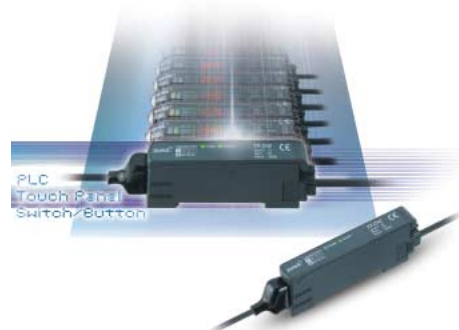


#### ■ Product lineup

Connector for input device  
CN-EP1 [1 pc. included with FX-CH2(-P)]

External input unit FX-CH2(-P)

Quick-connection cable  
CN-73-C□ (optional)

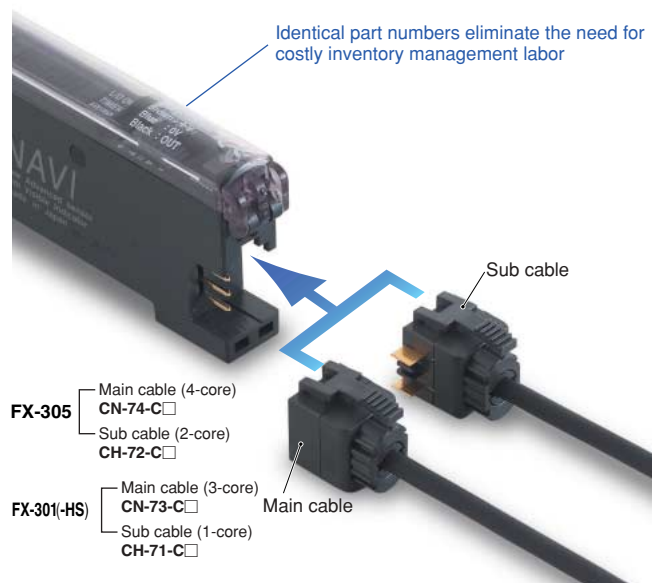


## Wiring- and labor-saving design allows side-by-side configuration for up to sixteen units

FX-301/B/G/H FX-301-HS FX-305

### One unit can be used as either a main unit or sub unit

The amplifier unit can be used as either a main unit or a sub unit. This feature allows for easy mounting in the side-by-side configuration. The main and sub unit functions are distinguished only by the proper use of the main cable and the sub cable. Moreover, inventory management and maintenance is simplified.



## An optical communication function allows up to 16 sensors to be adjusted simultaneously

FX-301/B/G/H FX-305

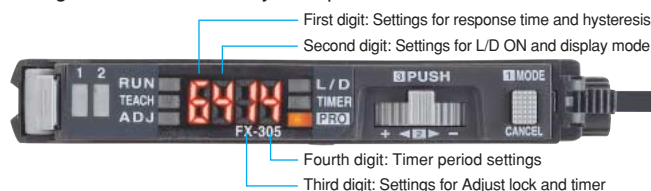
The optical communication function allows the data that is currently set to be copied and saved all at once for all amplifiers connected together from the right side. This greatly reduces troublesome setup tasks and makes setup much smoother. In addition, troublesome adjustment operations at times such as when replacing sensors can also be carried out easily and data can also be copied and stored using the optical communication function.



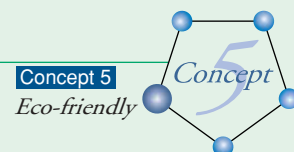
※ Use the optical communication function for only the same types of sensors. Furthermore, the FX-301-HS is not equipped with optical communication function capability. Refer to p. 30 for details.

## Settings can be entered directly using numerical input

Every function can be directly set merely by the input of a four digit code (numbers) from the code table. This convenient feature is easy to set up. In the event that settings are accidentally changed at the operating site, merely entering the correct code can restore the original settings. This results in easy and quick maintenance.



## Eco-friendly

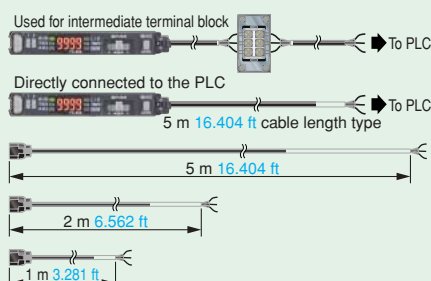


### Lead-free solder used is gentle on the environment

SUNX promotes the use of lead-free materials in all of its sensor manufacturing processes including those used for the FX-300 series of digital fiber sensors.

### Selectable cable length

Made available are 3 lengths, 1 m 3.281 ft, 2 m 6.562 ft, and 5 m 16.404 ft, to suit your application requirements. This helps reduce the waste caused by cutting cables and lightens the installation workload.



### Reduced power consumption possible (ECO mode)

This turns off the digital display to reduce power consumption to approximately 600 W or less. (960 W is consumed when the display is on.)

### Environmentally friendly packaging

With regard to effects on the environment, we only utilize the simplest of packaging methods greatly contributing to the reduction in wastes generated by your worksite. Also, the bags are made of polyethylene, a substance that doesn't give off polluting gases when burned.

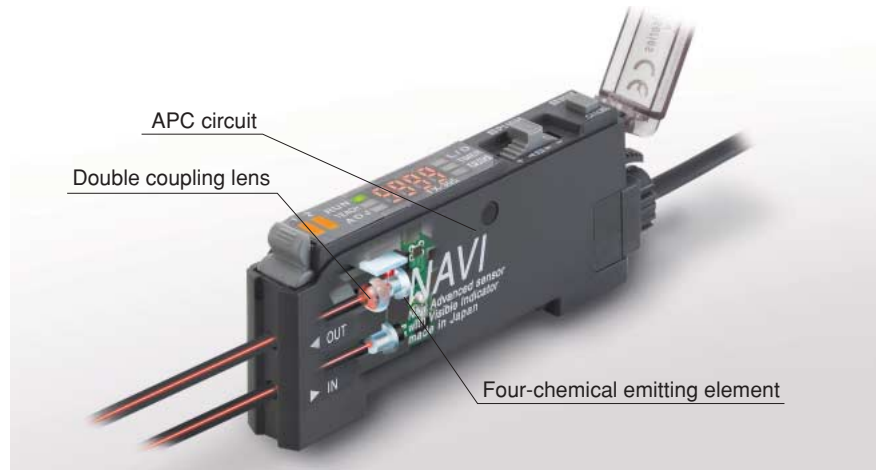
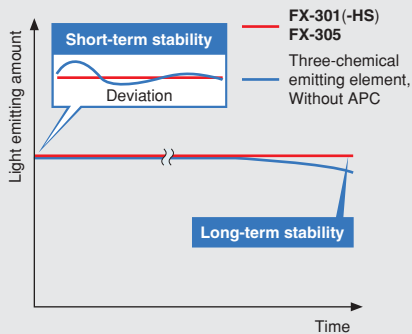


## Improved stability over long and short periods

FX-301 FX-301-HS FX-305

A **four-chemical emitting element** for stable sensing over long periods has been added, in addition to an **APC** (Auto Power Control) circuit that suppresses fluctuations in light amount over short periods. The light amount becomes stable a short period after the power is turned on, so setup time can be reduced.

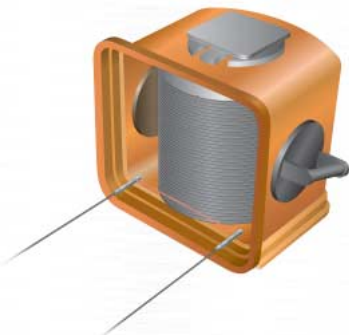
### • Stable sensing comparison



## Mapping fiber

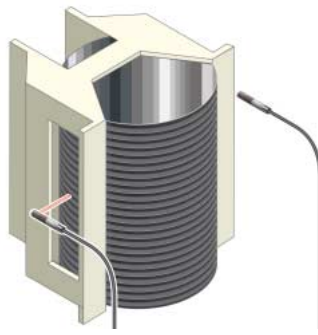
FT-KV1, FT-KV8, FR-KV1

This ultra-narrow optical beam fiber is ideal for mapping wafers.



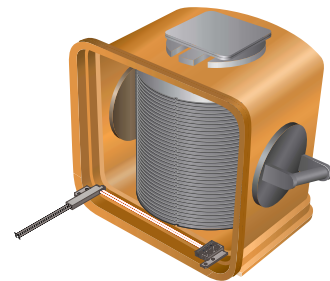
### 1.5 mm 0.059 in thickness FT-KV1

W2 × H1.5 × D20 mm **W0.079 × H0.059 × D0.787 in** ultra-compact size allows this sensor to be installed even in thin 200 mm **7.874 in** wafer handlers.



### Aperture angle 2° FT-KV8, FT-KV8

Aperture angle for the ultra-narrow optical beam is 2° or less. The light does not spread much at all, so that stable sensing can be obtained.



### Retroreflective type FR-KV1

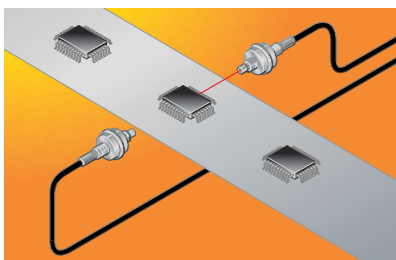
With a thickness of 2.3 mm **0.091 in**, this fiber can be installed almost anywhere, and it is a retroreflective type so optical beam axis alignment is simple.

## Heat-resistant fiber

FT-H□, FD-H□

A variety of types are available, including a convergent reflective type for accurately sensing glass substrates, and a type with a bending radius of 10 mm **0.394 in** that hardly takes up any space.

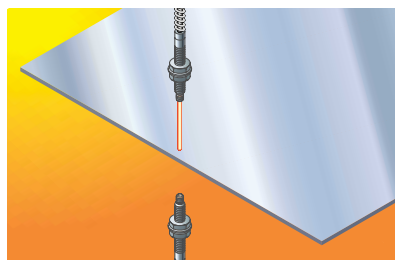
### IC detection within a high temperature handler



### Flexible type FT-H20W-M2

Withstands temperatures of +200 °C **+392 °F** and has a bending radius of 10 mm **0.394 in**, this fiber can be installed almost anywhere.

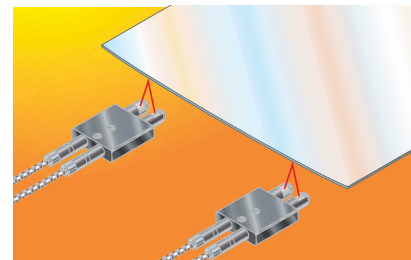
### Glass substrate detection



### Heat-resistant 350 °C +662 °F FD-H35-M2

Can be used in temperatures ranging from -60 to +350 °C **-76 to +662 °F**. Stable sensing is obtained even at temperatures exceeding +300 °C **+572 °F**.

### Glass substrate detection



### Convergent reflective type FD-H30-L32, FD-H18-L31

Accurately senses glass substrates at high temperatures of +300 °C **+572 °F**.

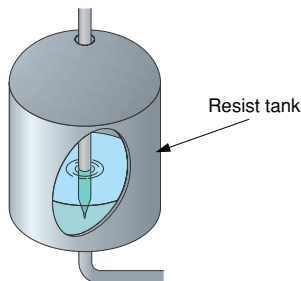
## Large display 9999

FX-305

Large display with 4 digits (9999).

Extremely fine settings for detecting minute changes can be made to provide more stable sensing for items such as transparent objects.

Contact type liquid level  
detection fiber FD-F8Y



[Example of using liquid level detection fiber sensor (LONG mode)]

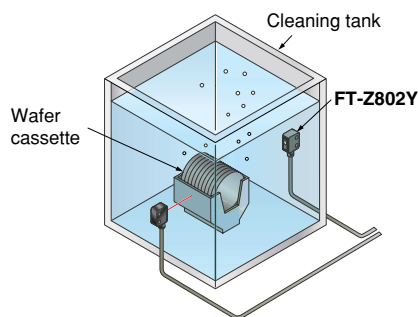
| Previous display |                             | FX-305         |                             |
|------------------|-----------------------------|----------------|-----------------------------|
|                  | <digit value> <Extra width> |                | <digit value> <Extra width> |
| Liquid absent    | 500 } 460                   | Liquid absent  | 2000 } <b>1840</b>          |
| Liquid present   | 40                          | Liquid present | 160                         |

Extra display width has been increased!

### Around liquids • Chemical-resistant fiber FT-Z802Y, FD-F705, FT-F902

Chemical-resistant fiber with fluorine resin coatings over the whole of the fiber, leak detection fiber that quickly sense leaks such as from detergents, and liquid detection fiber that accurately sense liquid levels are among the lineup of fibers that are ideal for liquid sensing.

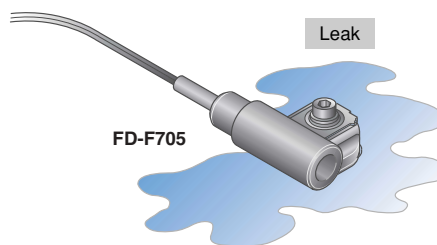
Detecting wafer cassette in cleaning tank



#### Chemical-resistant fiber FT-Z802Y

Fluorine resin coating allows fiber to be used with confidence even where contact with chemicals may occur.

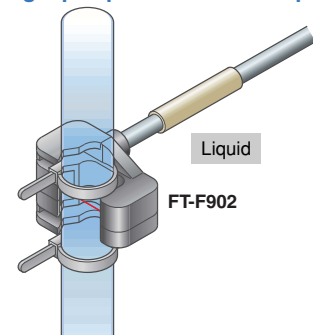
Detecting leak liquid in cleaning tank  
(Note)



#### Leak detection fiber FD-F705

The unique effect of capillarity enables reliable detection of small leaks and viscous liquids.

Detecting liquid presence within a pipe  
(Note)



#### Liquid detection fiber FT-F902

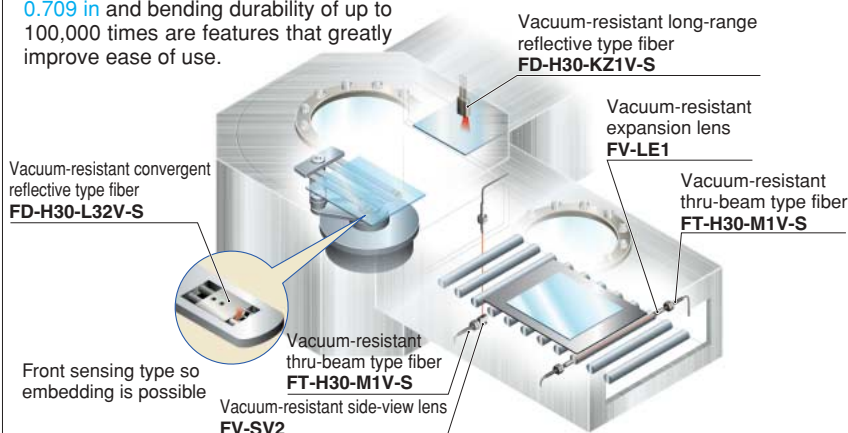
Even if pipe diameters and thicknesses vary, the center of the beam axis always follows a straight line along the pipe, so that the setup environment has almost no effect on sensing.

Note: Use the **FX-301-F** amplifier that is specially designed for leak / liquid detection. For details, please refer to the 'sensor general catalog 2003-2004' or 'SUNX homepage' (<http://www.sunx.co.jp/>).

### Vacuum-resistant fiber

FT/FD-□V

The vacuum-resistant fiber lineup lets you select the best fiber for the application. Withstanding temperatures of up to +300 °C +572 °F, a bending radius of 18 mm 0.709 in and bending durability of up to 100,000 times are features that greatly improve ease of use.



#### Vacuum-resistant convergent reflective type FD-H30-L32V-S

• Sensing range: 0 to 8 mm 0 to 0.315 in (LONG mode)

#### Vacuum-resistant long-range reflective type FD-H30-KZ1V-S

• Sensing range: 20 to 200 mm 0.787 to 7.874 in (LONG mode)

#### Vacuum-resistant thru-beam type FT-H30-M1V-S

• Sensing range: 250 mm 9.843 in (LONG mode)

#### Vacuum-resistant side-view lens FV-SV2

• Sensing range greatly increased without taking up space

#### Vacuum-resistant expansion lens FV-LE1

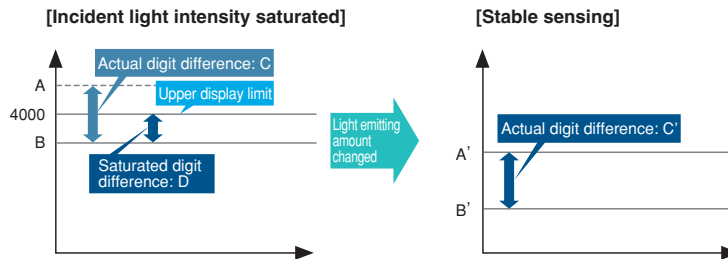
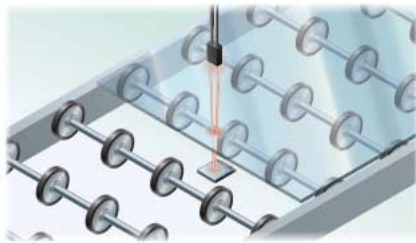
• Sensing range increased by 4 times or more

## Light emitting amount selection function

FX-301 FX-301-HS FX-305

When sensing transparent objects and minute objects, the light emitting amount can be changed without changing the response time, even for cases where the incident light intensity is fully saturated, which was not possible with conventional models. This allows stable sensing to be maintained, and there is no longer any need to change the sensing range or change the fiber sensor as used to be required.

Example: Sensing glass substrate



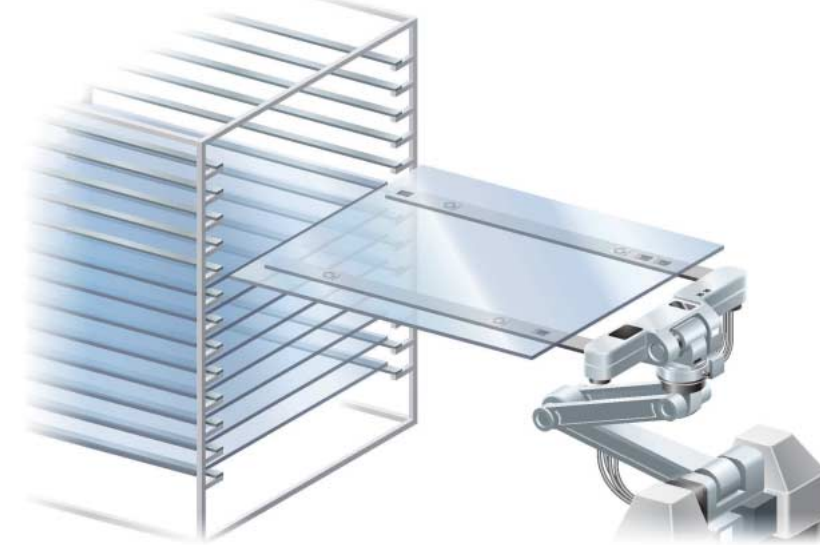
### Comparison of saturation remedies

| Previous models             |                                                                                   | FX-301(-HS), FX-305                                                                     |
|-----------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Remedy                      | Problem                                                                           |                                                                                         |
| • Changing response time    | Mode selection → Affects positioning precision                                    | Light emitting amount selection function makes steps such as those at left unnecessary. |
| • Changing fiber            | Change to thinner fiber to reduce light amount → Cost and man-hour inefficiencies |                                                                                         |
| • Changing setting position | Increase sensing range → Man-hour and space inefficiencies                        |                                                                                         |

### Fiber for glass substrate conveyor

FD-L40 series, FR-WKZ11

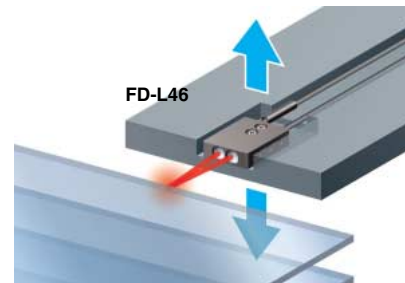
Fibers are available which are ideal for glass substrate conveyor processes.



#### Alignment / Convergent reflective type FD-L43, FD-L45

Even glass substrates with  $\pm 8^\circ$  (FD-L45:  $\pm 6^\circ$ ) of flexure can be stably sensed.

- High flexure of  $\pm 8^\circ$  (FD-L43)
- Long sensing range 30 mm 1.181 in (FD-L45)



#### Mapping / Convergent reflective type FD-L46

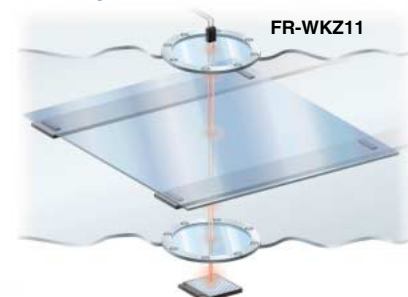
Accurate mapping even for 0.5 mm 0.020 in thin glass substrates.  
A light weight of approximately 39 g means it can even be installed at the ends of handlers.



#### Seating confirmation / Convergent reflective type FD-L44

Long sensing range 0 to 6 mm 0 to 0.236 in for seating confirmation.

#### Sensing glass substrate through a view port



#### Retroreflective type FR-WKZ11

A polarization filter allows accurate sensing of glass substrates that pass by the view port.

- Long sensing range 1.5 m 4.921 ft (when sensing glass substrates)

## External data bank switching and teaching are possible

External input unit FX-CH2

FX-301 FX-305

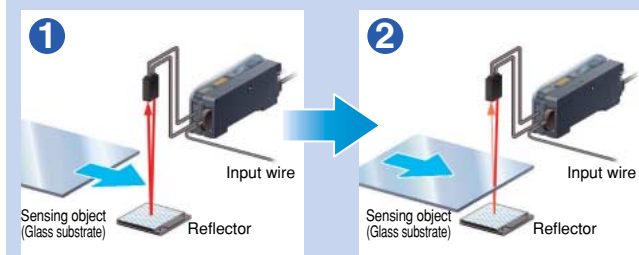
The **FX-CH2** external input unit (optional) can be used to carry out teaching and data bank switching operations externally without needing to operate the digital fiber sensors directly. This is ideal for locations such as clean rooms where entry and exit of personnel are restricted.

### Sensing glass substrate (stable sensing of minute differences)

When sensing transparent objects and extremely small objects, variations in the incident light intensity caused by external factors such as slippage of the beam axis due to vibration can result in incorrect operation.

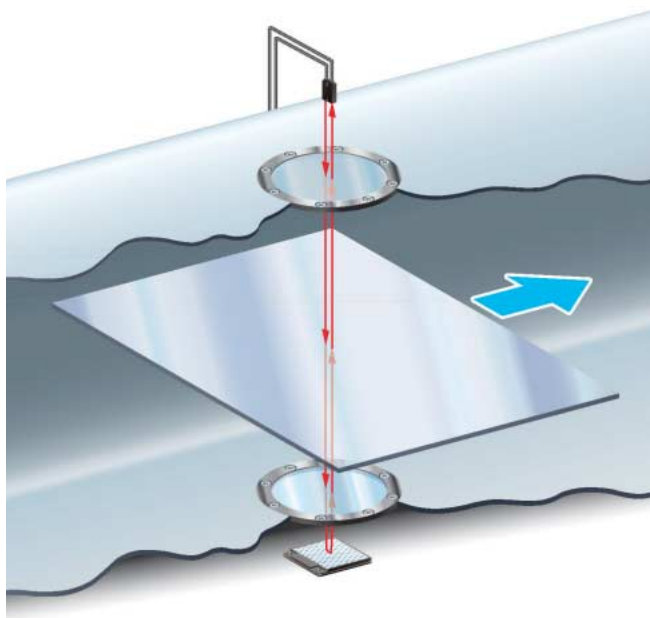
In such cases, periodically setting limit teaching '—' can be used to ensure more stable sensing.

The **FX-CH2** can be used to carry out teaching externally, so that teaching can be carried out much more easily in places where entry and exit of personnel are restricted.



① Carry out limit teaching '—' before the sensing object (glass substrate) arrives (while there is no sensing object present). When the shift value is set to 5 % beforehand, the threshold value is set to a value that is at a level 5 % lower than the incident light intensity during teaching.

② Even when sensing glass substrates with high degrees of transparency (low damping), stable sensing is possible without changes in the light amount due to external causes.



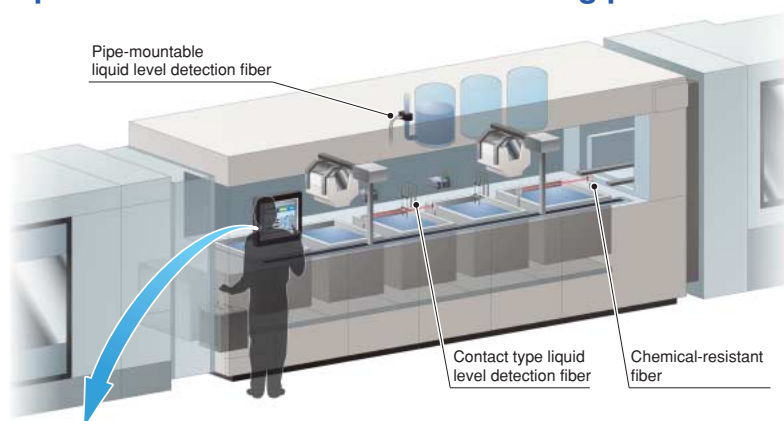
## Upstream communication for reading data and teaching are also possible

Upstream communication unit SC-GU1-485

FX-301 FX-305

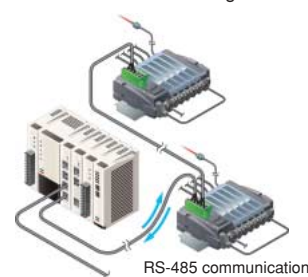
A PLC or computer can be used for sending inputs (teaching or data bank switching) to the digital fiber sensors, and also a communication unit can be used for confirming incident light intensities and output statuses for the digital fiber sensors, which is ideal for equipment such as semiconductor manufacturing equipment in places where entry and exit of personnel are restricted.

### Example of use in semiconductor cleaning process



### High general compatibility so that any type of PLC can be used

RS-485 communication provides a high level of general compatibility so that any type of PLC can be used. Integration with existing systems is possible without the need to change PLCs.



Compatible with all PLCs equipped with RS-485 compatible units

### Communication speed 57.6 kbps

High-speed communication at a maximum speed of 57.6 kbps allows the operator to instantly confirm information such as the incident light intensity and output statuses of the digital sensors.

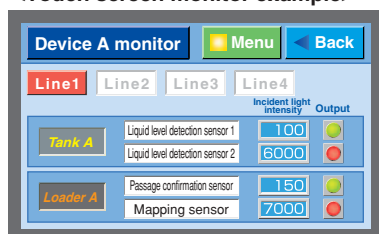
### Series connection of a maximum of 31 nodes is possible

A maximum of 31 nodes can be connected in series. This is ideal for flexible handling when the sensors are to be installed in scattered locations or if more sensors are added.

### Less wiring and installation work

Up to a maximum of 16 sensors can be connected side-by-side. Power can be supplied to all of them at once, so that less wiring and installation work is required. Wire-saving connectors also makes it possible to send output signals to the PLC in a single batch.

### <Touch screen monitor example>



### <Communicable commands>

- Sensor incident light intensity
- Sensor settings verification
- Sensor output status
- Threshold value settings, etc.

The sensor settings and operation can be confirmed on the touch screen, greatly improving ease of operation!

Ideal for workplaces such as semiconductor and LCD manufacturing lines where there are restrictions on operators entering and exiting

## High-speed response 35 $\mu$ s

FX-301-HS

These digital fiber sensors have the fast response time of 35  $\mu$ s. They are ideal for sensing minute objects that are moving at high speeds.

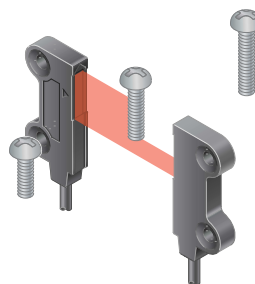


## Independent dual outputs

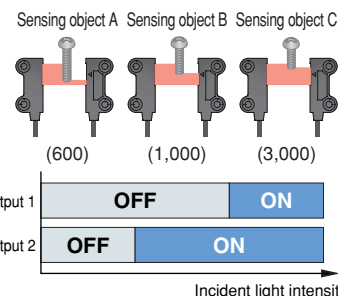
FX-305

Two independent output channels are provided, so that one sensor can be used for control tasks that previously required two sensors. In addition, the second output channel can be used for alarm output and error output, so that ease of maintenance is improved.

**Screw length discrimination**  
[Distinguishing between sensing objects A, B and C]



Output 1 and output 2 can be used together to distinguish between sensing objects A, B and C.



※ A window comparator mode for distinguishing between sensing objects with single output is also available.

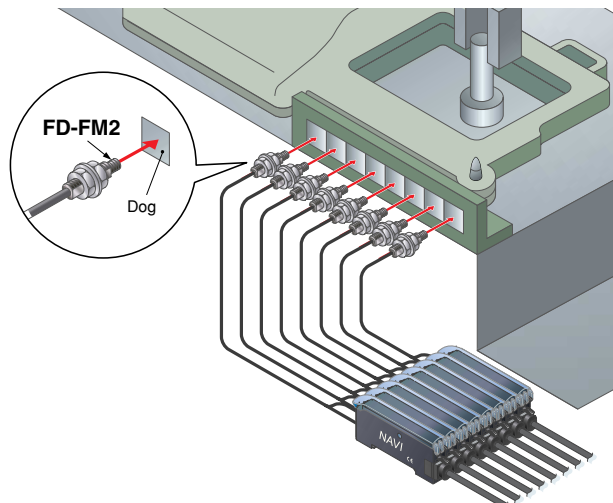
## Interference prevention up to maximum of sixteen units

FX-305

Interference prevention can be set for up to a maximum of 16 units, so that they can be used with confidence in locations where the fibers are installed in contact with each other. In addition, interference prevention for two fibers can be set during 65  $\mu$ s ultra high-speed mode.

| Mode | Interference prevention switching function |               |              |               |
|------|--------------------------------------------|---------------|--------------|---------------|
|      | IP-1                                       |               | IP-2         |               |
|      | No. of units                               | Response time | No. of units | Response time |
| H-SP | 2 units                                    | 65 $\mu$ s    | 4 units      | 130 $\mu$ s   |
| FAST | 4 units                                    | 150 $\mu$ s   | 8 units      | 300 $\mu$ s   |
| STD  | 4 units                                    | 250 $\mu$ s   | 8 units      | 500 $\mu$ s   |
| STDF | 4 units                                    | 700 $\mu$ s   | 8 units      | 1.4 ms        |
| LONG | 4 units                                    | 2.5 ms        | 8 units      | 5 ms          |
| U-LG | 8 units                                    | 4.5 ms        | 16 units     | 9 ms          |

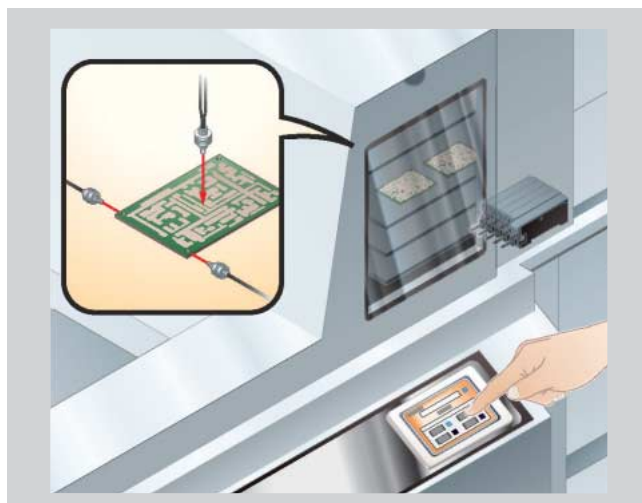
For the FX-301/B/G/H, up to 4 units can be set.  
The FX-301-HS is not equipped with an interference prevention function.



## Improved ease of working! External data bank switching and teaching

FX-301 FX-305

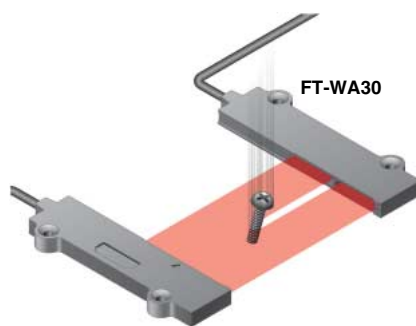
The FX-CH2 external input unit (optional) can be used to carry out teaching and data bank switching operations externally without needing to operate the digital fiber sensors directly. This is very convenient for equipment which requires frequent setup changes.



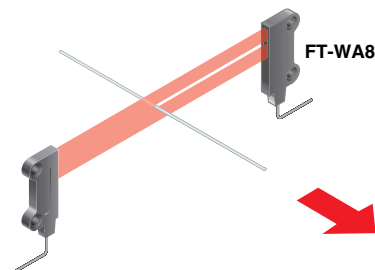
## Wide beam fiber

## FT-WA30/A30, FT-WA8/A8

It has a wide sensing width of 11 mm  $0.433$  in for the **FT-WA8/A8** and 32 mm  $1.260$  in for the **FT-WA30/A30** enabling long distance sensing of objects as far as 3,500 mm  $137.795$  in (with the **FX-301** in long range mode). Optimal for detecting unsteady works or small objects.



Detecting dropping screws



Wire breakage detection

## Finest spot fiber

## FX-MR6 + FD-EG3

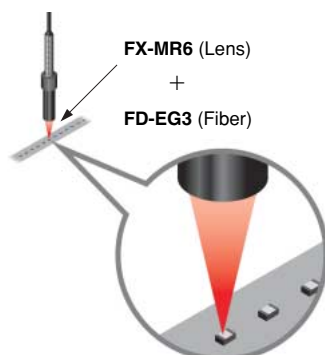
An ultra-small  $\phi 0.1$  mm  $\phi 0.004$  in spot size has now been made possible by combining our precision fiber with our finest spot lens. The orientation of 0603 chips can also be discriminated stably.

## Finest spot lens FX-MR6

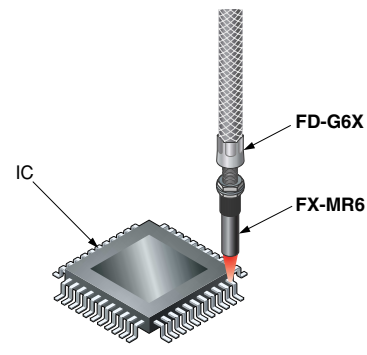
| Fiber model No.  | Distance to focal point             | Spot diameter                          |
|------------------|-------------------------------------|----------------------------------------|
| FD-EG3           | $7 \pm 0.5$ mm $0.276 \pm 0.020$ in | $\phi 0.1$ mm $\phi 0.004$ in approx.  |
| FD-EG2           | $7 \pm 0.5$ mm $0.276 \pm 0.020$ in | $\phi 0.15$ mm $\phi 0.006$ in approx. |
| FD-EG1           | $7 \pm 0.5$ mm $0.276 \pm 0.020$ in | $\phi 0.2$ mm $\phi 0.008$ in approx.  |
| FD-WG4/G4/G6X/G6 | $7 \pm 0.5$ mm $0.276 \pm 0.020$ in | $\phi 0.4$ mm $\phi 0.016$ in approx.  |

## Finest spot lens FX-MR3

| Fiber model No.  | Distance to focal point               | Spot diameter                          |
|------------------|---------------------------------------|----------------------------------------|
| FD-EG3           | $7.5 \pm 0.5$ mm $0.295 \pm 0.020$ in | $\phi 0.15$ mm $\phi 0.006$ in approx. |
| FD-EG2           | $7.5 \pm 0.5$ mm $0.295 \pm 0.020$ in | $\phi 0.2$ mm $\phi 0.008$ in approx.  |
| FD-EG1           | $7.5 \pm 0.5$ mm $0.295 \pm 0.020$ in | $\phi 0.3$ mm $\phi 0.012$ in approx.  |
| FD-WG4/G4/G6X/G6 | $7.5 \pm 0.5$ mm $0.295 \pm 0.020$ in | $\phi 0.5$ mm $\phi 0.020$ in approx.  |



0603 chip orientation discrimination

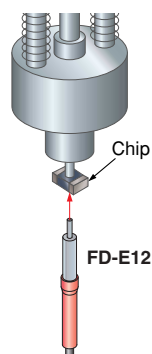


IC pin sensing

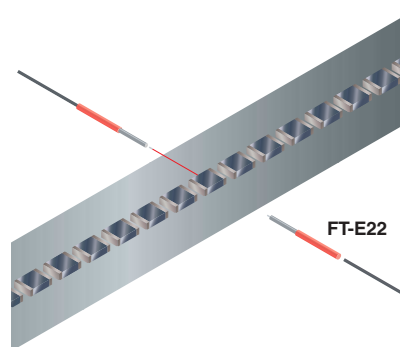
## Ultra small diameter fiber

## FT-E12/E22, FD-E12/E22

Sleeve head diameter of 0.25 mm  $0.010$  in has been realized (**FT-E12**). This has improved the sensing capability for minute objects such as the 0603 chip.



Sensing of chip components during suction transport



Confirming passage of chip components

## Rectangular head fiber

## FT-Z8□/WZ8□

The allowable bending radius is 4 mm  $0.157$  in (1 mm  $0.039$  in for the **FT-WZ8□**). This allows the fibers to be routed with great freedom and uses less space. Because it is installed with only two M2 screws, light beam axis alignment is easy. A front sensing type, side sensing type and top sensing type are provided.



Detecting ICs in transparent stick

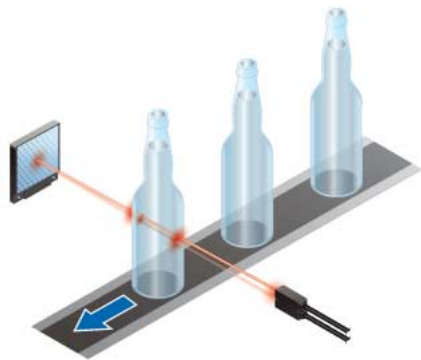


Parts feeder surplus detection

## Retroreflective type fiber

FR-WKZ11, FR-KZ21/22

The lineup includes retroreflective type fibers which are ideal for sensing transparent objects.



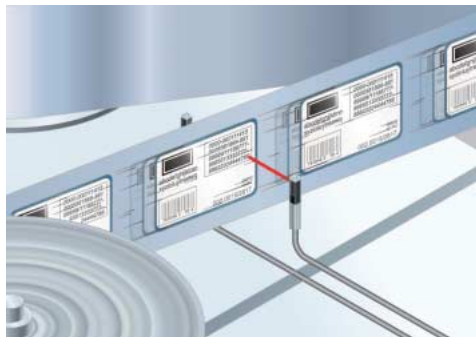
## With polarizing filters FR-WKZ11

This fiber has a compact head of  $W9.5 \times H5.2 \times D15$  mm  $W0.374 \times H0.205 \times D0.591$  in. Equipped with allowable bending radius: R1 mm  $R0.039$  in making it space efficient.

## Side-view fiber

FT-V10

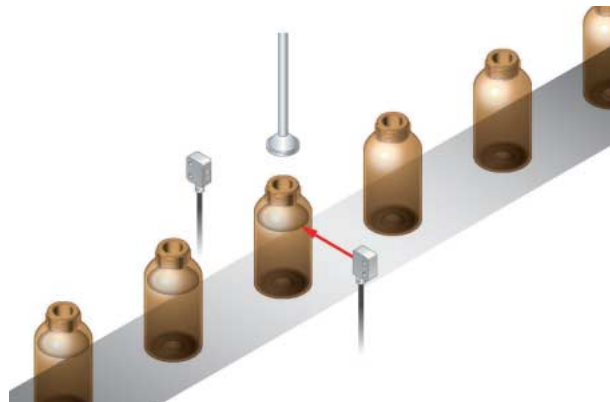
Because this is a side-view fiber, it is ideal for sensing in locations where space is scarce. Has a 4-side beveled shape and beam axis alignment with respect to the beveled surface is done when installing the product, so that the fiber can be installed easily just by aligning its surface.



## Chemical-resistant fiber

FT-Z802Y

With the case made of PFA (fluorine resin) and fiber sheath with PFA (fluorine resin), the fiber can be used with various types of chemical liquids.

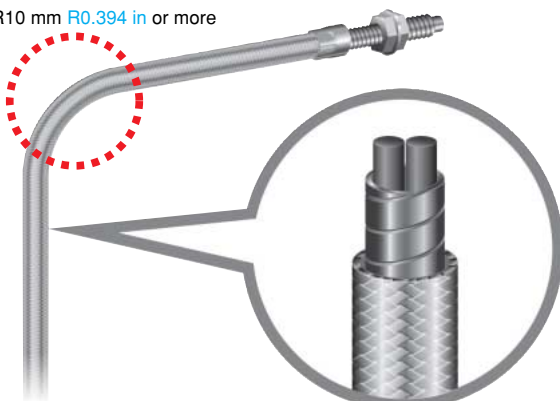


## Tough flexible fiber

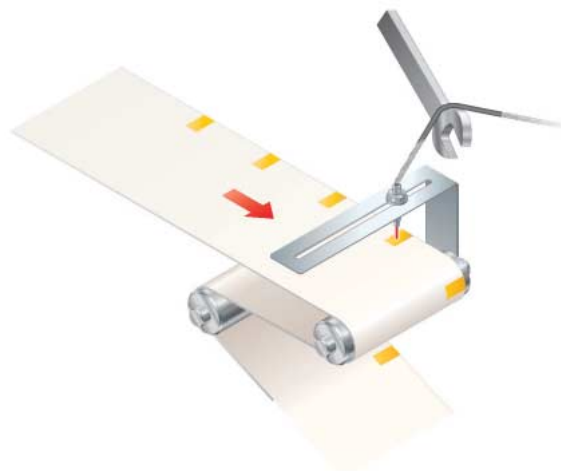
FT-P81X, FD-P81X, FD-G6X

Stainless steel braiding protects the fiber cable and prevents fiber breakage due to snagging.

R10 mm  $R0.394$  in or more



Strong stainless steel mesh protects fiber cables from breakage



## ORDER GUIDE

**Connector type amplifiers** Quick-connection cable is not supplied with the amplifier. Please order it separately.

| Type               | Appearance                                                                          | Model No.  | Emitting element | Output                        | Quick-connection cables |               |               |
|--------------------|-------------------------------------------------------------------------------------|------------|------------------|-------------------------------|-------------------------|---------------|---------------|
|                    |                                                                                     |            |                  |                               | Type                    | Model No.     | Length        |
| Standard type      |    | FX-301     | Red LED          | NPN open-collector transistor | Main cable (3-core)     | CN-73-C1      | 1 m 3.281 ft  |
|                    |                                                                                     | FX-301P    |                  | PNP open-collector transistor |                         |               |               |
|                    |                                                                                     | FX-301B    | Blue LED         | NPN open-collector transistor |                         | CN-73-C2      | 2 m 6.562 ft  |
|                    |                                                                                     | FX-301BP   |                  | PNP open-collector transistor |                         |               |               |
|                    |                                                                                     | FX-301G    | Green LED        | NPN open-collector transistor |                         | CN-73-C5      | 5 m 16.404 ft |
|                    |                                                                                     | FX-301GP   |                  | PNP open-collector transistor |                         |               |               |
|                    |                                                                                     | FX-301H    | Infrared LED     | NPN open-collector transistor | CN-71-C1                | 1 m 3.281 ft  |               |
|                    |                                                                                     | FX-301HP   |                  | PNP open-collector transistor | CN-71-C2                | 2 m 6.562 ft  |               |
| High-speed type    |                                                                                     | FX-301-HS  | Red LED          | NPN open-collector transistor | Sub cable (1-core)      | CN-71-C5      | 5 m 16.404 ft |
|                    |                                                                                     | FX-301P-HS |                  | PNP open-collector transistor |                         |               |               |
| High-function type |  | FX-305     | Red LED          | NPN open-collector transistor | Main cable (4-core)     | CN-74-C1      | 1 m 3.281 ft  |
|                    |                                                                                     |            |                  | CN-74-C2                      |                         | 2 m 6.562 ft  |               |
|                    |                                                                                     |            |                  | CN-74-C5                      |                         | 5 m 16.404 ft |               |
|                    |                                                                                     | FX-305P    |                  | PNP open-collector transistor | Sub cable (2-core)      | CN-72-C1      | 1 m 3.281 ft  |
|                    |                                                                                     |            |                  |                               |                         | CN-72-C2      | 2 m 6.562 ft  |
|                    |                                                                                     |            |                  |                               |                         | CN-72-C5      | 5 m 16.404 ft |

## ORDER GUIDE

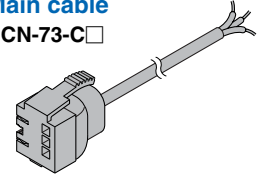
### Quick-connection cables

For FX-301(-HS)/B/G/H **Quick-connection cable is not supplied with the amplifier. Please order it separately.**

| Type                   | Model No.       | Description                  |                                                                                                                                              |
|------------------------|-----------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Main cable<br>(3-core) | <b>CN-73-C1</b> | Length: 1 m <b>3.281 ft</b>  | 0.15 mm <sup>2</sup> 3-core cabtyre cable, with connector on one end<br>Cable outer diameter: $\phi$ 3.0 mm <b><math>\phi</math>0.118 in</b> |
|                        | <b>CN-73-C2</b> | Length: 2 m <b>6.562 ft</b>  |                                                                                                                                              |
|                        | <b>CN-73-C5</b> | Length: 5 m <b>16.404 ft</b> |                                                                                                                                              |
| Sub cable<br>(1-core)  | <b>CN-71-C1</b> | Length: 1 m <b>3.281 ft</b>  | 0.15 mm <sup>2</sup> 1-core cabtyre cable, with connector on one end<br>Cable outer diameter: $\phi$ 3.0 mm <b><math>\phi</math>0.118 in</b> |
|                        | <b>CN-71-C2</b> | Length: 2 m <b>6.562 ft</b>  |                                                                                                                                              |
|                        | <b>CN-71-C5</b> | Length: 5 m <b>16.404 ft</b> |                                                                                                                                              |

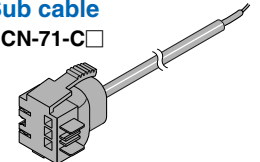
#### Main cable

• **CN-73-C□**



#### Sub cable

• **CN-71-C□**

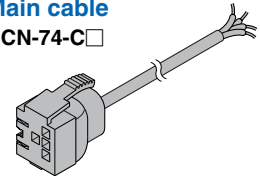


For FX-305 **Quick-connection cable is not supplied with the amplifier. Please order it separately.**

| Type                   | Model No.       | Description                  |                                                                                                                                              |
|------------------------|-----------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Main cable<br>(4-core) | <b>CN-74-C1</b> | Length: 1 m <b>3.281 ft</b>  | 0.15 mm <sup>2</sup> 4-core cabtyre cable, with connector on one end<br>Cable outer diameter: $\phi$ 3.0 mm <b><math>\phi</math>0.118 in</b> |
|                        | <b>CN-74-C2</b> | Length: 2 m <b>6.562 ft</b>  |                                                                                                                                              |
|                        | <b>CN-74-C5</b> | Length: 5 m <b>16.404 ft</b> |                                                                                                                                              |
| Sub cable<br>(2-core)  | <b>CN-72-C1</b> | Length: 1 m <b>3.281 ft</b>  | 0.15 mm <sup>2</sup> 2-core cabtyre cable, with connector on one end<br>Cable outer diameter: $\phi$ 3.0 mm <b><math>\phi</math>0.118 in</b> |
|                        | <b>CN-72-C2</b> | Length: 2 m <b>6.562 ft</b>  |                                                                                                                                              |
|                        | <b>CN-72-C5</b> | Length: 5 m <b>16.404 ft</b> |                                                                                                                                              |

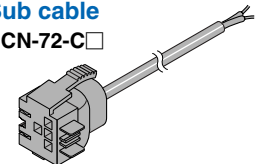
#### Main cable

• **CN-74-C□**

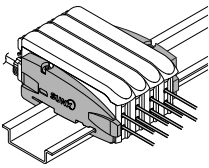


#### Sub cable

• **CN-72-C□**



**End plates** **End plates are not supplied with the amplifier. Please order them separately when the amplifiers are mounted in cascade.**

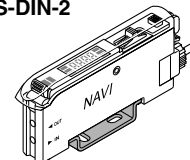
| Appearance                                                                          | Model No.       | Description                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>MS-DIN-E</b> | When cascading multiple amplifiers, or when it moves depending on the way it is installed on a DIN rail, these end plates ensure that all amplifiers are mounted together in a secure and fully connected manner.<br><br><b>Two pcs. per set</b> |

## OPTIONS

| Designation                     | Model No.       | Description                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Amplifier mounting bracket      | <b>MS-DIN-2</b> | Mounting bracket for amplifier                                                                                                                                                                                                                                                                                                        |
| Fiber amplifier protective seal | <b>FX-MB1</b>   | 10 sets of 2 communication window seals and 1 connector seal<br>Communication window seal:<br>It prevents malfunction due to transmission signal from another amplifier, as well as, prevents effect on another amplifier.<br>Connector seal:<br>It prevents contact of any metal, etc., with the pins of the quick-connection cable. |

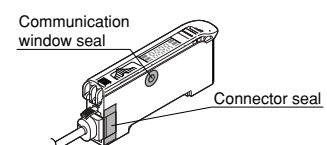
#### Amplifier mounting bracket

• **MS-DIN-2**



#### Fiber amplifier protective seal

• **FX-MB1**

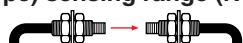


## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked with light blue in the table.

## FX-305 / FX-301 (Red LED type) sensing range (Note 1)

## Thru-beam type (one pair set)



The FX-305 and FX-301(-HS) have different sensing modes.  
 FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
 FX-301(-HS): S-D, H-SP, FAST, STD, LONG (no STDF or U-LG mode)

| Type               | Shape of fiber head<br>(mm in) | Sensing range (mm in)(Note 2)                                                                |                                                                                                                 | Min. sensing object<br>(Note 3)                                                      | Fiber cable length<br>Free-cut                  | Bending radius                                                    | Model No.                                       |                                                  |
|--------------------|--------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------|--------------------------------------------------|
| Threaded type      | M4                             | Lens mountable                                                                               | <div><div>1,600 62.992</div><div>1,100 43.307</div><div>700 27.559</div><div>530 20.866</div></div>             | <div><div>400 15.748</div><div>200 7.874</div><div>180 7.087</div></div>             | φ 0.04 mm<br>φ 0.0016 in<br>opaque object       | <div><div>Free-cut</div><div>2 m</div><div>6.562 ft</div></div>   | R25 mm<br>R0.984 in                             | FT-B8                                            |
|                    |                                | Lens mountable                                                                               |                                                                                                                 |                                                                                      |                                                 |                                                                   |                                                 | FT-FM2                                           |
|                    |                                | Sleeve 90 mm 3.543 in                                                                        | <div><div>1,000 39.370</div><div>780 30.709</div><div>500 19.685</div><div>400 15.748</div></div>               | <div><div>280 11.024</div><div>150 5.906</div><div>130 5.118</div></div>             | φ 0.03 mm<br>φ 0.0012 in<br>opaque object       |                                                                   | Fiber R25 mm<br>R0.984 in                       | FT-FM2S                                          |
|                    |                                | Sleeve 40 mm 1.575 in                                                                        |                                                                                                                 |                                                                                      |                                                 |                                                                   | Sleeve R10 mm<br>R0.394 in                      | FT-FM2S4                                         |
|                    |                                | Lens mountable                                                                               | <div><div>750 29.528</div><div>570 22.441</div><div>350 13.780</div><div>290 11.417</div></div>                 | <div><div>200 7.874</div><div>90 3.543</div><div>100 3.937</div></div>               | φ 0.03 mm<br>φ 0.0012 in<br>opaque object       | <div><div>R1 mm</div><div>R0.039 in</div></div>                   |                                                 | FT-W8                                            |
|                    |                                | Lens mountable                                                                               | <div><div>900 35.433</div><div>650 25.591</div><div>400 15.748</div><div>320 12.598</div></div>                 | <div><div>230 9.055</div><div>100 3.937</div><div>110 4.331</div></div>              | φ 0.04 mm<br>φ 0.0016 in<br>opaque object       |                                                                   | <div><div>R4 mm</div><div>R0.157 in</div></div> | FT-P80                                           |
|                    |                                | Lens mountable                                                                               | <div><div>900 35.433</div><div>650 25.591</div><div>380 14.961</div><div>320 12.598</div></div>                 | <div><div>230 9.055</div><div>100 3.937</div><div>110 4.331</div></div>              | φ 0.05 mm<br>φ 0.0020 in<br>opaque object       |                                                                   | 1 m<br>3.281 ft                                 | <div><div>R10 mm</div><div>R0.394 in</div></div> |
|                    |                                | Tough flexible                                                                               |                                                                                                                 |                                                                                      |                                                 |                                                                   |                                                 |                                                  |
|                    |                                | Lens mountable                                                                               | <div><div>550 21.654</div><div>400 15.748</div><div>250 9.843</div><div>190 7.480</div></div>                   | <div><div>140 5.512</div><div>70 2.756</div><div>80 3.150</div></div>                | φ 0.04 mm<br>φ 0.0016 in<br>opaque object       | <div><div>Free-cut</div><div>2 m</div><div>6.562 ft</div></div>   | <div><div>R4 mm</div><div>R0.157 in</div></div> | Flexible                                         |
|                    | Nut type                       | <div><div>W7 × H9 × D13.9</div><div>W0.276 × H0.354 × D0.547</div></div>                     | <div><div>750 29.528</div><div>570 22.441</div><div>350 13.780</div><div>290 11.417</div></div>                 | <div><div>200 7.874</div><div>90 3.543</div><div>100 3.937</div></div>               | φ 0.06 mm<br>φ 0.0024 in<br>opaque object       | <div><div>Free-cut</div><div>2 m</div><div>6.562 ft</div></div>   | <div><div>R1 mm</div><div>R0.039 in</div></div> | <div><div>NEW</div></div> FT-WR80                |
|                    |                                | <div><div>With lens</div><div>W7 × H9 × D14.6</div><div>W0.276 × H0.354 × D0.575</div></div> | <div><div>1,500 59.055</div><div>1,200 47.244</div><div>750 29.528</div><div>600 23.622</div></div>             | <div><div>420 16.535</div><div>200 7.874</div><div>210 8.268</div></div>             | φ 0.04 mm<br>φ 0.0016 in<br>opaque object       |                                                                   | <div><div>NEW</div></div> FT-WR80L              |                                                  |
|                    | Elbow                          | Lens mountable                                                                               | <div><div>740 29.134</div><div>530 20.866</div><div>320 12.598</div><div>230 9.055</div></div>                  | <div><div>150 5.906</div><div>75 2.953</div><div>80 3.150</div></div>                | φ 0.04 mm<br>φ 0.0016 in<br>opaque object       | <div><div>Free-cut</div><div>2 m</div><div>6.562 ft</div></div>   | R25 mm<br>R0.984 in                             | FT-R80                                           |
|                    | M3                             | Lens mountable (except FX-LE2)                                                               | <div><div>1,000 39.370</div><div>780 30.709</div><div>500 19.685</div><div>400 15.748</div></div>               | <div><div>280 11.024</div><div>150 5.906</div><div>130 5.118</div></div>             | φ 0.03 mm<br>φ 0.0012 in<br>opaque object       | <div><div>Free-cut</div><div>2 m</div><div>6.562 ft</div></div>   | R25 mm<br>R0.984 in                             | FT-T80                                           |
|                    |                                |                                                                                              |                                                                                                                 |                                                                                      |                                                 |                                                                   |                                                 | FT-NFM2                                          |
|                    |                                | Sleeve 90 mm 3.543 in                                                                        | <div><div>400 15.748</div><div>270 10.630</div><div>200 7.874</div><div>140 5.512</div></div>                   | <div><div>100 3.937</div><div>55 2.165</div><div>49 1.929</div></div>                | φ 0.025 mm<br>φ 0.0010 in<br>opaque object      |                                                                   | Fiber R25 mm<br>R0.984 in                       | FT-NFM2S                                         |
|                    |                                | Sleeve 40 mm 1.575 in                                                                        |                                                                                                                 |                                                                                      |                                                 |                                                                   | Sleeve R10 mm<br>R0.394 in                      | FT-NFM2S4                                        |
|                    |                                |                                                                                              | <div><div>220 8.661</div><div>160 6.299</div><div>100 3.937</div><div>80 3.150</div></div>                      | <div><div>55 2.165</div><div>25 0.984</div><div>28 1.102</div></div>                 | φ 0.02 mm<br>φ 0.0008 in<br>opaque object       | <div><div>R1 mm</div><div>R0.039 in</div></div>                   | FT-W4                                           |                                                  |
|                    |                                | <div><div>350 13.780</div><div>250 9.843</div><div>150 5.906</div><div>100 3.937</div></div> | <div><div>75 2.953</div><div>30 1.181</div><div>35 1.378</div></div>                                            |                                                                                      | <div><div>R4 mm</div><div>R0.157 in</div></div> | Flexible                                                          | FT-P40                                          |                                                  |
| Long sensing range |                                | With lens                                                                                    | <div><div>19,500 767.715</div><div>19,500 767.715</div><div>19,500 767.715</div><div>14,000 551.180</div></div> | <div><div>10,000 393.700</div><div>3,500 137.795</div><div>3,800 149.606</div></div> | φ 0.4 mm<br>φ 0.016 in<br>opaque object         | <div><div>Free-cut</div><div>10 m</div><div>32.808 ft</div></div> | R25 mm<br>R0.984 in                             | FT-FM10L                                         |

Notes: 1) Refer to p.27 for the sensing ranges for the FX-301(-HS) in H-SP mode and for the FX-301B/G/H.

2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

3) The minimum sensing object size is the value for red LED type. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type.

The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.

## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked with light blue in the table.

## FX-305 / FX-301 (Red LED type) sensing range (Note 1)

## Thru-beam type (one pair set)



The FX-305 and FX-301(-HS) have different sensing modes.  
 FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
 FX-301(-HS): S-D, H-SP, FAST, STD, LONG (no STDF or U-LG mode)

| Type             | Shape of fiber head<br>(mm in) | Sensing range (mm in)(Note 2)                                                                                                                                              | Min. sensing<br>object<br>(Note 3)                                         | Fiber cable<br>length<br>Free-cut                    | Bending<br>radius   | Model No.  |
|------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|------------------------------------------------------|---------------------|------------|
| Cylindrical type | $\phi 3$ $\phi 0.118$          | With lens · Long sensing range<br>$\phi 3$ $\phi 0.118$<br>1,500 59.055<br>1,200 47.244<br>750 29.528<br>600 23.622                                                        | U-LG: 420 16.535<br>LONG: 200 7.874<br>STDF: 210 8.268<br>STD: 200 7.874   | $\phi 0.02$ mm<br>$\phi 0.0008$ in<br>opaque object  | 2 m<br>6.562 ft     | FT-WS8L    |
|                  |                                | $\phi 3$ $\phi 0.118$<br>780 30.709<br>570 22.441<br>340 13.386<br>290 11.417                                                                                              | FAST: 200 7.874<br>H-SP: 90 3.543<br>S-D: 100 3.937                        | $\phi 0.05$ mm<br>$\phi 0.0020$ in<br>opaque object  |                     | FT-WS3     |
|                  |                                | With lens · Long sensing range<br>$\phi 2.5$ $\phi 0.098$<br>2,000 78.740<br>1,600 62.992<br>600 23.622<br>800 31.496                                                      | U-LG: 580 22.835<br>LONG: 170 6.693<br>STDF: 280 11.024<br>STD: 280 11.024 | $\phi 0.02$ mm<br>$\phi 0.0008$ in<br>opaque object  | R25 mm<br>R0.984 in | FT-SFM2L   |
|                  |                                | $\phi 2.5$ $\phi 0.098$<br>1,000 39.370<br>780 30.709<br>500 19.685<br>400 15.748                                                                                          | FAST: 280 11.024<br>H-SP: 150 5.906<br>S-D: 130 5.118                      | $\phi 0.03$ mm<br>$\phi 0.0012$ in<br>opaque object  | 2 m<br>6.562 ft     | FT-SFM2    |
|                  | $\phi 2.5$ $\phi 0.098$        | $\phi 2.5$ $\phi 0.098$<br>750 29.528<br>570 22.441<br>350 13.780<br>290 11.417                                                                                            | FAST: 200 7.874<br>H-SP: 90 3.543<br>S-D: 100 3.937                        |                                                      | R1 mm<br>R0.039 in  | FT-WS8     |
|                  |                                | $\phi 1.5$ $\phi 0.059$<br>400 15.748<br>270 10.630<br>200 7.874<br>140 5.512                                                                                              | FAST: 100 3.937<br>H-SP: 55 2.165<br>S-D: 49 1.929                         | $\phi 0.025$ mm<br>$\phi 0.0010$ in<br>opaque object | 2 m<br>6.562 ft     | FT-SNFM2   |
|                  |                                | $\phi 1.5$ $\phi 0.059$<br>220 8.661<br>160 6.299<br>100 3.937<br>80 3.150                                                                                                 | FAST: 55 2.165<br>H-SP: 25 0.984<br>S-D: 28 1.102                          | $\phi 0.02$ mm<br>$\phi 0.0008$ in<br>opaque object  | R1 mm<br>R0.039 in  | FT-WS4     |
|                  |                                | $\phi 1.5$ $\phi 0.059$<br>350 13.780<br>280 11.024<br>160 6.299<br>120 4.724                                                                                              | FAST: 90 3.543<br>H-SP: 40 1.575<br>S-D: 42 1.654                          |                                                      | 1 m<br>3.281 ft     | FT-P2      |
|                  | $\phi 1$ $\phi 0.039$          | $\phi 1$ $\phi 0.039$<br>100 3.937<br>80 3.150<br>50 1.969<br>40 1.575                                                                                                     | FAST: 30 1.181<br>H-SP: 13 0.512<br>S-D: 17 0.669                          | $\phi 0.02$ mm<br>$\phi 0.0008$ in<br>opaque object  | 500 mm<br>19.685 in | FT-PS1     |
|                  |                                | Ultra-small diameter<br>Beam diameter $\phi 0.125$ mm $\phi 0.005$ in<br>$\phi 0.25$ $\phi 3$<br>$\phi 0.010$ $\phi 0.118$<br>20 0.787<br>18 0.709<br>13 0.512<br>10 0.394 | FAST: 8 0.315<br>H-SP: 13 0.118<br>S-D: 13 0.118                           | $\phi 0.02$ mm<br>$\phi 0.0008$ in<br>opaque object  | 500 mm<br>19.685 in | FT-E12     |
|                  | Side-view                      | Beam diameter $\phi 0.25$ mm $\phi 0.010$ in<br>$\phi 0.4$ $\phi 3$<br>$\phi 0.016$ $\phi 0.118$<br>130 5.118<br>80 3.150<br>60 2.362<br>50 1.969                          | FAST: 36 1.417<br>H-SP: 18 0.709<br>S-D: 15 0.591                          |                                                      | 1 m<br>3.281 ft     | FT-E22     |
|                  |                                | Side-view<br>$\phi 4$ $\phi 0.157$<br>2,350 92.520<br>2,000 78.740<br>1,400 55.118<br>1,000 39.370                                                                         | FAST: 800 31.496<br>H-SP: 340 13.386<br>S-D: 350 13.780                    | $\phi 0.05$ mm<br>$\phi 0.0020$ in<br>opaque object  | 2 m<br>6.562 ft     | FT-V10     |
| Side-view        | $\phi 1.5$ $\phi 0.059$        | $\phi 1.5$ $\phi 0.059$<br>550 21.654<br>400 15.748<br>240 9.449<br>200 7.874                                                                                              | FAST: 140 5.512<br>H-SP: 65 2.559<br>S-D: 70 2.756                         |                                                      | R25 mm<br>R0.984 in | FT-SFM2SV2 |
|                  |                                | Side-view<br>$\phi 1$ $\phi 0.039$<br>410 16.142<br>390 15.354<br>220 8.661<br>180 7.087                                                                                   | FAST: 125 4.921<br>H-SP: 60 2.362<br>S-D: 63 2.480                         | $\phi 0.02$ mm<br>$\phi 0.0008$ in<br>opaque object  | 1 m<br>3.281 ft     | FT-V22     |
|                  | $\phi 1$ $\phi 0.039$          | $\phi 1$ $\phi 0.039$<br>220 8.661<br>175 6.890<br>100 3.937<br>80 3.150                                                                                                   | FAST: 60 2.362<br>H-SP: 25 0.984<br>S-D: 27 1.063                          |                                                      | 2 m<br>6.562 ft     | FT-V41     |
|                  |                                | Side-view<br>$\phi 1$ $\phi 0.039$<br>120 4.724<br>90 3.543<br>55 2.165<br>40 1.575                                                                                        | FAST: 30 1.181<br>H-SP: 13 0.512<br>S-D: 15 0.591                          |                                                      | R1 mm<br>R0.039 in  | FT-WV42    |
|                  | $\phi 1$ $\phi 0.039$          | $\phi 1$ $\phi 0.039$<br>120 4.724<br>90 3.543<br>55 2.165<br>40 1.575                                                                                                     | FAST: 30 1.181<br>H-SP: 13 0.512<br>S-D: 15 0.591                          |                                                      |                     |            |
|                  |                                | Side-view<br>$\phi 1$ $\phi 0.039$<br>120 4.724<br>90 3.543<br>55 2.165<br>40 1.575                                                                                        | FAST: 30 1.181<br>H-SP: 13 0.512<br>S-D: 15 0.591                          |                                                      |                     |            |

Notes: 1) Refer to p.27 for the sensing ranges for the FX-301-HS in H-SP mode and for the FX-301B/G/H.

2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

3) The minimum sensing object size is the value for red LED type. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type.

The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.

## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked with light blue in the table.

## FX-305 / FX-301 (Red LED type) sensing range (Note 1)

## Thru-beam type (one pair set)



The FX-305 and FX-301(-HS) have different sensing modes.  
 FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
 FX-301(-HS): S-D, H-SP, FAST, STD, LONG (no STDF or U-LG mode)

| Type        | Shape of fiber head (mm in)                                                                 | Sensing range (mm in) (Note 2) | Min. sensing object (Note 3) | Fiber cable length | Bending radius      | Model No. |
|-------------|---------------------------------------------------------------------------------------------|--------------------------------|------------------------------|--------------------|---------------------|-----------|
| Rectangular | Easy mounting · Top sensing<br>W3×H8×D12<br>W0.118×H0.315×D0.472                            | 3,500 137.795                  | 850 33.465                   | 2 m<br>6.562 ft    | R1 mm<br>R0.039 in  | FT-WZ8H   |
|             |                                                                                             | 2,500 98.425                   | 400 15.748                   |                    |                     |           |
|             |                                                                                             | 1,600 62.992                   | 410 16.142                   |                    |                     |           |
|             |                                                                                             | 1,200 47.244                   |                              |                    |                     |           |
|             |                                                                                             | 3,100 122.047                  | 1,000 39.370                 |                    | R4 mm<br>R0.157 in  | FT-Z8H    |
|             | Easy mounting · Side sensing<br>W3×H12×D8<br>W0.118×H0.472×D0.315                           | 2,700 106.299                  | 420 16.535                   | 2 m<br>6.562 ft    | Flexible            | FT-WZ8E   |
|             |                                                                                             | 1,550 61.024                   | 490 19.291                   |                    |                     |           |
|             |                                                                                             | 1,400 55.118                   |                              |                    |                     |           |
|             |                                                                                             | 2,100 82.677                   | 500 19.685                   |                    | R1 mm<br>R0.039 in  | FT-WZ8E   |
|             |                                                                                             | 1,500 59.055                   | 200 7.874                    |                    |                     |           |
| Rectangular | Easy mounting · Front sensing<br>W8.5×H12×D3<br>W0.335×H0.472×D0.118                        | 950 37.402                     | 240 9.449                    | 2 m<br>6.562 ft    | R1 mm<br>R0.039 in  | FT-WZ8    |
|             |                                                                                             | 700 27.559                     | 100 3.937                    |                    |                     |           |
|             |                                                                                             | 420 16.535                     | 120 4.724                    |                    |                     |           |
|             |                                                                                             | 330 12.992                     |                              |                    |                     |           |
|             |                                                                                             | 1,100 43.307                   | 300 11.811                   |                    | R4 mm<br>R0.157 in  | FT-Z8     |
|             | Front sensing<br>W10×H7×D2<br>W0.394×H0.276×D0.079                                          | 800 31.496                     | 120 4.724                    | 1 m<br>3.281 ft    | Flexible            | FT-WZ4    |
|             |                                                                                             | 500 19.685                     | 140 5.512                    |                    |                     |           |
|             |                                                                                             | 400 15.748                     | 70 2.756                     |                    |                     |           |
|             |                                                                                             | 300 11.811                     | 40 1.575                     |                    |                     |           |
|             |                                                                                             | 200 7.874                      | 40 1.575                     |                    |                     |           |
| Rectangular | Fiber bending type<br>W2×H10×D10 W0.079×H0.394×D0.394                                       | 220 8.661                      | 50 1.969                     | 2 m<br>6.562 ft    | R1 mm<br>R0.039 in  | FT-WZ4HB  |
|             |                                                                                             | 150 5.906                      | 30 1.181                     |                    |                     |           |
|             |                                                                                             | 105 4.134                      | 30 1.181                     |                    |                     |           |
|             |                                                                                             | 75 2.953                       |                              |                    |                     |           |
|             |                                                                                             | 660 25.984                     | 150 5.906                    |                    |                     |           |
| Rectangular | Front sensing<br>W14×H7×D3.5<br>W0.551×H0.276×D0.138                                        | 440 17.323                     | 80 3.150                     | 2 m<br>6.562 ft    | R1 mm<br>R0.039 in  | FT-WZ7    |
|             |                                                                                             | 308 12.126                     | 80 3.150                     |                    |                     |           |
|             |                                                                                             | 220 8.661                      |                              |                    |                     |           |
|             |                                                                                             | 870 34.252                     | 210 8.268                    |                    |                     |           |
|             |                                                                                             | 580 22.835                     | 110 4.331                    |                    |                     |           |
| Rectangular | Fiber bending type<br>W3.5×H14×D11 W0.138×H0.551×D0.433                                     | 406 15.984                     | 110 4.331                    | 2 m<br>6.562 ft    | R1 mm<br>R0.039 in  | FT-WZ7HB  |
|             |                                                                                             | 290 11.417                     | 110 4.331                    |                    |                     |           |
|             | Side-view type with small light dispersion<br>W2×H1.5×D20 W0.079×H0.059×D0.787              | 3,000 118.110                  | 800 31.496                   |                    | R25 mm<br>R0.984 in | FT-K8     |
|             |                                                                                             | 2,000 78.740                   | 300 11.811                   |                    |                     |           |
|             |                                                                                             | 1,500 59.055                   | 350 13.780                   |                    |                     |           |
| Special     | Wide area sensing<br>Sensing width 32 mm 1.260 in<br>W5×H69×D20<br>W0.197×H2.717×D0.787     | 3,500 137.795                  | 3,500 137.795                | 2 m<br>6.562 ft    | R1 mm<br>R0.039 in  | FT-WA30   |
|             |                                                                                             | 3,500 137.795                  | 3,000 118.110                |                    |                     |           |
|             |                                                                                             | 3,500 137.795                  | 3,500 137.795                |                    |                     |           |
|             |                                                                                             | 3,500 137.795                  | 3,500 137.795                |                    |                     |           |
|             |                                                                                             | 3,500 137.795                  | 3,500 137.795                |                    |                     |           |
| Special     | Wide area sensing<br>Sensing width 11 mm 0.433 in<br>W4.2×H31×D13.5<br>W0.165×H1.220×D0.531 | 3,500 137.795                  | 1,100 43.307                 | 2 m<br>6.562 ft    | R1 mm<br>R0.039 in  | FT-WA8    |
|             |                                                                                             | 3,500 137.795                  | 1,080 42.520                 |                    |                     |           |
|             |                                                                                             | 3,500 137.795                  | 750 29.528                   |                    |                     |           |
|             |                                                                                             | 1,500 59.055                   |                              |                    |                     |           |
|             |                                                                                             |                                |                              |                    |                     |           |
| Special     | Top sensing<br>W5×H15×D15 W0.197×H0.591×D0.591                                              | 850 33.465                     | 220 8.661                    | 2 m<br>6.562 ft    | R25 mm<br>R0.984 in | FT-AFM2   |
|             |                                                                                             | 650 25.591                     | 100 3.937                    |                    |                     |           |
|             |                                                                                             | 380 14.961                     | 115 4.528                    |                    |                     |           |
|             |                                                                                             | 330 12.992                     |                              |                    |                     |           |
|             |                                                                                             | 800 31.496                     | 200 7.874                    |                    |                     |           |
| Special     | Side sensing<br>W5×H15×D15 W0.197×H0.591×D0.591                                             | 590 23.228                     | 90 3.543                     | 2 m<br>6.562 ft    |                     | FT-AFM2E  |
|             |                                                                                             | 350 13.780                     | 100 3.937                    |                    |                     |           |
|             |                                                                                             | 290 11.417                     |                              |                    |                     |           |
|             |                                                                                             |                                |                              |                    |                     |           |
|             |                                                                                             |                                |                              |                    |                     |           |

Notes: 1) Refer to p.27 for the sensing ranges for the FX-301(-HS) in H-SP mode and for the FX-301B/G/H.

2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

3) The minimum sensing object size is the value for red LED type. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type.

The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.

4) The fiber cable length practically limits the sensing range to 3,500 mm 137.795 in long.

## LIST OF FIBERS

## FX-305 / FX-301 (Red LED type) sensing range (Note 1)

## Thru-beam type (one pair set)



The FX-305 and FX-301(-HS) have different sensing modes.  
 FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
 FX-301(-HS): S-D, H-SP, FAST, STD, LONG (no STDF or U-LG mode)

| Type               | Shape of fiber head (mm in)                                                                         | Sensing range (mm in)(Note 2)                                   | Min. sensing object (Note 3)             | Fiber cable length<br>Free-cut          | Bending radius                                    | Model No.              |
|--------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|------------------------------------------|-----------------------------------------|---------------------------------------------------|------------------------|
| Heat-resistant     | 350 °C 662 °F<br>Lens mountable<br>M4                                                               | 750 29.528<br>550 21.654<br>330 12.992<br>280 11.024            | 200 7.874<br>85 3.346<br>90 3.543        | φ0.04 mm<br>φ0.0016 in<br>opaque object | 2 m<br>6.562 ft                                   | FT-H35-M2              |
|                    | 350 °C 662 °F<br>Sleeve 60 mm 2.362 in M4<br>φ2.1 φ0.083                                            |                                                                 |                                          |                                         | Fiber R25 mm R0.984 in<br>Sleeve R10 mm R0.394 in | FT-H35-M2S6            |
|                    | Allows flexible wiring<br>200 °C 392 °F<br>Lens mountable<br>M4                                     | 420 16.535<br>310 12.205<br>180 7.087<br>140 5.512              | 100 3.937<br>40 1.575<br>50 1.969        | φ0.02mm<br>φ0.0008 in<br>opaque object  | 1 m<br>3.281 ft                                   | FT-H20W-M1             |
|                    | 200 °C 392 °F<br>Lens mountable<br>M4                                                               | 750 29.528<br>550 21.654<br>320 12.598<br>280 11.024            | 200 7.874<br>85 3.346<br>90 3.543        | φ0.04 mm<br>φ0.0016 in<br>opaque object | 1 m<br>3.281 ft                                   | FT-H20-M1              |
|                    | 130 °C 266 °F<br>Lens mountable (FX-LE2 only)<br>M4                                                 | 1,200 47.244<br>880 34.646<br>550 21.654<br>440 17.323          | 300 11.811<br>150 5.906<br>155 6.102     | φ0.06 mm<br>φ0.0024 in<br>opaque object | 2 m<br>6.562 ft                                   | FT-H13-FM2             |
|                    | Lens mountable (FX-LE1)                                                                             |                                                                 |                                          |                                         | 200 mm 7.874 in (Note 4)                          | FT-H20-J20-S (Note 6)  |
|                    |                                                                                                     | 530 20.866<br>390 15.354<br>225 8.858<br>200 7.874              | 140 5.512<br>60 2.362<br>60 2.362        | φ0.12 mm<br>φ0.005 in<br>opaque object  | 300 mm 11.811 in (Note 4)                         | FT-H20-J30-S (Note 6)  |
|                    | Side-view                                                                                           |                                                                 |                                          |                                         | 500 mm 19.685 in (Note 4)                         | FT-H20-J50-S (Note 6)  |
|                    |                                                                                                     | 840 33.071<br>550 21.654<br>370 14.567<br>280 11.024            | 200 7.874<br>90 3.543<br>90 3.543        | φ0.16 mm<br>φ0.006 in<br>opaque object  | 800 mm 31.496 in (Note 4)                         | FT-H20-VJ80-S (Note 6) |
|                    | Easy mounting - Rectangular head<br>SEMI S2 compliant<br>W7 × H15 × D13<br>W0.276 × H0.591 × D0.512 | 3,500 137.795<br>3,500 137.795<br>3,000 118.110<br>1,500 59.055 | 1,000 39.370<br>500 19.685<br>530 20.866 | φ4 mm<br>φ0.157 in<br>opaque object     | 2 m<br>6.562 ft                                   | FT-Z802Y               |
| Chemical-resistant | φ5.5 φ0.217                                                                                         | 3,500 137.795<br>3,500 137.795<br>2,000 78.740<br>1,500 59.055  | 1,000 39.370<br>500 19.685<br>530 20.866 | φ0.2 mm<br>φ0.008 in<br>opaque object   | 2 m<br>6.562 ft (Note 7)                          | FT-L80Y                |
|                    | Side-view                                                                                           | 1,000 39.370<br>800 31.496<br>500 19.685<br>400 15.748          | 280 11.024<br>120 4.724<br>140 5.512     |                                         |                                                   | FT-V80Y                |
|                    | 300 °C 572 °F<br>Lens mountable (FV-LE1/SV2 only)<br>M4                                             | 350 13.780<br>250 9.843<br>150 5.906<br>125 4.921               | 90 3.543<br>50 1.969<br>40 1.575         | φ0.03 mm<br>φ0.0012 in<br>opaque object | 1 m<br>3.281 ft                                   | FT-H30-M1V-S (Note 8)  |

- Notes: 1) Please contact our office for the sensing ranges for the FX-301-HS in H-SP mode and for the FX-301B/G/H.  
 2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.  
 3) The minimum sensing object size is the value for red LED type. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type.  
 The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.  
 4) This is the fiber length (fixed length) for heat-resistant fibers. The ordinary-temperature fibers are free-cut to 2 m 6.562 ft.  
 5) The ordinary-temperature fiber is R25 mm R0.984 in or more.  
 6) Heat-resistant joint fibers and ordinary-temperature fibers (FT-FM2) are sold as a set. Please refer to 'Heat-resistant joint fibers catalog' for details.  
 7) The allowable cutting range is 500 mm 19.685 in from the end that the amplifier inserted.  
 8) Sold as a set comprising vacuum type fiber + photo-terminal (FV-BR1) + fiber at atmospheric side (FT-J8). Please refer to 'Vacuum resistant fiber catalog' for details.

## Model No. when ordering heat-resistant joint fibers individually as replacement parts

- FT-H20-J20 (one pair set)
- FT-H20-J30 (one pair set)
- FT-H20-J50 (one pair set)
- FT-H20-VJ80 (one pair set)

## Model No. when ordering vacuum-resistant fibers individually as replacement parts

- Vacuum-resistant fiber
- Photo-terminal
- Fiber at atmospheric side
- FT-H30-M1V (one pair set)
- FV-BR1 (one pair set)
- FT-J8 (one pair set)

## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked with light blue in the table.

## FX-305 / FX-301 (Red LED type) sensing range (Note 1)

## Retroreflective type



The FX-305 and FX-301 (-HS) have different sensing modes.  
**FX-305:** H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
**FX-301 (-HS):** S-D, H-SP, FAST, STD, LONG (no STDF or U-LG mode)

| Type                                     | Shape of fiber head (mm in)                                                                    | Sensing range (mm in)(Note 2, 3)                                                                                                                                                                                                                                           | <div> <span style="color:red">■</span> : U-LG           <span style="color:yellow">■</span> : FAST           <span style="color:orange">■</span> : H-SP           <span style="color:blue">■</span> : STDF           <span style="color:purple">■</span> : STD         </div> | Min. sensing object (Note 4)                                                                                                                                                                                                                                                                                                | Fiber cable length<br><div> <span style="color:blue">✂</span> : Free-cut         </div>           | Bending radius                                                                                         | Model No. |
|------------------------------------------|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-----------|
| Sharp bending<br>With polarizing filters | <br>W9.5 X H5.2 X D15 W0.374 X H0.205 X D0.591<br>W30 X H30 X D0.5 W1.181 X H1.181 X D0.020    | <div> <span style="color:red">100 to 910 3.937 to 35.827</span><br/> <span style="color:orange">100 to 730 3.937 to 28.740</span><br/> <span style="color:blue">100 to 600 3.937 to 23.622</span><br/> <span style="color:purple">100 to 520 3.937 to 20.472</span> </div> | <div> <span style="color:yellow">100 to 460 3.937 to 18.110</span><br/>           Cannot use<br/>           Cannot use         </div>                                                                                                                                         | <div> <span style="color:blue">φ 0.3 mm</span><br/> <span style="color:blue">φ 0.012 in</span><br/>           opaque object         </div>                                                                                                                                                                                  | <div> <span style="color:blue">✂</span><br/>           2 m<br/>           6.562 ft         </div> | <div> <span style="color:red">R1 mm</span><br/> <span style="color:red">R0.039 in</span> </div>        | FR-WKZ11  |
| Narrow beam<br>Top sensing               | <br>W9.5 X H5.2 X D21 W0.374 X H0.205 X D0.827<br>W10.6 X H28 X D10.1 W0.417 X H1.102 X D0.398 | <div> <span style="color:red">200 7.874</span><br/> <span style="color:orange">200 7.874</span><br/> <span style="color:blue">200 7.874</span><br/> <span style="color:purple">200 7.874</span> </div>                                                                     | <div> <span style="color:yellow">200 7.874</span><br/> <span style="color:orange">200 7.874</span><br/> <span style="color:blue">200 7.874</span> </div>                                                                                                                      | <div>           Horizontal:<br/> <span style="color:blue">φ 5.5 mm</span><br/> <span style="color:blue">φ 0.217 in</span><br/>           opaque object<br/>           Vertical:<br/> <span style="color:blue">φ 0.06 mm</span><br/> <span style="color:blue">φ 0.0024 in</span><br/>           opaque object         </div> | <div> <span style="color:blue">✂</span><br/>           2 m<br/>           6.562 ft         </div> | <div> <span style="color:purple">R10 mm</span><br/> <span style="color:purple">R0.394 in</span> </div> | FR-KZ21   |
| Side sensing                             | <br>W9.5 X H25 X D5.2 W0.374 X H0.984 X D0.205<br>W10.6 X H28 X D10.1 W0.417 X H1.102 X D0.398 |                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                             |                                                                                                   |                                                                                                        | FR-KZ21E  |
| Water mapping                            | <br>W7.5 X H2.2 X D11.2 W0.295 X H0.087 X D0.441<br>W4 X H2 X D21.5 W0.157 X H0.079 X D0.846   | <div> <span style="color:red">15 to 370 0.591 to 14.567</span><br/> <span style="color:orange">15 to 330 0.591 to 12.992</span><br/> <span style="color:blue">15 to 240 0.591 to 9.449</span><br/> <span style="color:purple">15 to 210 0.591 to 8.268</span> </div>       | <div> <span style="color:yellow">15 to 170 0.591 to 6.693</span><br/> <span style="color:orange">15 to 80 0.591 to 3.150</span><br/> <span style="color:blue">15 to 90 0.591 to 3.543</span> </div>                                                                           | <div> <span style="color:blue">φ 0.12 mm</span><br/> <span style="color:blue">φ 0.005 in</span><br/>           opaque object         </div>                                                                                                                                                                                 | <div> <span style="color:blue">✂</span><br/>           2 m<br/>           6.562 ft         </div> | <div> <span style="color:purple">R10 mm</span><br/> <span style="color:purple">R0.394 in</span> </div> | FR-KV1    |

- Notes: 1) Please contact our office for the sensing ranges for the **FX-301-HS** in H-SP mode and for the **FX-301B/G/H**.  
 2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.  
 The sensing range of **FR-WKZ11** is specified for the **RF-13**. The sensing range of **FR-KZ21**, **FR-KZ21E** and **FR-KV1** is specified for the attached reflector.  
 3) The sensing range of **FR-WKZ11** is the possible setting range for the reflector or reflective tape. The fiber can detect an object less than 100 mm 3.937 in away.  
 However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier unit before use.  
 The sensing range of **FR-KZ21(E)** is the possible setting range for the reflector. However, if setting the fiber to detect objects passing within 0 to 20 mm 0 to 0.787 in from the fiber head, unstable detection may result.  
 The sensing range of **FR-KV1** is the possible setting range for the reflector. The fiber can detect an object less than 15 mm 0.591 in away.  
 4) The minimum sensing object size is the value for red LED type.  
 The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.

## FX-305 / FX-301 (Red LED type) sensing range (Note 1)

## Reflective type



The FX-305 and FX-301 (-HS) have different sensing modes.  
**FX-305:** H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
**FX-301 (-HS):** S-D, H-SP, FAST, STD, LONG (no STDF or U-LG mode)

| Type          | Shape of fiber head (mm in)                  | Sensing range (mm in)(Note 2, 3)                                                                                                                                                                          | <div> <span style="color:red">■</span> : U-LG           <span style="color:yellow">■</span> : FAST           <span style="color:orange">■</span> : H-SP           <span style="color:blue">■</span> : STDF           <span style="color:purple">■</span> : STD         </div> | Min. sensing object (Note 4)          | Fiber cable length<br><div> <span style="color:blue">✂</span> : Free-cut         </div>           | Bending radius                                                  | Model No. |
|---------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------|
| Threaded type | M6                                           | <div> <span style="color:red">600 23.622</span><br/> <span style="color:orange">480 18.898</span><br/> <span style="color:blue">280 11.024</span><br/> <span style="color:purple">220 8.661</span> </div> | <div> <span style="color:yellow">160 6.299</span><br/> <span style="color:orange">85 3.346</span><br/> <span style="color:blue">75 2.953</span> </div>                                                                                                                        |                                       |                                                                                                   | R25 mm<br>R0.984 in                                             | FD-B8     |
|               | Coaxial M6                                   | <div> <span style="color:red">410 16.142</span><br/> <span style="color:orange">310 12.205</span><br/> <span style="color:blue">200 7.874</span><br/> <span style="color:purple">140 5.512</span> </div>  | <div> <span style="color:yellow">100 3.937</span><br/> <span style="color:orange">55 2.165</span><br/> <span style="color:blue">47 1.850</span> </div>                                                                                                                        |                                       |                                                                                                   |                                                                 | FD-FM2    |
|               | Sleeve 90 mm 3.543 in<br>M6<br>φ 2.5 φ 0.098 | <div> <span style="color:red">370 14.567</span><br/> <span style="color:orange">270 10.630</span><br/> <span style="color:blue">170 6.693</span><br/> <span style="color:purple">110 4.331</span> </div>  | <div> <span style="color:yellow">85 3.346</span><br/> <span style="color:orange">45 1.772</span><br/> <span style="color:blue">39 1.535</span> </div>                                                                                                                         | φ 0.02 mm<br>φ 0.0008 in<br>gold wire | <div> <span style="color:blue">✂</span><br/>           2 m<br/>           6.562 ft         </div> | Fiber<br>R25 mm<br>R0.984 in<br>Sleeve<br>R10 mm<br>R0.394 in   | FD-FM2S   |
|               | Sleeve 40 mm 1.575 in<br>M6<br>φ 2.5 φ 0.098 |                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                               |                                       |                                                                                                   |                                                                 | FD-FM2S4  |
|               | M6                                           | <div> <span style="color:red">250 9.843</span><br/> <span style="color:orange">190 7.480</span><br/> <span style="color:blue">110 4.331</span><br/> <span style="color:purple">90 3.543</span> </div>     | <div> <span style="color:yellow">60 2.362</span><br/> <span style="color:orange">25 0.984</span><br/> <span style="color:blue">32 1.260</span> </div>                                                                                                                         |                                       |                                                                                                   | <span style="color:red">R1 mm</span><br>R0.039 in               | FD-W8     |
|               | M6                                           | <div> <span style="color:red">300 11.811</span><br/> <span style="color:orange">220 8.661</span><br/> <span style="color:blue">130 5.118</span><br/> <span style="color:purple">100 3.937</span> </div>   | <div> <span style="color:yellow">70 2.756</span><br/> <span style="color:orange">30 1.181</span><br/> <span style="color:blue">35 1.378</span> </div>                                                                                                                         |                                       |                                                                                                   | <span style="color:green">R4 mm</span><br>R0.157 in<br>Flexible | FD-P80    |
|               | M6                                           | <div> <span style="color:red">270 10.630</span><br/> <span style="color:orange">185 7.283</span><br/> <span style="color:blue">100 3.937</span><br/> <span style="color:purple">80 3.150</span> </div>    | <div> <span style="color:yellow">60 2.362</span><br/> <span style="color:orange">30 1.181</span><br/> <span style="color:blue">35 1.378</span> </div>                                                                                                                         |                                       |                                                                                                   | <span style="color:purple">R10 mm</span><br>R0.394 in           | FD-P81X   |
|               | Tough flexible                               |                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                               |                                       | 1 m<br>3.281 ft                                                                                   |                                                                 |           |
|               | Elbow                                        | <div> <span style="color:red">240 9.449</span><br/> <span style="color:orange">185 7.283</span><br/> <span style="color:blue">110 4.331</span><br/> <span style="color:purple">85 3.346</span> </div>     | <div> <span style="color:yellow">60 2.362</span><br/> <span style="color:orange">25 0.984</span><br/> <span style="color:blue">30 1.181</span> </div>                                                                                                                         | φ 0.02 mm<br>φ 0.0008 in<br>gold wire | <div> <span style="color:blue">✂</span><br/>           2 m<br/>           6.562 ft         </div> | R25 mm<br>R0.984 in                                             | FD-R80    |

- Notes: 1) Refer to p.27 for the sensing ranges for the **FX-301-HS** in H-SP mode and for the **FX-301B/G/H**.  
 2) The sensing range is specified for white non-glossy paper [400 × 400 mm 15.748 × 15.748 in] as the object.  
 3) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.  
 4) The minimum sensing object size is the value for red LED type at maximum sensitivity.  
 Note that the corresponding setting distance is different from the rated sensing distance.

## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked with light blue in the table.

## FX-305 / FX-301 (Red LED type) sensing range (Note 1)

## Reflective type



The FX-305 and FX-301(-HS) have different sensing modes.  
 FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
 FX-301(-HS): S-D, H-SP, FAST, STD, LONG (no STDF or U-LG mode)

| Type          | Shape of fiber head<br>(mm in)                                    | Sensing range (mm in)(Note 2, 3)                                                                   | <div> <div> <div>U-LG</div> <div>LONG</div> <div>STDF</div> <div>STD</div> </div> <div> <div>FAST</div> <div>H-SP</div> <div>S-D</div> </div> </div> | Min. sensing<br>object<br>(Note 4)  | Fiber cable<br>length<br>Free-cut | Bending<br>radius                                             | Model No.  |
|---------------|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------------------|---------------------------------------------------------------|------------|
| Threaded type | M4                                                                | <div> <div>370 14.567</div> <div>270 10.630</div> <div>170 6.693</div> <div>110 4.331</div> </div> | <div> <div>85 3.346</div> <div>45 1.772</div> <div>39 1.535</div> </div>                                                                             |                                     |                                   | R25 mm<br>R0.984 in                                           | FD-T80     |
|               | M4                                                                |                                                                                                    |                                                                                                                                                      |                                     |                                   |                                                               | FD-NFM2    |
|               | Sleeve 90 mm 3.543 in<br>M4<br>φ1.48 φ0.058                       | <div> <div>140 5.512</div> <div>90 3.543</div> <div>60 2.362</div> <div>45 1.772</div> </div>      | <div> <div>35 1.378</div> <div>16 0.630</div> <div>16 0.630</div> </div>                                                                             |                                     |                                   | Fiber<br>R25 mm<br>R0.984 in<br>Sleeve<br>R10 mm<br>R0.394 in | FD-NFM2S   |
|               | Sleeve 40 mm 1.575 in<br>M4<br>φ1.48 φ0.058                       |                                                                                                    |                                                                                                                                                      |                                     |                                   |                                                               | FD-NFM2S4  |
|               | Sleeve 40 mm 1.575 in<br>M4<br>φ1.48 φ0.058                       | <div> <div>40 1.575</div> <div>30 1.181</div> <div>18 0.709</div> <div>15 0.591</div> </div>       | <div> <div>12 0.472</div> <div>4.5 0.177</div> <div>5 0.197</div> </div>                                                                             | φ0.02 mm<br>φ0.0008 in<br>gold wire | 2 m<br>6.562 ft                   | Fiber<br>R1 mm<br>R0.039 in<br>Sleeve<br>R10 mm<br>R0.394 in  | FD-W44     |
|               | M4                                                                | <div> <div>250 9.843</div> <div>190 7.480</div> <div>110 4.331</div> <div>90 3.543</div> </div>    | <div> <div>60 2.362</div> <div>25 0.984</div> <div>32 1.260</div> </div>                                                                             |                                     |                                   | R1 mm<br>R0.039 in                                            | FD-WT8     |
|               | Coaxial · Lens mountable<br>M4                                    | <div> <div>85 3.346</div> <div>65 2.559</div> <div>37 1.457</div> <div>32 1.260</div> </div>       | <div> <div>25 0.984</div> <div>10 0.394</div> <div>11 0.433</div> </div>                                                                             |                                     |                                   | R2 mm<br>R0.079 in                                            | FD-WG4     |
|               | M4                                                                | <div> <div>150 5.906</div> <div>110 4.331</div> <div>65 2.559</div> <div>55 2.165</div> </div>     | <div> <div>42 1.654</div> <div>15 0.591</div> <div>19 0.748</div> </div>                                                                             |                                     |                                   | R25 mm<br>R0.984 in                                           | FD-G4      |
|               | M4                                                                | <div> <div>130 5.118</div> <div>90 3.543</div> <div>55 2.165</div> <div>45 1.772</div> </div>      | <div> <div>30 1.181</div> <div>13 0.512</div> <div>16 0.630</div> </div>                                                                             |                                     |                                   | R4 mm<br>R0.157 in<br>Flexible                                | FD-P60     |
|               | Small diameter<br>M3                                              | <div> <div>140 5.512</div> <div>90 3.543</div> <div>60 2.362</div> <div>45 1.772</div> </div>      | <div> <div>35 1.378</div> <div>16 0.630</div> <div>16 0.630</div> </div>                                                                             |                                     |                                   | R25 mm<br>R0.984 in                                           | FD-T40     |
|               | M3                                                                | <div> <div>40 1.575</div> <div>30 1.181</div> <div>18 0.709</div> <div>15 0.591</div> </div>       | <div> <div>12 0.472</div> <div>4.5 0.177</div> <div>5 0.197</div> </div>                                                                             |                                     |                                   | R1 mm<br>R0.039 in                                            | FD-WT4     |
|               | M3                                                                | <div> <div>50 1.969</div> <div>36 1.417</div> <div>20 0.787</div> <div>18 0.709</div> </div>       | <div> <div>14 0.551</div> <div>5.5 0.217</div> <div>6 0.236</div> </div>                                                                             | φ0.02 mm<br>φ0.0008 in<br>gold wire | 2 m<br>6.562 ft                   | R4 mm<br>R0.157 in<br>Flexible                                | FD-P40     |
|               | Lens mountable (FX-MR3, FX-MR6)<br>M3                             | <div> <div>150 5.906</div> <div>110 4.331</div> <div>65 2.559</div> <div>55 2.165</div> </div>     | <div> <div>42 1.654</div> <div>15 0.591</div> <div>19 0.748</div> </div>                                                                             |                                     |                                   | R25 mm<br>R0.984 in                                           | FD-G6      |
|               | Coaxial · Lens mountable (FX-MR3, FX-MR6)<br>M3                   | <div> <div>150 5.906</div> <div>90 3.543</div> <div>48 1.890</div> <div>45 1.772</div> </div>      | <div> <div>35 1.378</div> <div>12 0.472</div> <div>20 0.787</div> </div>                                                                             |                                     | 1 m<br>3.281 ft<br>(Note 5)       | R10 mm<br>R0.394 in                                           | FD-G6X     |
|               | Coaxial · Lens mountable (FX-MR3, FX-MR6)<br>M3                   | <div> <div>50 1.969</div> <div>38 1.496</div> <div>25 0.984</div> <div>18 0.709</div> </div>       | <div> <div>14 0.551</div> <div>5 0.197</div> <div>6 0.236</div> </div>                                                                               |                                     |                                   | R25 mm<br>R0.984 in                                           | FD-EG1     |
|               | High precision<br>Coaxial · Lens mountable (FX-MR3, FX-MR6)<br>M3 | <div> <div>40 1.575</div> <div>25 0.984</div> <div>14 0.551</div> <div>12 0.472</div> </div>       | <div> <div>9 0.354</div> <div>3 0.118</div> <div>5 0.197</div> </div>                                                                                | φ0.04 mm<br>φ0.0016 in<br>gold wire | 500 mm<br>19.685 in               | R10 mm<br>R0.394 in                                           | FD-EG2     |
|               | High precision<br>Coaxial · Lens mountable (FX-MR3, FX-MR6)<br>M3 | <div> <div>20 0.787</div> <div>15 0.591</div> <div>9 0.354</div> <div>8 0.315</div> </div>         | <div> <div>5 0.197</div> <div>2.5 0.098</div> <div>3 0.118</div> </div>                                                                              |                                     |                                   |                                                               | FD-EG3     |
| M3            | High precision<br>Coaxial · Lens mountable (FX-MR3, FX-MR6)<br>M3 | <div> <div>6.5 0.256</div> <div>5 0.197</div> <div>3 0.118</div> </div>                            | <div> <div>2 0.079</div> <div>Cannot use</div> <div>Cannot use</div> </div>                                                                          | φ0.02 mm<br>φ0.0008 in<br>gold wire |                                   | R25 mm<br>R0.984 in                                           | FD-EN500S1 |
|               | Sleeve part cannot be bent.<br>Coaxial<br>M3                      | <div> <div>50 1.969</div> <div>38 1.496</div> <div>20 0.787</div> <div>18 0.709</div> </div>       | <div> <div>14 0.551</div> <div>5 0.197</div> <div>6 0.236</div> </div>                                                                               |                                     | 1 m<br>3.281 ft                   |                                                               | FD-ENM1S1  |
|               | Sleeve part cannot be bent.<br>Coaxial<br>M3                      | <div> <div>50 1.969</div> <div>38 1.496</div> <div>20 0.787</div> <div>18 0.709</div> </div>       | <div> <div>14 0.551</div> <div>5 0.197</div> <div>6 0.236</div> </div>                                                                               |                                     |                                   |                                                               |            |
|               | Sleeve part cannot be bent.<br>Coaxial<br>M3                      | <div> <div>50 1.969</div> <div>38 1.496</div> <div>20 0.787</div> <div>18 0.709</div> </div>       | <div> <div>14 0.551</div> <div>5 0.197</div> <div>6 0.236</div> </div>                                                                               |                                     |                                   |                                                               |            |

Notes: 1) Refer to p.27 for the sensing ranges for the FX-301-HS in H-SP mode and for the FX-301B/G/H.

2) The sensing range is specified for white non-glossy paper [200 × 200 mm 7.874 × 7.874 in (FD-T80, FD-WT8: 400 × 400 mm 15.748 × 15.748 in, FD-W44, FD-WT4, FD-P40, FD-G6, FD-EG1, FD-EG2, FD-EG3, FD-EN500S1, FD-ENM1S1: 100 × 100 mm 3.937 × 3.937 in)] as the object.

3) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

4) The minimum sensing object size is the value for red LED type at maximum sensitivity.

Note that the corresponding setting distance is different from the rated sensing distance.

5) The allowable cutting range is 700 mm 27.559 in from the end that the amplifier inserted.

## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked with light blue in the table.

## FX-305 / FX-301 (Red LED type) sensing range (Note 1)

## Reflective type



The FX-305 and FX-301(-HS) have different sensing modes.  
 FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
 FX-301(-HS): S-D, H-SP, FAST, STD, LONG (no STDF or U-LG mode)

| Type             | Shape of fiber head (mm in)                  | Sensing range (mm in)(Note 2, 3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <div> <span style="color:red">■</span> : U-LG           <span style="color:yellow">■</span> : FAST           <span style="color:blue">■</span> : LONG           <span style="color:purple">■</span> : STDF           <span style="color:gray">■</span> : STD         </div> | Min. sensing object (Note 4)             | Fiber cable length<br><div> <span style="color:blue">✂</span> : Free-cut         </div> | Bending radius      | Model No. |
|------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-----------------------------------------------------------------------------------------|---------------------|-----------|
| Cylindrical type | φ3 φ0.118                                    | <div> <span style="color:red">■</span> 370 14.567           <span style="color:yellow">■</span> 85 3.346           <span style="color:blue">■</span> 270 10.630           <span style="color:purple">■</span> 45 1.772           <span style="color:gray">■</span> 170 6.693           <span style="color:gray">■</span> 39 1.535           <span style="color:purple">■</span> 110 4.331         </div>                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                             |                                          |                                                                                         | R25 mm<br>R0.984 in | FD-S80    |
|                  | φ3 φ0.118                                    | <div> <span style="color:red">■</span> 250 9.843           <span style="color:yellow">■</span> 60 2.362           <span style="color:blue">■</span> 190 7.480           <span style="color:purple">■</span> 25 0.984           <span style="color:gray">■</span> 110 4.331           <span style="color:gray">■</span> 32 1.260           <span style="color:purple">■</span> 90 3.543         </div>                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                             | φ 0.02 mm<br>φ 0.0008 in gold wire       | <div> <span style="color:blue">✂</span> 2 m<br/>6.562 ft         </div>                 | R1 mm<br>R0.039 in  | FD-WS8    |
|                  | Coaxial                                      | <div> <span style="color:red">■</span> 85 3.346           <span style="color:yellow">■</span> 25 0.984           <span style="color:blue">■</span> 65 2.559           <span style="color:purple">■</span> 10 0.394           <span style="color:gray">■</span> 37 1.457           <span style="color:gray">■</span> 11 0.433           <span style="color:purple">■</span> 32 1.260         </div>                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                             |                                          |                                                                                         | R2 mm<br>R0.079 in  | FD-WSG4   |
|                  | φ3 φ0.118                                    | <div> <span style="color:red">■</span> 130 5.118           <span style="color:yellow">■</span> 30 1.181           <span style="color:blue">■</span> 90 3.543           <span style="color:purple">■</span> 13 0.512           <span style="color:gray">■</span> 55 2.165           <span style="color:gray">■</span> 16 0.630           <span style="color:purple">■</span> 45 1.772         </div>                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                             |                                          |                                                                                         | R4 mm<br>R0.157 in  | FD-P50    |
|                  | φ3 φ0.118                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                             |                                          |                                                                                         | Flexible            |           |
|                  | φ2.5 φ0.098                                  | <div> <span style="color:red">■</span> 140 5.512           <span style="color:yellow">■</span> 35 1.378           <span style="color:blue">■</span> 90 3.543           <span style="color:purple">■</span> 16 0.630           <span style="color:gray">■</span> 60 2.362           <span style="color:gray">■</span> 16 0.630           <span style="color:purple">■</span> 45 1.772         </div>                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                             | φ 0.02 mm<br>φ 0.0008 in gold wire       | <div> <span style="color:blue">✂</span> 2 m<br/>6.562 ft         </div>                 | R25 mm<br>R0.984 in | FD-SNFM2  |
|                  | φ1.5 φ0.059                                  | <div> <span style="color:red">■</span> 80 3.150           <span style="color:yellow">■</span> 19 0.748           <span style="color:blue">■</span> 50 1.969           <span style="color:purple">■</span> 7.5 0.295           <span style="color:gray">■</span> 30 1.181           <span style="color:gray">■</span> 9 0.354           <span style="color:purple">■</span> 25 0.984         </div>                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                             | φ 0.02 mm<br>φ 0.0008 in gold wire       | <div> <span style="color:blue">✂</span> 1 m<br/>3.281 ft         </div>                 | R4 mm<br>R0.157 in  | FD-P2     |
|                  | φ1.5 φ0.059                                  | <div> <span style="color:red">■</span> 15 0.591           <span style="color:yellow">■</span> 4 0.157           <span style="color:blue">■</span> 11 0.433           <span style="color:purple">■</span> 2 0.079           <span style="color:gray">■</span> 8 0.315           <span style="color:gray">■</span> 1 0.039           <span style="color:purple">■</span> 6 0.236         </div>                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                             | φ 0.02 mm<br>φ 0.0008 in gold wire       | <div> <span style="color:blue">✂</span> 1 m<br/>3.281 ft         </div>                 | R10 mm<br>R0.394 in | FD-E12    |
|                  | φ3 φ0.118                                    | <div> <span style="color:red">■</span> 65 2.559           <span style="color:yellow">■</span> 17 0.669           <span style="color:blue">■</span> 45 1.772           <span style="color:purple">■</span> 8 0.315           <span style="color:gray">■</span> 28 1.102           <span style="color:gray">■</span> 7 0.276           <span style="color:purple">■</span> 23 0.906         </div>                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                             | φ 0.02 mm<br>φ 0.0008 in gold wire       |                                                                                         | R25 mm<br>R0.984 in | FD-E22    |
|                  | φ3 φ0.118                                    | <div> <span style="color:red">■</span> 80 3.150           <span style="color:yellow">■</span> 17 0.669           <span style="color:blue">■</span> 55 2.165           <span style="color:purple">■</span> 8 0.315           <span style="color:gray">■</span> 30 1.181           <span style="color:gray">■</span> 9 0.354           <span style="color:purple">■</span> 25 0.984         </div>                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                             |                                          |                                                                                         | R25 mm<br>R0.984 in | FD-V41    |
| Rectangular type | W25 × H7.3 × D30<br>W0.984 × H0.287 × D1.181 | <div> <span style="color:red">■</span> 12 to 50 0.472 to 1.969           <span style="color:yellow">■</span> 16 to 29 0.630 to 1.142           <span style="color:blue">■</span> 12.5 to 37.5 0.492 to 1.476           <span style="color:purple">■</span> 15 to 36 0.591 to 1.417           <span style="color:gray">■</span> 15 to 35 0.591 to 1.378         </div>                                                                                                                                                                                                                                                                                                                                       | <div> <span style="color:yellow">■</span> Cannot use           <span style="color:blue">■</span> Cannot use         </div>                                                                                                                                                  | φ 0.3 mm<br>φ 0.012 in gold wire         | <div> <span style="color:blue">✂</span> 4 m<br/>13.123 ft         </div>                | R25 mm<br>R0.984 in | FD-L46    |
|                  | W20 × H29 × D3.8<br>W0.787 × H1.142 × D0.150 | <div> <span style="color:red">■</span> 0 to 50 0 to 1.969           <span style="color:yellow">■</span> 0 to 30 0 to 1.181           <span style="color:blue">■</span> 0 to 36 0 to 1.417           <span style="color:purple">■</span> 0 to 15 0 to 0.591           <span style="color:gray">■</span> 0 to 33 0 to 1.299           <span style="color:gray">■</span> 0 to 30 0 to 1.181         </div>                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                             | (LCD glass)                              | <div> <span style="color:blue">✂</span> 3 m<br/>9.843 ft         </div>                 | R4 mm<br>R0.157 in  | FD-L45    |
|                  | W17 × H29 × D3.8<br>W0.669 × H1.142 × D0.150 | <div> <span style="color:red">■</span> 0 to 23 0 to 0.906         </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                             |                                          | <div> <span style="color:blue">✂</span> 2 m<br/>6.562 ft         </div>                 |                     | FD-L43    |
|                  | W12 × H19 × D3<br>W0.472 × H0.748 × D0.118   | <div> <span style="color:red">■</span> 0 to 8.2 0 to 0.323           <span style="color:yellow">■</span> 0 to 5.7 0 to 0.224           <span style="color:blue">■</span> 0 to 7 0 to 0.276           <span style="color:purple">■</span> 0 to 5 0 to 0.197           <span style="color:gray">■</span> 0 to 6.5 0 to 0.256           <span style="color:gray">■</span> 0 to 5.2 0 to 0.205           <span style="color:purple">■</span> 0 to 6 0 to 0.236         </div>                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                             | φ 0.03 mm<br>φ 0.0012 in gold wire       | <div> <span style="color:blue">✂</span> 2 m<br/>6.562 ft         </div>                 | R10 mm<br>R0.394 in | FD-L44    |
|                  | W12 × H19 × D3<br>W0.472 × H0.748 × D0.118   | <div> <span style="color:red">■</span> 0 to 4.7 0 to 0.185           <span style="color:yellow">■</span> 0 to 3.8 0 to 0.150           <span style="color:blue">■</span> 0 to 4.5 0 to 0.177           <span style="color:purple">■</span> 0 to 3 0 to 0.118           <span style="color:gray">■</span> 0 to 4 0 to 0.157           <span style="color:gray">■</span> 0 to 3.5 0 to 0.138           <span style="color:purple">■</span> 0 to 4 0 to 0.157         </div>                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                             |                                          |                                                                                         |                     | FD-L44S   |
|                  | W24 × H21 × D4<br>W0.945 × H0.827 × D0.157   | <div> <span style="color:red">■</span> 6.5 to 14.5 0.256 to 0.571 (Convergent point 8 0.315)           <span style="color:yellow">■</span> 7.5 to 12 0.295 to 0.472 (Convergent point 8 0.315)           <span style="color:blue">■</span> 6.5 to 14 0.256 to 0.551 (Convergent point 8 0.315)           <span style="color:purple">■</span> Cannot use           <span style="color:gray">■</span> 7 to 14 0.276 to 0.551 (Convergent point 8 0.315)           <span style="color:gray">■</span> Cannot use           <span style="color:purple">■</span> 17 to 12 0.276 to 0.472 (Convergent point 8 0.315)         </div>                                                                                |                                                                                                                                                                                                                                                                             | φ 1.9 mm<br>φ 0.075 in metal pipe (gray) |                                                                                         | R1 mm<br>R0.039 in  | FD-WL41   |
|                  | W24 × H21 × D4<br>W0.945 × H0.827 × D0.157   | <div> <span style="color:red">■</span> 2 to 19 0.079 to 0.748 (Convergent point 8 0.315)           <span style="color:yellow">■</span> 3.5 to 15 0.138 to 0.591 (Convergent point 8 0.315)           <span style="color:blue">■</span> 2.5 to 18 0.098 to 0.709 (Convergent point 8 0.315)           <span style="color:purple">■</span> Cannot use           <span style="color:gray">■</span> 3 to 16 0.118 to 0.630 (Convergent point 8 0.315)           <span style="color:gray">■</span> Cannot use           <span style="color:purple">■</span> 3 to 16 0.118 to 0.630 (Convergent point 8 0.315)         </div>                                                                                     |                                                                                                                                                                                                                                                                             | φ 0.06 mm<br>φ 0.024 in gold wire        | <div> <span style="color:blue">✂</span> 2 m<br/>6.562 ft         </div>                 | R10 mm<br>R0.394 in | FD-L41    |
|                  | W6 × H18 × D14<br>W0.236 × H0.709 × D0.551   | <div> <span style="color:red">■</span> 2 to 20 0.079 to 0.787 (Convergent point 6 0.236)           <span style="color:yellow">■</span> 4.5 to 11 0.177 to 0.433 (Convergent point 6 0.236)           <span style="color:blue">■</span> 2.5 to 18 0.098 to 0.709 (Convergent point 6 0.236)           <span style="color:purple">■</span> 1.5 to 8.5 0.197 to 0.335 (Convergent point 6 0.236)           <span style="color:gray">■</span> 4 to 12 0.157 to 0.472 (Convergent point 6 0.236)           <span style="color:gray">■</span> 4.8 to 9.5 0.189 to 0.374 (Convergent point 6 0.236)           <span style="color:purple">■</span> 4 to 12 0.157 to 0.472 (Convergent point 6 0.236)         </div> |                                                                                                                                                                                                                                                                             | φ 0.02 mm<br>φ 0.0008 in gold wire       |                                                                                         |                     | FD-L4     |
|                  | W7.2 × H7.5 × D2<br>W0.283 × H0.295 × D0.079 | <div> <span style="color:red">■</span> 0.5 to 8.5 0.020 to 0.335           <span style="color:yellow">■</span> 1 to 5 0.039 to 0.197           <span style="color:blue">■</span> 0.5 to 7.5 0.020 to 0.295           <span style="color:purple">■</span> Cannot use           <span style="color:gray">■</span> 1 to 6.5 0.039 to 0.256           <span style="color:gray">■</span> Cannot use           <span style="color:purple">■</span> 1 to 5.5 0.039 to 0.217         </div>                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                             | φ 0.3 mm<br>φ 0.012 in copper wire       | <div> <span style="color:blue">✂</span> 1 m<br/>3.281 ft         </div>                 | R1 mm<br>R0.039 in  | FD-WL48   |

Notes: 1) Refer to p.27 for the sensing ranges for the FX-301-HS in H-SP mode and for the FX-301B/G/H.

2) The sensing range is specified for white non-glossy paper (FD-S80, FD-WS8: 400 × 400 mm 15.748 × 15.748 in, FD-WSG4, FD-P50, FD-SNFM2, FD-V41, FD-SFM2SV2: 200 × 200 mm 7.874 × 7.874 in, FD-P2, FD-E12, FD-E22, FD-WV42, FD-L4, FD-WL48: 100 × 100 mm 3.937 × 3.937 in, FD-L46: 100 × 100 × t 0.7 mm 3.937 × 3.937 × t 0.028 in R edge of LCD glass substrates, FD-L43, FD-L44 and FD-L45: 100 × 100 × t 0.7 mm 3.937 × 3.937 × t 0.028 in LCD glass substrates, FD-L44S: silicon wafers polished surface, FD-WL41, FD-L41: 100 × 100 × t 2 mm 3.937 × 3.937 × t 0.079 in glass substrates).

3) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

4) The minimum sensing object size is the value for red LED type at maximum sensitivity. Note that the corresponding setting distance is different from the rated sensing distance. However, with the convergent reflective type, when the sensitivity is at MAX., it is only possible to detect the minimum size of the sensing object at a distance corresponding to the convergent point.

## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked with light blue in the table.

## FX-305 / FX-301 (Red LED type) sensing range (Note 1)

## Reflective type



The FX-305 and FX-301(-HS) have different sensing modes.  
 FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
 FX-301(-HS): S-D, H-SP, FAST, STD, LONG (no STDF or U-LG mode)

| Type                                                           | Shape of fiber head (mm in)                                                                                      | Sensing range (mm in)(Note 2, 3)                                                                                                                                                   | Min. sensing object (Note 4)                                                                                                                                                                                   | Fiber cable length                     | Bending radius                        | Model No.                       |                                                                                  |
|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------|---------------------------------|----------------------------------------------------------------------------------|
| Rectangular                                                    | Small                                                                                                            |                                                                                                                                                                                    |                                                                                                                                                                                                                |                                        |                                       |                                 |                                                                                  |
|                                                                | Front sensing                                                                                                    | <br>1 to 50 0.039 to 1.969<br>1.5 to 34 0.059 to 1.339<br>2 to 24 0.079 to 0.945<br>3 to 17 0.098 to 0.906                                                                         | 3 to 10 0.118 to 0.394<br>Cannot use<br>Cannot use                                                                                                                                                             | φ 0.16 mm<br>φ 0.006 in<br>copper wire | <br>1 m<br>3.281 ft                   | <b>NEW</b><br>FD-WZ4            |                                                                                  |
|                                                                | Fiber bending type                                                                                               | <br>1 to 70 0.039 to 2.756<br>1 to 46 0.039 to 1.811<br>1 to 32.2 0.039 to 1.268<br>2.5 to 23 0.098 to 0.906                                                                       | 2.5 to 15 0.098 to 0.591<br>3 to 7 0.118 to 0.276<br>3 to 7 0.118 to 0.276                                                                                                                                     |                                        |                                       | <b>NEW</b><br>FD-WZ4HB          |                                                                                  |
|                                                                | Front sensing                                                                                                    | <br>200 7.874<br>120 4.724<br>1 to 84 0.039 to 3.307<br>1 to 60 0.039 to 2.362                                                                                                     | 1.5 to 35 0.059 to 1.378<br>2.5 to 18 0.098 to 0.709<br>2.5 to 18 0.098 to 0.709                                                                                                                               | φ 0.03 mm<br>φ 0.0012 in<br>gold wire  | <br>2 m<br>6.562 ft                   | <b>NEW</b><br>FD-WZ7            |                                                                                  |
| Fiber bending type                                             | <br>0.5 to 270 0.002 to 10.630<br>0.5 to 180 0.002 to 7.087<br>1 to 126 0.039 to 4.961<br>1 to 90 0.039 to 3.543 | 1 to 70 0.039 to 2.756<br>1 to 35 0.039 to 1.378<br>1 to 35 0.039 to 1.378                                                                                                         |                                                                                                                                                                                                                |                                        | <b>NEW</b><br>FD-WZ7HB                |                                 |                                                                                  |
| Special                                                        | Long sensing range                                                                                               | <br>20 to 660 0.787 to 25.984<br>20 to 480 0.787 to 18.898<br>20 to 300 0.787 to 11.811<br>20 to 230 0.787 to 9.055                                                                | 20 to 170 0.787 to 6.693<br>25 to 90 0.984 to 3.543<br>25 to 100 0.984 to 3.937                                                                                                                                | φ 0.3 mm<br>φ 0.012 in<br>copper wire  | <br>2 m<br>6.562 ft                   | R1 mm<br>R0.039 in<br>FD-WKZ1   |                                                                                  |
|                                                                | Wide beam                                                                                                        | <br>230 9.055<br>200 7.874<br>150 5.906<br>150 5.906                                                                                                                               | 100 3.937<br>45 1.772<br>50 1.969                                                                                                                                                                              | φ 0.02 mm<br>φ 0.0008 in<br>gold wire  | <br>2 m<br>6.562 ft                   | R25 mm<br>R0.984 in<br>FD-A15   |                                                                                  |
|                                                                | Array                                                                                                            | Top sensing                                                                                                                                                                        | <br>290 11.417<br>220 8.661<br>135 5.315<br>110 4.331                                                                                                                                                          | 78 3.071<br>35 1.378<br>39 1.535       | φ 0.02 mm<br>φ 0.0008 in<br>gold wire | <br>2 m<br>6.562 ft             | R25 mm<br>R0.984 in<br>FD-AFM2                                                   |
|                                                                |                                                                                                                  | Side sensing                                                                                                                                                                       | <br>78 3.071<br>35 1.378<br>39 1.535                                                                                                                                                                           |                                        |                                       |                                 | FD-AFM2E                                                                         |
|                                                                | Liquid level sensing                                                                                             | Contact type                                                                                                                                                                       | <br>φ6 φ0.236                                                                                                                                                                                                  |                                        |                                       | <br>2 m<br>6.562 ft<br>(Note 5) | Protective tube<br>R40 mm<br>R1.575 in<br>Fiber<br>R15 mm<br>R0.591 in<br>FD-F8Y |
|                                                                |                                                                                                                  | Mountable on pipe - Standard                                                                                                                                                       | Applicable pipe diameter:<br>Outer dia. φ6 to φ26 mm φ0.236 to φ1.024 in transparent pipe<br>[PVC (vinyl chloride), fluorine resin, polycarbonate, acrylic, glass, wall thickness 1 to 3 mm 0.039 to 0.118 in] |                                        | (Liquid)                              | <br>2 m<br>6.562 ft             | R10 mm<br>R0.394 in<br>FD-F41                                                    |
| Mountable on pipe - For PFA, wall thickness 1 mm 0.039 in pipe |                                                                                                                  | Applicable pipe diameter:<br>Outer dia. φ6 to φ26 mm φ0.236 to φ1.024 in transparent pipe<br>[PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1 mm 0.039 in] |                                                                                                                                                                                                                |                                        |                                       | FD-F4                           |                                                                                  |

Notes: 1) Refer to p.27 for the sensing ranges for the FX-301(-HS) in H-SP mode and for the FX-301B/G/H.

2) The sensing range is specified for white non-glossy paper [200 × 200 mm 7.874 × 7.874 in (FD-WKZ1, FD-AFM2, FD-AFM2E: 400 × 400 mm 15.478 × 15.478 in)] as the object.

3) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

4) The minimum sensing object size is the value for red LED type at maximum sensitivity. Note that the corresponding setting distance is different from the rated sensing distance.

5) The allowable cutting range is 1,000 mm 39.370 in from the end that the amplifier inserted.

LIST OF FIBERS

FX-305 / FX-301 (Red LED type) sensing range (Note 1)

Reflective type



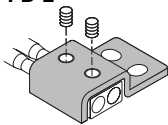
The FX-305 and FX-301 (-HS) have different sensing modes.  
FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
FX-301 (-HS): S-D, H-SP, FAST, STD, LONG (no STDF or U-LG mode)

| Type             | Shape of fiber head (mm in)                                                                                              | Sensing range (mm in)(Note 2, 3)                                                                              | U-LG<br>LONG<br>STDF<br>STD | FAST<br>H-SP<br>S-D                                           | Min. sensing object (Note 4) | Fiber cable length<br>Free-cut | Bending radius                                                                 | Model No.                 |
|------------------|--------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------------------------------------------------|------------------------------|--------------------------------|--------------------------------------------------------------------------------|---------------------------|
| Special          | 350 °C 662 °F · Coaxial<br>M6                                                                                            |                                                                                                               |                             |                                                               |                              |                                |                                                                                |                           |
|                  | 350 °C 662 °F · Sleeve 60 mm 2.362 in<br>φ2.8<br>φ0.110                                                                  | 300 11.811<br>270 10.630<br>150 5.906<br>140 5.512                                                            |                             | 100 3.937<br>35 1.378<br>47 1.850                             |                              | 2 m<br>6.562 ft                | R25 mm<br>R0.984 in<br>Fiber R25 mm<br>R0.984 in<br>Sleeve R10 mm<br>R0.394 in | FD-H35-M2<br>FD-H35-M2S6  |
|                  | 200 °C 392 °F · Coaxial<br>M6                                                                                            |                                                                                                               |                             |                                                               |                              |                                |                                                                                |                           |
|                  | 350 °C 662 °F · Sleeve 90 mm 3.543 in<br>M4<br>φ2.1<br>φ0.083                                                            | 190 7.480<br>160 6.299<br>80 3.150<br>80 3.150                                                                |                             | 57 2.244<br>20 0.787<br>26 1.024                              |                              | 1 m<br>3.281 ft                | R25 mm<br>R0.984 in<br>Fiber R25 mm<br>R0.984 in<br>Sleeve R10 mm<br>R0.394 in | FD-H20-M1<br>FD-H35-20S   |
|                  | 200 °C 392 °F · Coaxial<br>M4                                                                                            | 300 11.811<br>270 10.630<br>150 5.906<br>140 5.512                                                            |                             | 100 3.937<br>35 1.378<br>47 1.850                             |                              |                                |                                                                                | FD-H20-21                 |
|                  | 300 °C 572 °F · Glass substrate detection<br>Convergent reflective type<br>W19 X H27 X D5<br>W0.748 X H1.063<br>X D0.197 | 0 to 20 0 to 0.787<br>0 to 15 0 to 0.591<br>0 to 10 0 to 0.394<br>0 to 10 0 to 0.394                          |                             | 1 to 8 0.039 to 0.315<br>Cannot use<br>12 to 6 0.079 to 0.236 |                              | 2 m<br>6.562 ft                | R25 mm<br>R0.984 in                                                            | FD-H30-L32                |
|                  | 180 °C 356 °F · Glass substrate detection<br>Convergent reflective type<br>W19 X H27 X D5<br>W0.748 X H1.063<br>X D0.197 | 0 to 20 0 to 0.787<br>0 to 15 0 to 0.591<br>0 to 10 0 to 0.394<br>0 to 10 0 to 0.394                          |                             | 1 to 8 0.039 to 0.315<br>Cannot use<br>12 to 6 0.079 to 0.236 |                              | 2 m<br>6.562 ft                | R25 mm<br>R0.984 in                                                            | FD-H18-L31                |
|                  | 130 °C 266 °F<br>M6                                                                                                      | 410 16.142<br>310 12.205<br>200 7.874<br>140 5.512                                                            |                             | 100 3.937<br>55 2.165<br>47 1.850                             |                              |                                |                                                                                | FD-H13-FM2                |
|                  | 300 °C 572 °F · Rectangular head<br>W9.5 X H5.2 X D15 W0.374 X H0.205 X D0.591                                           | 20 to 300 0.787 to 11.811<br>20 to 200 0.787 to 7.874<br>20 to 150 0.787 to 5.906<br>25 to 130 0.984 to 5.118 |                             | 30 to 100 1.181 to 3.937<br>Cannot use<br>Cannot use          |                              | 1 m<br>3.281 ft                | R18 mm<br>R0.709 in                                                            | FD-H30-KZ1V-S<br>(Note 5) |
|                  | 300 °C 572 °F · Glass substrate detection<br>Convergent reflective type<br>W19 X H5 X D27<br>W0.748 X H1.063<br>X D1.063 | 0 to 11 0 to 0.433<br>0 to 8 0 to 0.315<br>1.5 to 6 0.059 to 0.236<br>1.5 to 5 0.059 to 0.197                 |                             | 2 to 4 0.079 to 0.157<br>Cannot use<br>Cannot use             |                              | 3 m<br>9.843 ft                |                                                                                | FD-H30-L32V-S<br>(Note 5) |
| Vacuum-resistant |                                                                                                                          |                                                                                                               |                             |                                                               |                              |                                |                                                                                |                           |

- Notes: 1) Refer to p.27 for the sensing ranges for the FX-301-HS in H-SP mode and for the FX-301B/G/H.  
2) The sensing range is specified for white non-glossy paper [400 × 400 mm 15.748 × 15.748 in (FD-H30-L32, FD-H18-L31: 50 × 50 mm 1.969 × 1.969 in glass substrate, FD-H30-KZ1V-S, FD-H30-L32V-S: 100 × 100 × t 0.7 mm 3.937 × 3.937 × t 0.028 in transparent glass)] as the object.  
3) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.  
4) The minimum sensing object size is the value for red LED type at maximum sensitivity. Note that the corresponding setting distance is different from the rated sensing distance.  
5) Sold as a set comprising vacuum type fiber + photo-terminal (FV-BR1) + fiber at atmospheric side (FT-J8). Please refer to 'Vacuum resistant fiber catalog' for details.

Model No. when ordering vacuum-resistant fibers individually as replacement parts

- Vacuum-resistant fiber  
FD-H30-KZ1V  
FD-H30-L32V
- Mounting bracket for FD-H30-KZ1V  
MS-FD-2
- Photo-terminal  
FV-BR1 (one pair set)
- Fiber at atmospheric side  
FT-J8 (one pair set)

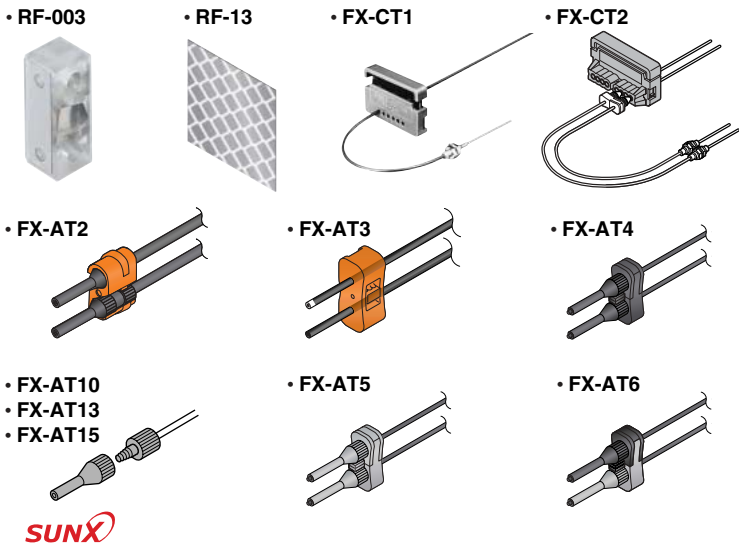


Accessories (attached with fibers)

- RF-003 (FR-KZ21/KZ21E exclusive mirror)
- RF-13 (Reflective tape)
- FX-CT1 (Fiber cutter)
- FX-CT2 (Fiber cutter)
- FX-AT2 (Attachment for fixed-length fiber, Orange)
- FX-AT3 (Attachment for φ2.2 mm φ0.087 in fiber, Clear orange)
- FX-AT4 (Attachment for φ1 mm φ0.039 in fiber, Black)
- FX-AT5 (Attachment for φ1.3 mm φ0.051 in fiber, Gray)
- FX-AT6 (Attachment for φ1 mm φ0.039 in / φ1.3 mm φ0.051 in mixed fiber, Black / Gray)

If connecting to a fiber amplifier other than the FX-300 series

- Applicable fiber amplifiers: FX2 / FX3 series  
FX-AT10 (Attachment for φ1 mm φ0.039 in fiber)  
FX-AT13 (Attachment for φ1.3 mm φ0.051 in fiber)  
FX-AT15 (Attachment for φ1 mm φ0.039 in / φ1.3 mm φ0.051 in mixed fiber)



## LIST OF SENSING RANGE FOR FX-301(P)-HS・FX-301B/G/H

Sensing range for ultra high-speed type FX-301(P)-HS in H-SP mode (35  $\mu$ s)(Typical model)

|                | Fiber model No. | Sensing range<br>(mm in) (Note) |                 | Fiber model No. | Sensing range<br>(mm in) (Note) |
|----------------|-----------------|---------------------------------|-----------------|-----------------|---------------------------------|
| Thru-beam type | <b>FT-B8</b>    | 160 6.299                       | Reflective type | <b>FD-B8</b>    | 60 2.362                        |
|                | <b>FT-FM2</b>   | 120 4.724                       |                 | <b>FD-FM2</b>   | 35 1.378                        |
|                | <b>FT-NFM2</b>  | 40 1.575                        |                 | <b>FD-NFM2</b>  | 14 0.551                        |
|                | <b>FT-E12</b>   | 2 0.079                         |                 | <b>FD-E12</b>   | 1 0.039                         |
|                | <b>FT-E22</b>   | 10 0.394                        |                 | <b>FD-E22</b>   | 5 0.197                         |

Note: The sensing ranges are in H-SP mode. The sensing ranges in FAST, STD, S-D and LONG modes are the same as for the **FX-301**. (Refer to p.18~)

## Sensing range for FX-301B/G/H (Typical model)

(mm in)

|                          |      | Thru-beam type |           |          |            |          |           |           |              |            |           |          |
|--------------------------|------|----------------|-----------|----------|------------|----------|-----------|-----------|--------------|------------|-----------|----------|
|                          |      | FT-B8          | FT-FM2    | FT-NFM2  | FT-V10     | FT-W8    | FT-Z8     | FT-P80    | FT-A30       | FT-A8      | FT-E12    | FT-E22   |
| <b>FX-301B</b>           | LONG | 220 8.661      | 150 5.906 | 50 1.969 | 400 15.748 | 90 3.543 | 120 4.724 | 130 5.118 | 2,400 94.488 | 600 23.622 | 3 0.118   | 14 0.551 |
|                          | STD  | 110 4.331      | 75 2.953  | 25 0.984 | 200 7.874  | 45 1.772 | 60 2.362  | 65 2.559  | 1,200 47.244 | 300 11.811 | 2 0.079   | 7 0.276  |
|                          | FAST | 75 2.953       | 40 1.575  | 16 0.630 | 130 5.118  | 30 1.181 | 40 1.575  | 45 1.772  | 700 27.559   | 220 8.661  | 1 0.039   | 4 0.157  |
| <b>FX-301G</b>           | LONG | 110 4.331      | 70 2.756  | 24 0.945 | 200 7.874  | 56 2.205 | 60 2.362  | 70 2.756  | 1,200 47.244 | 300 11.811 | 1 0.039   | 6 0.236  |
|                          | STD  | 55 2.165       | 35 1.378  | 12 0.472 | 100 3.937  | 28 1.102 | 30 1.181  | 35 1.378  | 600 23.622   | 150 5.906  | —         | 3 0.118  |
|                          | FAST | 40 1.575       | 24 0.945  | 8 0.315  | 65 2.559   | 20 0.787 | 22 0.866  | 25 0.984  | 350 13.780   | 110 4.331  | —         | 2 0.079  |
| <b>FX-301H</b><br>(Note) | LONG | 100 3.937      | 50 1.969  | 16 0.630 | 150 5.906  | 42 1.654 | 46 1.811  | 56 2.205  | 800 31.496   | 220 8.661  | 4 0.157   | 10 0.394 |
|                          | STD  | 50 1.969       | 25 0.984  | 8 0.315  | 75 2.953   | 21 0.827 | 23 0.906  | 28 1.102  | 400 15.748   | 110 4.331  | 2 0.079   | 5 0.197  |
|                          | FAST | 30 1.181       | 18 0.709  | 5 0.197  | 40 1.575   | 15 0.591 | 16 0.630  | 20 0.787  | 240 9.449    | 80 3.150   | 1.5 0.059 | 3 0.118  |

Note: Infrared types are easily affected by humidity, so if using them in environments with high humidity or where the humidity fluctuates, please contact our office.

(mm in)

|                          |      | Reflective type |          |          |           |          |          |           |           |         |           |          |
|--------------------------|------|-----------------|----------|----------|-----------|----------|----------|-----------|-----------|---------|-----------|----------|
|                          |      | FD-B8           | FD-FM2   | FD-NFM2  | FD-W8     | FD-P80   | FD-AFM2  | FD-G4     | FD-EG1    | FD-E12  | FD-E22    | FD-G6X   |
| <b>FX-301B</b>           | LONG | 80 3.150        | 46 1.811 | 16 0.630 | 23 0.906  | 40 1.575 | 40 1.575 | 22 0.866  | 6 0.236   | 2 0.079 | 6 0.236   | 22 0.866 |
|                          | STD  | 40 1.575        | 23 0.906 | 8 0.315  | 11 0.433  | 20 0.787 | 20 0.787 | 11 0.433  | 3 0.118   | 1 0.039 | 3 0.118   | 11 0.433 |
|                          | FAST | 26 1.024        | 15 0.591 | 5 0.197  | 8 0.315   | 13 0.512 | 13 0.512 | 8 0.315   | 2 0.079   | —       | 2 0.079   | 6 0.236  |
| <b>FX-301G</b>           | LONG | 42 1.654        | 24 0.945 | 8 0.315  | 14 0.551  | 20 0.787 | 18 0.709 | 12 0.472  | 3 0.118   | 1 0.039 | 3 0.118   | 12 0.472 |
|                          | STD  | 21 0.827        | 12 0.472 | 4 0.157  | 7 0.276   | 10 0.394 | 9 0.354  | 6 0.236   | 1.5 0.059 | —       | 1.5 0.059 | 6 0.236  |
|                          | FAST | 14 0.551        | 8 0.315  | 2 0.079  | 4 0.157   | 7 0.276  | 5 0.197  | 4 0.157   | 1 0.039   | —       | 1 0.039   | 4 0.157  |
| <b>FX-301H</b><br>(Note) | LONG | 26 1.024        | 20 0.787 | 6 0.236  | 11 0.433  | 18 0.709 | 12 0.472 | 7 0.276   | 10 0.394  | 1 0.039 | 6 0.236   | 18 0.709 |
|                          | STD  | 13 0.512        | 10 0.394 | 3 0.118  | 5.5 0.217 | 9 0.354  | 6 0.236  | 3.5 0.138 | 5 0.197   | —       | 3 0.118   | 9 0.354  |
|                          | FAST | 9 0.354         | 7 0.276  | 2 0.079  | 3 0.118   | 6 0.236  | 4 0.157  | 2 0.079   | 3 0.118   | —       | 2 0.079   | 5 0.197  |

Note: Infrared types are easily affected by humidity, so if using them in environments with high humidity or where the humidity fluctuates, please contact our office.

## Sensing range when using in combination with FR-WKZ11 reflector (optional)

The sensing ranges are the values for **FX-305** / **FX-301** infrared types.

(mm in)

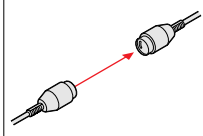
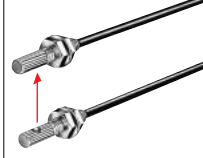
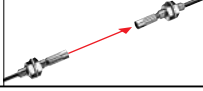
|               |                                                                                                                                                   |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>RF-230</b> | 100 to 3,200 3.937 to 125.984 (LONG), 100 to 2,000 3.937 to 78.740 (STD), 100 to 1,600 3.937 to 62.992 (FAST), 100 to 1,000 3.937 to 39.370 (S-D) |
| <b>RF-220</b> | 100 to 2,400 3.937 to 94.488 (LONG), 100 to 1,300 3.937 to 51.181 (STD), 100 to 1,000 3.937 to 39.370 (FAST), 100 to 600 3.937 to 23.622 (S-D)    |
| <b>RF-210</b> | 100 to 1,100 3.937 to 43.307 (LONG), 100 to 700 3.937 to 27.559 (STD), 100 to 550 3.937 to 21.654 (FAST), 100 to 300 3.937 to 11.811 (S-D)        |

Note: The sensing range indicates the allowable setting range for the reflector. The fiber head can detect objects at distances of 100 mm 3.937 in or less.

However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier before use.

## FIBER OPTIONS

## Lens (For thru-beam type fiber)

| Designation              | Model No.                                   | Description   |                                                                                                                                                                                                                                                                              |
|--------------------------|---------------------------------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| For thru-beam type fiber | Expansion lens<br>(Note 1)                  | <b>FX-LE1</b> |  <p>Increases the sensing range by 5 times or more.</p> <ul style="list-style-type: none"> <li>Ambient temperature:<br/>- 60 to +350 °C<br/>- 76 to +662 °F</li> </ul>                      |
|                          | Super-expansion lens<br>(Note 1)            | <b>FX-LE2</b> |  <p>Tremendously increases the sensing range with large diameter lenses.</p> <ul style="list-style-type: none"> <li>Ambient temperature:<br/>- 60 to +350 °C<br/>- 76 to +662 °F</li> </ul> |
|                          | Side-view lens                              | <b>FX-SV1</b> |  <p>Beam axis is bent by 90 °.</p> <ul style="list-style-type: none"> <li>Ambient temperature:<br/>- 60 to +300 °C<br/>- 76 to +572 °F</li> </ul>                                          |
|                          | Expansion lens for vacuum fiber<br>(Note 1) | <b>FV-LE1</b> |  <p>Sensing range increases by 10 times or more.</p> <ul style="list-style-type: none"> <li>Ambient temperature:<br/>- 40 to +120 °C - 40 to +248 °F</li> </ul>                           |

| Sensing range for red LED type (mm) [Lens on both sides] (Note 3) |      |       |       |       |       |       |       |       |
|-------------------------------------------------------------------|------|-------|-------|-------|-------|-------|-------|-------|
| Fiber                                                             | Mode | U-LG  | LONG  | STDF  | STD   | FAST  | S-D   | H-SP  |
| FT-B8                                                             |      | 3,500 | 3,500 | 3,000 | 2,500 | 2,000 | 1,000 | 1,000 |
| FT-FM2                                                            |      | 3,500 | 3,500 | 3,500 | 3,500 | 2,500 | 1,300 | 1,000 |
| FT-T80                                                            |      | 3,500 | 3,500 | 3,500 | 3,500 | 2,500 | 1,300 | 1,000 |
| FT-R80                                                            |      | 3,500 | 3,500 | 3,500 | 2,300 | 1,600 | 800   | 750   |
| FT-W8                                                             |      | 3,500 | 3,500 | 3,500 | 2,900 | 2,000 | 1,000 | 900   |
| FT-P80                                                            |      | 3,500 | 3,500 | 3,500 | 3,500 | 2,500 | 1,100 | 1,000 |
| FT-P60                                                            |      | 3,500 | 3,500 | 3,500 | 3,500 | 1,500 | 900   | 800   |
| FT-P81X                                                           |      | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 | 1,100 | 950   |
| FT-H35-M2                                                         |      | 3,500 | 3,500 | 2,500 | 2,000 | 1,500 | 750   | 700   |
| FT-H20W-M1                                                        |      | 1,600 | 1,600 | 1,600 | 1,300 | 900   | 500   | 400   |
| FT-H20-M1                                                         |      | 1,600 | 1,600 | 1,600 | 1,600 | 1,100 | 900   | 600   |

| Sensing range for red LED type (mm) [Lens on both sides] (Note 3) |      |       |       |       |       |       |       |       |
|-------------------------------------------------------------------|------|-------|-------|-------|-------|-------|-------|-------|
| Fiber                                                             | Mode | U-LG  | LONG  | STDF  | STD   | FAST  | S-D   | H-SP  |
| FT-B8                                                             |      | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 |
| FT-FM2                                                            |      | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 |
| FT-R80                                                            |      | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 |
| FT-W8                                                             |      | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 |
| FT-P80                                                            |      | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 |
| FT-P60                                                            |      | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 |
| FT-P81X                                                           |      | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 |
| FT-H35-M2                                                         |      | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 |
| FT-H20W-M1                                                        |      | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 | 1,500 | 1,600 |
| FT-H20-M1                                                         |      | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 |
| FT-H13-FM2                                                        |      | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 |

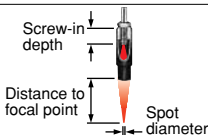
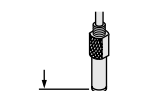
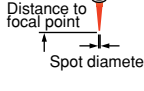
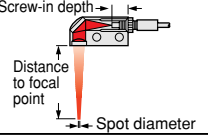
| Sensing range for red LED type (mm) [Lens on both sides] (Note 3) |      |       |     |      |
|-------------------------------------------------------------------|------|-------|-----|------|
| Fiber                                                             | Mode | LONG  | STD | FAST |
| FT-B8                                                             |      | 1,100 | 530 | 400  |
| FT-FM2                                                            |      | 1,200 | 600 | 440  |
| FT-T80                                                            |      | 1,200 | 600 | 440  |
| FT-W8                                                             |      | 900   | 450 | 330  |
| FT-P80                                                            |      | 1,200 | 600 | 440  |
| FT-P60                                                            |      | 650   | 300 | 200  |
| FT-P81X                                                           |      | 1,200 | 600 | 440  |
| FT-H35-M2                                                         |      | 550   | 280 | 200  |
| FT-H20W-M1                                                        |      | 310   | 140 | 100  |
| FT-H20-M1                                                         |      | 550   | 280 | 200  |

| Sensing range for red LED type (mm) [Lens on both sides] (Note 3, 4) |      |       |       |      |     |      |     |      |
|----------------------------------------------------------------------|------|-------|-------|------|-----|------|-----|------|
| Fiber                                                                | Mode | U-LG  | LONG  | STDF | STD | FAST | S-D | H-SP |
| FT-H30-M1V                                                           |      | 1,600 | 1,200 | 650  | 450 | 300  | 150 | 200  |

Notes: 1) Be careful when installing the thru-beam type fiber equipped with the expansion lens, as the beam envelope becomes narrow and alignment is difficult. Especially when installing a fiber with many cores (sharp bending fibers and heat-resistant glass fiber), please be sure to use it only after you have adjusted it sufficiently.  
2) The fiber cable length practically limits the sensing range to 3,500 mm [137.795 in](#) long (FT-H20W-M1, FT-P81X and FT-H20-M1: 1,600 mm [62.992 in](#)).  
3) The sensing ranges are the values for red LED type amplifier. Please contact our office for details on sensing ranges for other types of amplifiers.  
4) The fiber cable length for the FT-H30-M1V is 1 m [3.281 ft](#). The sensing ranges in U-LG and LONG modes take into account the length of the FT-J8 atmospheric side fiber.

## Lens (For reflective type fiber)

| Designation                | Model No.     | Description                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pinpoint spot lens         | <b>FX-MR1</b> |                                                                      | <p>Pinpoint spot of <math>\phi 0.5</math> mm <math>\phi 0.020</math> in. Enables detection of minute objects or small marks.</p> <ul style="list-style-type: none"> <li>Distance to focal point: <math>6 \pm 1</math> mm <math>0.236 \pm 0.039</math> in</li> <li>Ambient temperature: - 40 to +70 °C - 40 to +158 °F</li> </ul>                                                                                    |
| Zoom lens                  | <b>FX-MR2</b> |  <p>Screw-in depth<br/>Distance to focal point<br/>Spot diameter</p> | <p>The spot diameter is adjustable from <math>\phi 0.7</math> mm to <math>\phi 2</math> mm <math>\phi 0.028</math> in to <math>\phi 0.079</math> in according to how much the fiber is screwed in.</p> <ul style="list-style-type: none"> <li>Applicable fibers: <b>FD-WG4, FD-G4</b></li> <li>Ambient temperature: - 40 to +70 °C - 40 to +158 °F</li> <li>Accessory: <b>MS-EX-3</b> (mounting bracket)</li> </ul> |
| Finest spot lens           | <b>FX-MR3</b> |                                                                      | <p>Extremely fine spot of <math>\phi 0.3</math> mm <math>\phi 0.012</math> in approx. achieved.</p> <ul style="list-style-type: none"> <li>Applicable fibers: <b>FD-WG4, FD-G4, FD-EG1, FD-EG2, FD-EG3, FD-G6X, FD-G6</b></li> <li>Ambient temperature: - 40 to +70 °C - 40 to +158 °F</li> </ul>                                                                                                                   |
| Finest spot lens           | <b>FX-MR6</b> |  <p>Distance to focal point<br/>Spot diameter</p>                    | <p>Extremely fine spot of <math>\phi 0.1</math> mm <math>\phi 0.004</math> in approx. achieved.</p> <ul style="list-style-type: none"> <li>Applicable fibers: <b>FD-WG4, FD-G4, FD-EG1, FD-EG2, FD-EG3, FD-G6X, FD-G6</b></li> <li>Ambient temperature: - 20 to +60 °C - 4 to +140 °F</li> </ul>                                                                                                                    |
| Zoom lens (Side-view type) | <b>FX-MR5</b> |  <p>Screw-in depth<br/>Distance to focal point<br/>Spot diameter</p> | <p><b>FX-MR2</b> is converted into a side-view type and can be mounted in a very small space.</p> <ul style="list-style-type: none"> <li>Applicable fibers: <b>FD-WG4, FD-G4</b></li> <li>Ambient temperature: - 40 to +70 °C - 40 to +158 °F</li> </ul>                                                                                                                                                            |

| Sensing range for red LED type (Note) |                         |               |
|---------------------------------------|-------------------------|---------------|
| Screw-in depth                        | Distance to focal point | Spot diameter |
| 7 mm                                  | 18.5 mm approx.         | $\phi 0.7$ mm |
| 12 mm                                 | 27 mm approx.           | $\phi 1.2$ mm |
| 14 mm                                 | 43 mm approx.           | $\phi 2.0$ mm |

| Sensing range for red LED type (Note) |                         |                        |
|---------------------------------------|-------------------------|------------------------|
| Fiber model No.                       | Distance to focal point | Spot diameter          |
| FD-EG3                                | $7.5 \pm 0.5$ mm        | $\phi 0.15$ mm approx. |
| FD-EG2                                | $7.5 \pm 0.5$ mm        | $\phi 0.2$ mm approx.  |
| FD-EG1                                | $7.5 \pm 0.5$ mm        | $\phi 0.3$ mm approx.  |
| FD-WG4/G4/G6X/G6                      | $7.5 \pm 0.5$ mm        | $\phi 0.5$ mm approx.  |

| Sensing range for red LED type (Note) |                         |                        |
|---------------------------------------|-------------------------|------------------------|
| Fiber model No.                       | Distance to focal point | Spot diameter          |
| FD-EG3                                | $7 \pm 0.5$ mm          | $\phi 0.1$ mm approx.  |
| FD-EG2                                | $7 \pm 0.5$ mm          | $\phi 0.15$ mm approx. |
| FD-EG1                                | $7 \pm 0.5$ mm          | $\phi 0.2$ mm approx.  |
| FD-WG4/G4/G6X/G6                      | $7 \pm 0.5$ mm          | $\phi 0.4$ mm approx.  |

| Sensing range for red LED type (Note) |                         |               |
|---------------------------------------|-------------------------|---------------|
| Screw-in depth                        | Distance to focal point | Spot diameter |
| 8 mm                                  | 13 mm approx.           | $\phi 0.5$ mm |
| 10 mm                                 | 15 mm approx.           | $\phi 0.8$ mm |
| 14 mm                                 | 30 mm approx.           | $\phi 3.0$ mm |

Note: The sensing ranges are the values when used in combination with red LED type amplifier. Please contact our office for details on sensing ranges for other types of amplifier.

## FIBER OPTIONS

### Others

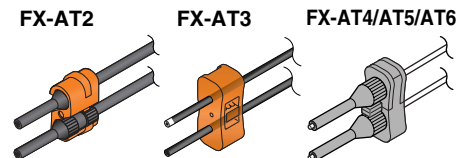
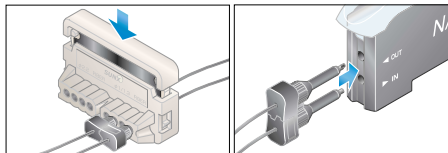
| Designation                                                                            | Model No.                  | Description                                                                                                                                                         |                                                                             |                                                                           |                                                                                                                      |
|----------------------------------------------------------------------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Protective tube<br>(For thru-beam)<br>type fiber                                       | FTP-500 (0.5 m 1.640 ft)   | For<br>M4<br>thread                                                                                                                                                 | Applicable fibers                                                           | FT-B8      FT-P80<br>FT-FM2    FT-P60<br>FT-FM2S   FT-FM2S4<br>FT-H13-FM2 | The protective tube, made of non-corrosive stainless steel, protects the inner fiber cable from any external forces. |
|                                                                                        | FTP-1000 (1 m 3.281 ft)    |                                                                                                                                                                     |                                                                             |                                                                           |                                                                                                                      |
|                                                                                        | FTP-1500 (1.5 m 4.921 ft)  |                                                                                                                                                                     |                                                                             |                                                                           |                                                                                                                      |
|                                                                                        | FTP-N500 (0.5 m 1.640 ft)  | For<br>M3<br>thread                                                                                                                                                 |                                                                             | FT-T80      FT-P40<br>FT-NFM2    FD-T40<br>FT-NFM2S   FD-P40<br>FT-NFM2S4 |                                                                                                                      |
|                                                                                        | FTP-N1000 (1 m 3.281 ft)   |                                                                                                                                                                     |                                                                             |                                                                           |                                                                                                                      |
|                                                                                        | FTP-N1500 (1.5 m 4.921 ft) |                                                                                                                                                                     |                                                                             |                                                                           |                                                                                                                      |
| Protective tube<br>(For reflective)<br>type fiber                                      | FDP-500 (0.5 m 1.640 ft)   | For<br>M6<br>thread                                                                                                                                                 | FD-B8      FD-P80<br>FD-FM2    FT-H13-FM2<br>FD-FM2S<br>FD-FM2S4            |                                                                           |                                                                                                                      |
|                                                                                        | FDP-1000 (1 m 3.281 ft)    |                                                                                                                                                                     |                                                                             |                                                                           |                                                                                                                      |
|                                                                                        | FDP-1500 (1.5 m 4.921 ft)  |                                                                                                                                                                     |                                                                             |                                                                           |                                                                                                                      |
|                                                                                        | FDP-N500 (0.5 m 1.640 ft)  | For<br>M4<br>thread                                                                                                                                                 | FD-T80<br>FD-NFM2<br>FD-NFM2S<br>FD-NFM2S4                                  |                                                                           |                                                                                                                      |
|                                                                                        | FDP-N1000 (1 m 3.281 ft)   |                                                                                                                                                                     |                                                                             |                                                                           |                                                                                                                      |
|                                                                                        | FDP-N1500 (1.5 m 4.921 ft) |                                                                                                                                                                     |                                                                             |                                                                           |                                                                                                                      |
| Fiber bender                                                                           | FB-1                       | The fiber bender bends the sleeve part of the fiber head at the proper radius. (Note)                                                                               |                                                                             |                                                                           |                                                                                                                      |
| Universal sensor mounting stand                                                        | MS-AJ1-F                   | Horizontal mounting type                                                                                                                                            | Mounting stand assembly for fiber<br>(For M3, M4 or M6 threaded head fiber) |                                                                           |                                                                                                                      |
|                                                                                        | MS-AJ2-F                   | Vertical mounting type                                                                                                                                              |                                                                             |                                                                           |                                                                                                                      |
| Fiber cutter                                                                           | FX-CT2                     | The free-cut type fiber can be easily cut.<br>[Accessory. FX-CT1 is attached with the FT-P80 or the FD-P80.]<br>The FX-CT2 is provided with fibers other than this. |                                                                             |                                                                           |                                                                                                                      |
|                                                                                        | FX-CT1                     |                                                                                                                                                                     |                                                                             |                                                                           |                                                                                                                      |
| Attachment for fixed-length fiber                                                      | FX-AT2                     | This is the attachment for the fixed length fiber. (Accessory)                                                                                                      |                                                                             |                                                                           |                                                                                                                      |
| Attachment for $\phi 2.2$ mm $\phi 0.087$ in fiber                                     | FX-AT3                     | This is the attachment for the $\phi 2.2$ mm $\phi 0.087$ in fiber. .<br>(Accessory. Does not attach with the FT-P80 or the FD-P80.)                                |                                                                             |                                                                           |                                                                                                                      |
| Attachment for $\phi 1$ mm $\phi 0.039$ in fiber                                       | FX-AT4                     | This is the attachment for the $\phi 1$ mm $\phi 0.039$ in fiber. (Accessory)                                                                                       |                                                                             |                                                                           |                                                                                                                      |
| Attachment for $\phi 1.3$ mm $\phi 0.051$ in fiber                                     | FX-AT5                     | This is the attachment for the $\phi 1.3$ mm $\phi 0.051$ in fiber.<br>(Accessory)                                                                                  |                                                                             |                                                                           |                                                                                                                      |
| Attachment for $\phi 1$ mm $\phi 0.039$ in / $\phi 1.3$ mm $\phi 0.051$ in mixed fiber | FX-AT6                     | This is the attachment for the $\phi 1$ mm $\phi 0.039$ in / $\phi 1.3$ mm $\phi 0.051$ in mixed fiber. (Accessory)                                                 |                                                                             |                                                                           |                                                                                                                      |

Note: Do not bend the sleeve part of any side-view type fiber or ultra-small diameter head type fiber.

### Fiber attachment

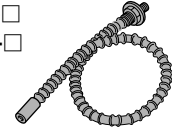
It's possible to simultaneously cut two fibers to the same length

Each fiber (with some exceptions) has a newly developed two-in-one fiber attachment (**FX-AT3/AT4/AT5/AT6**) which enables two fibers to be cut simultaneously to the same length with the new fiber cutter (**FX-CT2**). Also, since the fibers can be attached to the amplifier while being fixed in position in the two-in-one fiber attachment, sensitivity changes resulting from variation in the amount of fiber insertion do not occur.



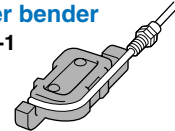
### Protective tube

- FTP-□
- FDP-□



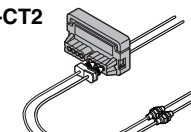
### Fiber bender

- FB-1

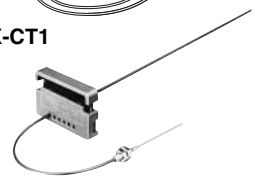


### Fiber cutter

- FX-CT2



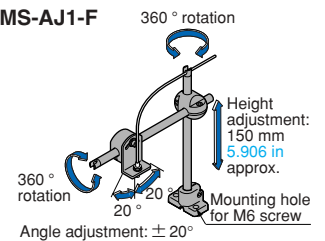
- FX-CT1



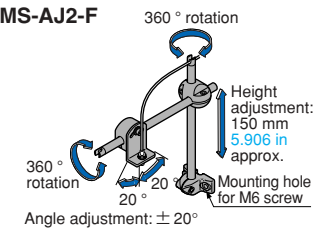
### Universal sensor mounting stand

Using the arm which enables adjustment in the horizontal direction, sensing can also be done from above an assembly line.

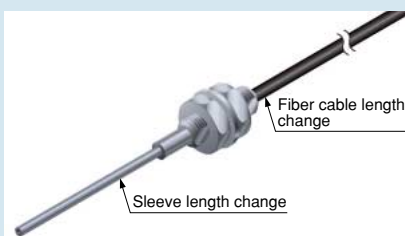
- MS-AJ1-F



- MS-AJ2-F



## Guide to interchanging fiber length and sleeve length



Custom-ordered products are available with different fiber lengths and sleeve lengths in order to respond quickly to different requirements.

### Custom-ordered product (Typical)

- Fiber length can be set up to 30 m 98.425 ft in units of 1 m 3.281 ft ..... **FT-B8**, **FT-AFM2** etc.
- Sleeve length can be set up to 12 cm 4.724 in units of 1 cm 0.394 in ..... **FT-FM2S4**, **FD-NFM2S4** etc.

Please contact us.

## SPECIFICATIONS

Refer to the 'Sensor general catalog 2003-2004' for fiber specifications.

|                                            |                          | Type       | Standard type                                                                                                                                                                                                                                                                                                                                            |          |           |              | High-speed type                                                                                                                                                                                                                                   | High-function type                                                                                                                                                 |
|--------------------------------------------|--------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            |                          |            | Red LED                                                                                                                                                                                                                                                                                                                                                  | Blue LED | Green LED | Infrared LED |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
| Item                                       | Model No.                | NPN output | FX-301                                                                                                                                                                                                                                                                                                                                                   | FX-301B  | FX-301G   | FX-301H      | FX-301-HS                                                                                                                                                                                                                                         | FX-305                                                                                                                                                             |
|                                            |                          | PNP output | FX-301P                                                                                                                                                                                                                                                                                                                                                  | FX-301BP | FX-301GP  | FX-301HP     | FX-301P-HS                                                                                                                                                                                                                                        | FX-305P                                                                                                                                                            |
| Supply voltage                             |                          |            | 12 to 24 V DC ± 10 % Ripple P-P 10 % or less                                                                                                                                                                                                                                                                                                             |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
| Power consumption                          |                          |            | <Red LED / Infrared LED type><br>Normal operation: 960 mW or less (Current consumption 40 mA or less at 24 V supply voltage)<br>ECO mode: 600 mW or less (Current consumption 25 mA or less at 24 V supply voltage)                                                                                                                                      |          |           |              | <Blue LED / Green LED type><br>Normal operation: 720 mW or less (Current consumption 30 mA or less at 24 V supply voltage)<br>ECO mode: 430 mW or less (Current consumption 18 mA or less at 24 V supply voltage)                                 |                                                                                                                                                                    |
| Output                                     |                          |            | <NPN output type><br>NPN open-collector transistor<br>• Maximum sink current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade.)<br>• Applied voltage: 30 V DC or less (between output and 0 V)<br>• Residual voltage: 1.5 V or less [at 100 mA (at 50 mA, if five, or more, amplifiers are connected in cascade) sink current.]     |          |           |              | <NPN output type><br>NPN open-collector transistor 2 outputs<br>• Maximum sink current: 50 mA each (Note 1)<br>• Applied voltage: 30 V DC or less (between output and 0 V)<br>• Residual voltage: 1.5 V or less [at 50 mA (Note 1)]               |                                                                                                                                                                    |
|                                            |                          |            | <PNP output type><br>PNP open-collector transistor<br>• Maximum source current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade.)<br>• Applied voltage: 30 V DC or less (between output and + V)<br>• Residual voltage: 1.5 V or less [at 100 mA (at 50 mA, if five, or more, amplifiers are connected in cascade) source current.] |          |           |              | <PNP output type><br>PNP open-collector transistor 2 outputs<br>• Maximum source current: 50 mA each (Note 1)<br>• Applied voltage: 30 V DC or less (between output and + V)<br>• Residual voltage: 1.5 V or less [at 50 mA (Note 1)]             |                                                                                                                                                                    |
|                                            | Output operation         |            | Selectable either Light-ON or Dark-ON, with jog switch                                                                                                                                                                                                                                                                                                   |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
|                                            | Short-circuit protection |            | Incorporated                                                                                                                                                                                                                                                                                                                                             |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
| Response time                              |                          |            | 65 μs or less [H-SP (Red LED type only)], 150 μs or less (FAST), 250 μs or less [STD / S-D (Red LED type only)], 2 ms or less (LONG), selectable with jog switch                                                                                                                                                                                         |          |           |              | 35 μs or less (H-SP), 150 μs or less (FAST), 250 μs or less (STD / S-D), 2 ms or less (LONG), selectable with jog switch                                                                                                                          | 65 μs or less (H-SP), 150 μs or less (FAST), 250 μs or less (STD), 700 μs or less (STDF), 2.5 ms or less (LONG), 4.5 ms or less (U-LG), selectable with jog switch |
| Sensitivity setting                        |                          |            | 2-level teaching / Limit teaching / Manual adjustment / Full-auto teaching / Max. sensitivity teaching                                                                                                                                                                                                                                                   |          |           |              | Normal mode: 2-level teaching / Limit teaching / Full-auto teaching / Max. sensitivity teaching / Manual adjustment<br>Window comparator mode: Teaching (1-level / 2-level / 3-level) / Manual adjustment                                         |                                                                                                                                                                    |
| Operation indicator                        |                          |            | Orange LED (lights up when the output is ON)                                                                                                                                                                                                                                                                                                             |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
| Stability indicator                        |                          |            | Green LED (lights up under stable light received condition or stable dark condition)                                                                                                                                                                                                                                                                     |          |           |              | —————                                                                                                                                                                                                                                             |                                                                                                                                                                    |
| MODE indicator                             |                          |            | RUN: Green LED, TEACH · ADJ · L/D ON · TIMER · PRO: Yellow LED                                                                                                                                                                                                                                                                                           |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
| Digital display                            |                          |            | 4 digit red LED display                                                                                                                                                                                                                                                                                                                                  |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
| Fine sensitivity adjustment function       |                          |            | Incorporated                                                                                                                                                                                                                                                                                                                                             |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
| Timer function                             |                          |            | Incorporated with variable ON-delay / OFF-delay / ONE-SHOT timer, switchable either effective or ineffective.<br>[Timer period: Red LED type; 0.5 ms approx., 1 ms to 9999 ms<br>(Blue LED, Green LED, Infrared LED type; approx. 0.5 ms to 500 ms)]                                                                                                     |          |           |              | Incorporated with variable ON-delay / OFF-delay / ONE-SHOT / ON-delay · OFF-delay / ON-delay · ONE-SHOT timer, switchable either effective or ineffective.<br>(Timer period: Output 1; 0.5 ms, 1 ms to 9999 ms, Output 2; 0.5 ms, 1 ms to 500 ms) |                                                                                                                                                                    |
| Light emitting amount selection function   |                          |            | Incorporated (Red LED type only)(Note 2)<br>FAST, STD, LONG: 4 level, H-SP: 3 level, S-D: 2 level                                                                                                                                                                                                                                                        |          |           |              | Incorporated (Note 2)<br>FAST, STD, LONG: 4 level<br>H-SP, S-D: 2 level                                                                                                                                                                           | Incorporated (Note 2)<br>FAST, STD, STDF, LONG, U-LG: 4 level<br>H-SP: 3 level                                                                                     |
| Automatic interference prevention function |                          |            | Incorporated (Up to four sets of fiber heads can be mounted close together. However, H-SP mode is 2 fiber heads.)(Note 3)                                                                                                                                                                                                                                |          |           |              | —————                                                                                                                                                                                                                                             | Incorporated [Up to four sets of fiber heads can be mounted close together. (However, U-LG mode is 8 fiber heads, H-SP mode is 2 fiber heads.)(Note 4)]            |
| Environmental resistance                   | Ambient temperature      |            | − 10 to + 55 °C + 14 to + 131 °F (If 4 to 7 units are connected in cascade: − 10 to + 50 °C + 14 to + 122 °F, if 8 to 16 units are connected in cascade: − 10 to + 45 °C + 14 to + 113 °F (No dew condensation or icing allowed), Storage: − 20 to + 70 °C − 4 to + 158 °F                                                                               |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
|                                            | Ambient humidity         |            | 35 to 85 % RH, Storage: 35 to 85 % RH                                                                                                                                                                                                                                                                                                                    |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
|                                            | Ambient illuminance      |            | Sunlight: 10,000 lx at the light-receiving face, Incandescent light: 3,000 lx at the light-receiving face                                                                                                                                                                                                                                                |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
|                                            | Voltage withstandability |            | 1,000 V AC for one min. between all supply terminals connected together and enclosure (Note 5)                                                                                                                                                                                                                                                           |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
|                                            | Insulation resistance    |            | 20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure (Note 5)                                                                                                                                                                                                                                              |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
|                                            | Vibration resistance     |            | 10 to 150 Hz frequency, 0.75 mm 0.030 in amplitude in X, Y and Z directions for two hours each                                                                                                                                                                                                                                                           |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
| Shock resistance                           |                          |            | 98 m/s <sup>2</sup> acceleration (10 G approx.) in X, Y and Z directions for five times each                                                                                                                                                                                                                                                             |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
| Emitting element (modulated)               |                          |            | Red LED                                                                                                                                                                                                                                                                                                                                                  | Blue LED | Green LED | Infrared LED | Red LED                                                                                                                                                                                                                                           | Red LED                                                                                                                                                            |
| Material                                   |                          |            | Enclosure: Heat-resistant ABS, Case cover: Polycarbonate, MODE key: Acrylic, Jog switch: Heat-resistant ABS (FX-301B/G/H: Acrylic)                                                                                                                                                                                                                       |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
| Connecting method                          |                          |            | Connector (Note 6)                                                                                                                                                                                                                                                                                                                                       |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
| Cable extension                            |                          |            | Extension up to total 100 m 328.084 ft (50 m 164.042 ft for 5 to 8 units, 20 m 65.617 ft for 9 to 16 units) is possible with 0.3 mm <sup>2</sup> , or more, cable.                                                                                                                                                                                       |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
| Weight                                     |                          |            | Net weight: 20 g approx., Gross weight: 25 g approx.                                                                                                                                                                                                                                                                                                     |          |           |              |                                                                                                                                                                                                                                                   |                                                                                                                                                                    |

Notes: 1) 50 mA per output. 25 mA if five, or more, amplifiers are connected in cascade.

2) The light emitting amount can be zero (emission halt) in all modes.

3) When the power supply is switched on, the light emission timing is automatically set for interference prevention.

4) When the interference prevention function 'IP-2' is set, the number of mountable fiber heads becomes double. Furthermore, take care that the response time also becomes double.

5) The voltage withstandability and the insulation resistance values given in the above table are for the amplifier only.

6) The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cables given below.

Main cable (3-core) for FX-301(P)(-HS): CN-73-C1 (Cable length 1 m 3.281 ft), CN-73-C2 (Cable length 2 m 6.562 ft), CN-73-C5 (Cable length 5 m 16.404 ft)

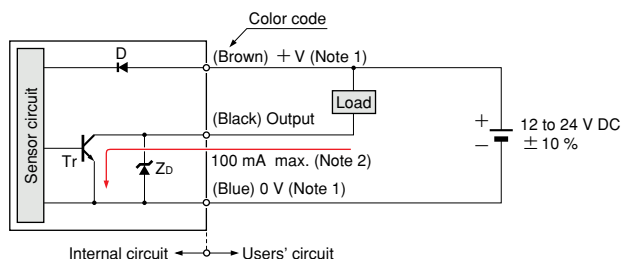
Sub cable (1-core) for FX-301(P)(-HS): CN-71-C1 (Cable length 1 m 3.281 ft), CN-71-C2 (Cable length 2 m 6.562 ft), CN-71-C5 (Cable length 5 m 16.404 ft)

Main cable (4-core) for FX-305(P): CN-74-C1 (Cable length 1 m 3.281 ft), CN-74-C2 (Cable length 2 m 6.562 ft), CN-74-C5 (Cable length 5 m 16.404 ft)

Sub cable (2-core) for FX-305(P): CN-72-C1 (Cable length 1 m 3.281 ft), CN-72-C2 (Cable length 2 m 6.562 ft), CN-72-C5 (Cable length 5 m 16.404 ft)

## I/O CIRCUIT DIAGRAMS

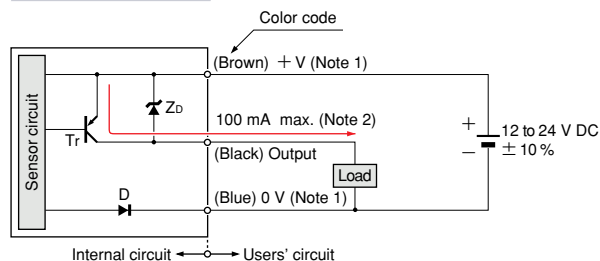
**FX-301(-HS)** NPN output type



Notes: 1) The quick-connection sub cable does not have + V (brown) and 0 V (blue).  
The power is supplied from the connector of the main cable.  
2) 50 mA max., if five amplifiers, or more, are connected together.

Symbols ... D : Reverse supply polarity protection diode  
Z<sub>D</sub>: Surge absorption zener diode  
Tr : NPN output transistor

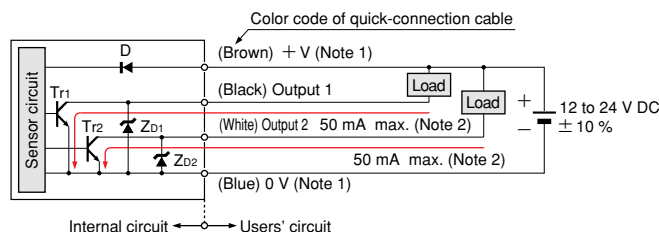
**FX-301P(-HS)** PNP output type



Notes: 1) The quick-connection sub cable does not have + V (brown) and 0 V (blue).  
The power is supplied from the connector of the main cable.  
2) 50 mA max., if five amplifiers, or more, are connected together.

Symbols ... D : Reverse supply polarity protection diode  
Z<sub>D</sub>: Surge absorption zener diode  
Tr : PNP output transistor

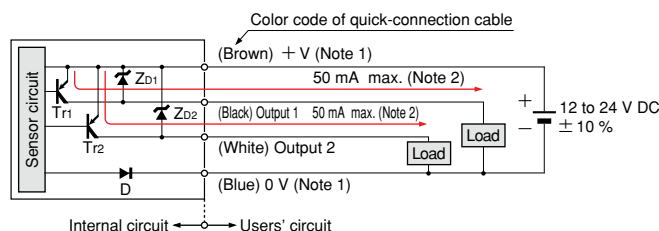
**FX-305** NPN output type



Notes: 1) The quick-connection sub cable does not have + V (brown) and 0 V (blue).  
The power is supplied from the connector of the main cable.  
2) 25 mA max., if five amplifiers, or more, are connected together.

Symbols ... D: Reverse supply polarity protection diode  
ZD1, ZD2: Surge absorption zener diode  
Tr1, Tr2 : NPN output transistor

**FX-305P** PNP output type



Notes: 1) The quick-connection sub cable does not have + V (brown) and 0 V (blue).  
The power is supplied from the connector of the main cable.  
2) 25 mA max., if five amplifiers, or more, are connected together.

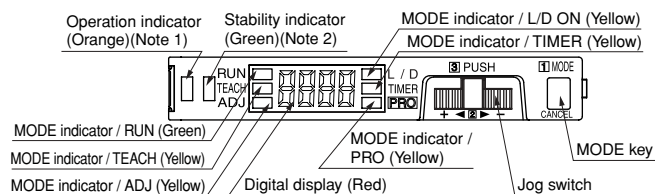
Symbols ... D: Reverse supply polarity protection diode  
ZD1, ZD2: Surge absorption zener diode  
Tr1, Tr2 : PNP output transistor

## PRECAUTIONS FOR PROPER USE



This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

## Part description

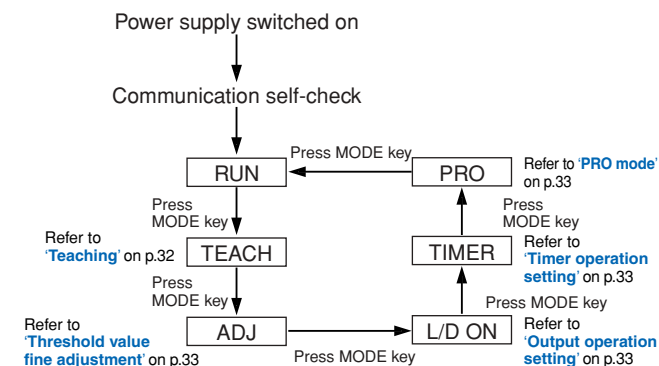


Notes: 1) **FX-305(P)**; Output 1 operation indicator (Orange)  
2) **FX-305(P)**; Output 2 operation indicator (Orange)

Refer to the 'Sensor general catalog 2003-2004' for fiber precautions.

## Operation procedure

- When the power supply is switched on, communication self-check is carried out and normal condition is displayed [MODE indicator / RUN (green) lights up and the digital display shows incident light intensity].
- When MODE key is pressed, the mode changes as per the diagram below.



When jog switch is pressed, the setting is confirmed.  
When MODE key is pressed for 2 sec., or more, the sensor returns to the RUN mode.  
Cancellation is possible by pressing MODE key during setting.

**For FX-305(P)**

The **FX-305** is equipped with two independent outputs, but the items that can be set in output 1 and output 2 respectively are only the following. The items other than those are common.

- ① Threshold value ② Output operation  
③ Timer operation and Timer period ④ Sensing mode

## PRECAUTIONS FOR PROPER USE

Refer to the 'Sensor general catalog 2003-2004' for fiber precautions.

### Teaching

- The threshold values can be set by normal mode (2-level teaching, limit teaching or full-auto teaching) or window comparator mode (1-level / 2-level / 3-level teaching) [FX-305(P) only], when the MODE indicator / TEACH (yellow) lights up.

#### In case of 2-level teaching

- This is the method of setting the threshold value by teaching two levels, corresponding to the object present and object absent conditions. Normally, setting is done by this method.

| Step | Description                                                                                                                                                                                                                                                                                                                                                                                                                               | Display       |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| ①    | Set the fiber within the sensing range.<br>Press the MODE key to light up MODE indicator / TEACH (yellow).                                                                                                                                                                                                                                                                                                                                | 1234          |
| ②    | For the <b>FX-305(P)</b> , select 'Out 1' or 'Out 2' beforehand.<br>Press jog switch in the object present condition.<br>If the teaching is accepted, the read incident light intensity blinks in the digital display.                                                                                                                                                                                                                    | 567           |
| ③    | MODE indicator / TEACH (yellow) blinks.<br>Press the jog switch in the object absent condition.                                                                                                                                                                                                                                                                                                                                           | 1234          |
| ④    | If the teaching is accepted, the read incident light intensity blinks in the digital display and the threshold value is set at the mid-value between the incident light intensities in the object present and the object absent conditions. After this, the judgment on the stability of sensing is displayed.<br>• In case stable sensing is possible: 'Good' is displayed.<br>• In case stable sensing is not possible: 'Err-d' blinks. | Good<br>Err-d |
| ⑤    | The threshold value is displayed.                                                                                                                                                                                                                                                                                                                                                                                                         | 900           |
| ⑥    | '....' blinks in the digital display. ( <b>FX-301B/G/H</b> only)                                                                                                                                                                                                                                                                                                                                                                          | ....          |
| ⑦    | The incident light intensity in the digital display and the setting is complete.                                                                                                                                                                                                                                                                                                                                                          | 1234          |

Notes: 1) Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.  
2) In case of using the reflective type fibers, if Jog switch is pressed in the object absent condition at ② and ③, the sensitivity is set to the maximum.

#### In case of full-auto teaching

- Full-auto teaching is used when it is desired to set the threshold value without stopping the assembly line, with the object in the moving condition.

| Step | Description                                                                                                                                                                                                                                                                                                                                                                                                                               | Display       |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| ①    | Set the fiber within the sensing range.<br>Press MODE key to light up MODE indicator / TEACH (yellow).                                                                                                                                                                                                                                                                                                                                    | 1234          |
| ②    | For the <b>FX-305(P)</b> , select 'Out 1' or 'Out 2' beforehand.<br>Press the jog switch continuously for 0.5 sec. or more with the object moving on the assembly line. (The incident light intensity is displayed during sampling.)                                                                                                                                                                                                      | 1234          |
| ③    | 'Auto' is displayed on the digital display. Release the jog switch when the object has passed.                                                                                                                                                                                                                                                                                                                                            | Auto          |
| ④    | If the teaching is accepted, the read incident light intensity blinks in the digital display and the threshold value is set at the mid-value between the incident light intensities in the object present and the object absent conditions. After this, the judgment on the stability of sensing is displayed.<br>• In case stable sensing is possible: 'Good' is displayed.<br>• In case stable sensing is not possible: 'Err-d' blinks. | Good<br>Err-d |
| ⑤    | The threshold value is displayed.                                                                                                                                                                                                                                                                                                                                                                                                         | 900           |
| ⑥    | '....' blinks in the digital display. ( <b>FX-301B/G/H</b> only)                                                                                                                                                                                                                                                                                                                                                                          | ....          |
| ⑦    | The incident light intensity in the digital display and the setting is complete.                                                                                                                                                                                                                                                                                                                                                          | 1234          |

Notes: 1) The threshold value's shift amount can be selected in PRO mode. (Increments of 5 % between -45 and 45 % for setting possible. 0 % default.)  
2) Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

#### In case of limit teaching

- This is the method of setting the threshold value by teaching only the object absent condition (stable incident light condition). This is used for detection in the presence of a background body or for detection of minute objects.

| Step | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Display       |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| ①    | Set the fiber within the sensing range.<br>Press the MODE key to light up MODE indicator / TEACH (yellow).                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1234          |
| ②    | For the <b>FX-305(P)</b> , select 'Out 1' or 'Out 2' beforehand.<br>Press the jog switch in the object absent condition.<br>If the teaching is accepted, the read incident light intensity blinks in the digital display.                                                                                                                                                                                                                                                                                                                                        | 1234          |
| ③    | MODE indicator / TEACH (yellow) blinks.<br>Turn jog switch to the '+' side or '-' side.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1234          |
| ④    | If the jog switch is turned to the '+' side, ' ' scrolls (twice)(Note 2) the display from right to left, and the threshold level is shifted to a value approx. 15 % higher (lower sensitivity) than that set at ②. (Note 1)<br>This is used in case of reflective type fibers.<br>If the jog switch is turned to the '-' side, ' ' scrolls (twice) (Note 2) the display from left to right, and the threshold level is shifted to a value approx. 15 % lower (higher sensitivity) than that set at ②. (Note 1)<br>This is used in case of thru-beam type fibers. |               |
| ⑤    | After this, the judgment on whether the setting shift amount can be shifted or not is displayed.<br>• In case shifting is possible: 'Good' blinks.<br>• In case shifting is not possible: 'Err-d' blinks.                                                                                                                                                                                                                                                                                                                                                        | Good<br>Err-d |
| ⑥    | The threshold value is displayed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 900           |
| ⑦    | '....' blinks in the digital display. ( <b>FX-301B/G/H</b> only)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ....          |
| ⑧    | The incident light intensity appears in the digital display and the setting is complete.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1234          |

Notes: 1) The **FX-301B/G/H** has no scroll display.  
2) The approx. 15 % amount of shift is the initial value. The amount of shift can be changed in the PRO mode from approx. 5 to 80 % (5 % step).  
3) Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

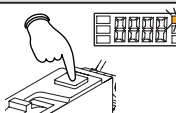
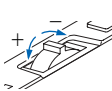
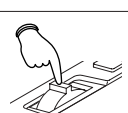
Please refer to the 'Sensor general catalog 2003-2004' or website (<http://www.sunx.jp>) for setting of threshold value when used in combination with contact type liquid level detection fiber **FD-F8Y**, and for setting of threshold value when used in combination with pipe-mountable liquid level detection fiber **FD-F4**.

## PRECAUTIONS FOR PROPER USE

### Threshold value fine adjustment

| Step | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Display                                      |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| ①    | Press the MODE key to light up MODE indicator / ADJ (yellow).<br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | —                                            |
| ②    | For the <b>FX-305(P)</b> , select 'Out1' or 'Out2' beforehand.<br>In case the threshold value is to be increased (sensitivity to be reduced), turn the jog switch to the '+' side to increase the threshold value slowly. If the jog switch is turned continuously to the '+' side, the threshold value increases rapidly.<br>In case the threshold value is to be decreased (sensitivity to be increased), turn the jog switch to the '-' side to decrease the threshold value slowly. If the jog switch is turned continuously to the '-' side, the threshold value decreases rapidly.<br> | 1234<br>↓<br>1235<br>or<br>1234<br>↓<br>1233 |
| ③    | When the jog switch is pressed, the threshold value is confirmed.<br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | —                                            |

### Output operation setting

| Step | Description                                                                                                                                                                                                                                                 | Display                                     |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| ①    | Press the MODE key to light up MODE indicator / L/D ON (yellow).<br>                                                                                                      | L-on<br>Displays present setting            |
| ②    | For the <b>FX-305(P)</b> , select 'Out1' or 'Out2' beforehand.<br>If the jog switch is turned to the '+' or '-' direction, the output operation setting will change.<br> | L-on<br>↓ Light state<br>d-on<br>Dark state |
| ③    | When the jog switch is pressed, the threshold value is confirmed.<br>                                                                                                    | d-on<br>Displays selected setting           |

### Timer operation setting

- When the MODE indicator / TIMER (yellow) lights up, you can set the type of timer and whether the timer is to be used or not. For the **FX-301B/G/H**, the type of timer is set in PRO mode.
- Further, an OFF-delay which is useful when the response of the connected device is slow, etc., an ON-delay which is useful to detect only objects taking a long time to travel, and ONE-SHOT, which is useful when the input specifications of the connected device require a signal of a fixed width, are possible with the **FX-301□(-HS)**. [Furthermore, ON-delay • OFF-delay and ON-delay • ONE-SHOT timer are incorporated for **FX-305(P)**.]

### Cascading amplifiers

- The **FX-301(P)**, **FX-301B/G/H(P)** and **FX-305(P)** cannot use communication for any settings other than the automatic interference prevention function. When using these amplifiers as well, use only the same type of amplifiers all together. However, the **FX-301-HS(P)** is not equipped with an optical communication function for setting the automatic interference prevention function, so be aware of this when using these amplifiers with other amplifiers.
- If the **FX-301(P)** updated version unit or the **FX-305(P)** is mounted with the **FX-301(P)** previous version unit or the **FX-301B/G/H(P)** in cascade, place the **FX-301(P)** updated version units and the **FX-305** units to the right side (seen from the connector side) of the previous version units. For a difference between the updated version unit and the previous version unit, refer to '[A difference between the updated version unit and the previous version unit](#)' (P.34).

### PRO mode

- PRO settings can be done when MODE indicator / PRO (yellow) lights up.

#### PRO mode table

|               | Display | Description                                                                                                                                                                                                                                                                                     |
|---------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PRO1          | Pro1    | ① Response time change function 'SPed'<br>② Timer setting function 'dELy'<br>③ Hysteresis function 'HYSt'<br>④ Stability function 'StEb'<br>⑤ Shift function 'SWfE'<br>⑥ Emitting power selection function 'PcLt' (Note 1)                                                                      |
| PRO2          | Pro2    | ① Digital display setting function 'dISp'<br>② Digital display inversion function 'InVrn'<br>③ ECO mode setting function 'EcO'                                                                                                                                                                  |
| PRO3          | Pro3    | ① Data bank load setting function 'chLd'<br>② Data bank save setting function 'chSv'                                                                                                                                                                                                            |
| PRO4          | Pro4    | ① Setting condition copy function 'cOPY'<br>② Remote data bank load setting function 'chLd'<br>③ Remote data bank save setting function 'chSv'<br>④ Communication condition confirmation function 'tEST' (Note 2)<br>⑤ Communication lock function 'L-Lc'<br>⑥ Back-up function 'b-uP' (Note 3) |
| PRO5          | Pro5    | ① Code setting function 'Code'<br>② Adjust lock setting function 'R.Lc'<br>③ Setting reset function 'rSEt'<br>④ Interference prevention function 'InPr' (Note 4)                                                                                                                                |
| PRO6 (Note 4) | Pro6    | ① Output setting function 'Out1', 'Out2'                                                                                                                                                                                                                                                        |

Notes: 1) **FX-301(P)** updated version unit, **FX-301(P)-HS**, **FX-305(P)** only  
 2) **FX-301B(P)/G(P)/H(P)** only  
 3) **FX-301(P)** updated version unit, **FX-305(P)** only  
 4) **FX-305(P)** only

### Key-lock function

- If the jog switch and the MODE key are pressed for more than 3 sec. at the same time in RUN mode condition, the key operations are locked, and only the threshold value confirmation function or the adjust function (valid only when the adjust lock function is canceled) is valid.

### Wiring

- When the emission halt of the emitting power switching function is set from 'OFF' to 'ON', the output may be unstable. Do not use the output control for 0.5 sec. after starting emission.
- Make sure that the power supply is off while wiring.
- Verify that the supply voltage variation is within the rating.
- Take care that if a voltage exceeding the rated range is applied, or if an AC power supply is directly connected, the sensor may get burnt or damaged.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- Take care that short-circuit or wrong wiring of the load may burn or damage the sensor.
- Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.
- Ensure that an isolation transformer is utilized for the DC power supply. If an auto transformer is utilized, the main amplifier or power supply may be damaged.
- Make sure to use the optional quick-connection cable for the connection of the amplifier [**FX-301(P)-HS**] / **FX-305(P)**. Extension up to total 100 m **328.084 ft** (50 m **164.042 ft** for 5 to 8 units, 20 m **65.617 ft** for 9 to 16 units,) is possible with 0.3 mm<sup>2</sup>, or more, cable. However, in order to reduce noise, make the wiring as short as possible.

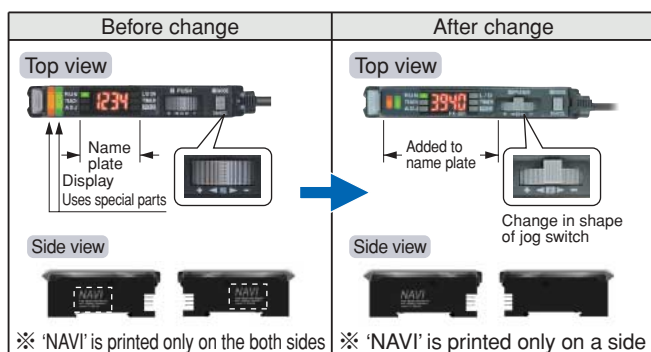
### Others

- Do not use during the initial transient time (0.5 sec. approx.) after the power supply is switched on.
- Take care that the sensor is not directly exposed to fluorescent light from a rapid-starter lamp or a high frequency lighting device, as it may affect the sensing performance.
- This sensor is suitable for indoor use only.
- Avoid dust, dirt, and steam.
- Take care that the product does not come in direct contact with water, oil, grease, or organic solvents, such as, thinner, etc.
- This sensor cannot be used in an environment containing inflammable or explosive gasses.
- Never disassemble or modify the sensor.

|                                                           | Previous models                      |                  |                      | New models                          |                      |                   |
|-----------------------------------------------------------|--------------------------------------|------------------|----------------------|-------------------------------------|----------------------|-------------------|
|                                                           | FX-301(P)<br>(Previous version unit) | FX-302(P)        | FX-303(P)            | FX-301(P)<br>(Updated version unit) | FX-301(P)-HS         | FX-305(P)         |
| Four-chemical emitting element + APC circuit              | ×                                    | ×                | ×                    | ○                                   | ○                    | ○                 |
| Four-chemical emitting element only                       | ○ (Note 1)                           | ○                | ○                    | —                                   | —                    | —                 |
| Light emitting amount selection function                  | ×                                    | ×                | ×                    | ○                                   | ○                    | ○                 |
| Reduced intensity mode (S-D)                              | ○ (Note 1)                           | ○                | ×                    | ○                                   | ○                    | —                 |
| 9,999 digit display                                       | ×                                    | ×                | ×                    | ×                                   | ×                    | ○                 |
| Response time (Max. speed)                                | 150 $\mu$ s                          | 300 $\mu$ s      | 90 $\mu$ s           | 65 $\mu$ s                          | 35 $\mu$ s           | 65 $\mu$ s        |
| Interference prevention function (Effective no. of units) | Incorporated (4)                     | Incorporated (8) | Not incorporated (0) | Incorporated (4)                    | Not incorporated (0) | Incorporated (16) |
| Independent 2 outputs                                     | ×                                    | ×                | ×                    | ×                                   | ×                    | ○                 |
| Alarm output function                                     | ×                                    | ×                | ×                    | ×                                   | ×                    | ○                 |
| Error output function                                     | ×                                    | ×                | ×                    | ×                                   | ×                    | ○                 |
| Differential sensing                                      | ×                                    | ×                | ×                    | ×                                   | ×                    | ○                 |
| Window comparator mode                                    | ×                                    | ○                | ×                    | ×                                   | ×                    | ○                 |
| <b>Peripheral units that can be combined</b>              |                                      |                  |                      |                                     |                      |                   |
| <b>FX-CH(-P)</b>                                          | ○                                    | ○                | ×                    | ×                                   | ×                    | ×                 |
| <b>FX-CH2(-P)</b>                                         | ×                                    | ×                | ×                    | ○                                   | ×                    | ○                 |
| <b>SC-GU1-485</b>                                         | ×                                    | ×                | ×                    | ○                                   | ×                    | ○                 |

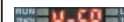
Note: Except **FX-301B/G/H**.

### Changes in operation



Checking minor changes between previous and new models can be done by checking whether the printing is on both sides or only one side.

An ultra high-speed mode (H-SP) has been added to the existing 4 response time modes [high-speed (FAST), reduced intensity (S-D), standard (STD) and long range (LONG)]. This is changed using 'Pro1' in 'SPEd'.

| Before change                                                                       |                    | After change                                                                        |                          |
|-------------------------------------------------------------------------------------|--------------------|-------------------------------------------------------------------------------------|--------------------------|
| 4 steps                                                                             |                    | 5 steps                                                                             |                          |
|  | 150 $\mu$ s (FAST) |  | 65 $\mu$ s (added)(H-SP) |
|  | 250 $\mu$ s (S-D)  |  | 150 $\mu$ s (FAST)       |
|  | 250 $\mu$ s (STD)  |  | 250 $\mu$ s (S-D)        |
|  | 2 ms (LONG)        |  | 250 $\mu$ s (STD)        |
|                                                                                     |                    |  | 2 ms (LONG)              |

The setting range for the timer period was previously 500 ms, but this has been extended to a new range of 9999 ms.

The light emitting amount can be changed to one of 4 levels (5 levels when emission halt is included).

**Backup:** This selects whether or not threshold values set by teaching are written to (stored in) an EEPROM.

Copy lock: This selects whether copy function and data bank function communication are possible or not.

**Key lock:** This disables input using switches to prevent accidental changing of settings.

Previous version unit: Timer type was changed using PRO1 mode. The 'TIMER' setting in NAVI mode could only be turned on or off.

After change: The type of timer can be changed using the 'TIMER' function in NAVI mode.

The threshold values can be checked by turning the jog switch.

The stable surplus display method after teaching has been changed.

Previous version unit: Sensitivity surplus is indicated by the number of blinks of the stability indicator.

**After change**  Digital display only

The factory default settings for the direct codes have been changed.

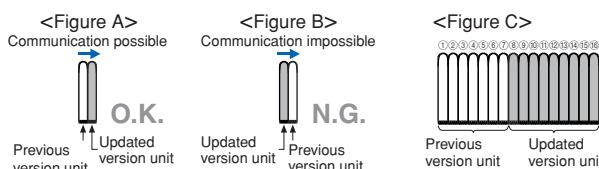
Previous version unit 0000  After change 0004

※ The default setting for the timer period is 10 ms, and the direct code for 10 ms is '4', so this has been changed.

A four-chemical emitting element which provides stable sensing over long periods has been added, as well as an APC (Auto Power Control) circuit that improves stability during short periods.

When using the newer sensors together with previous version units (including the **FX-301B/G/H**), note the following.

- Communication is possible when the previous version units and the updated version units are used in an arrangement such as that shown in Figure A below.
- If the previous version units and the updated version units are used in an arrangement such as that shown in Figure B below, the interference prevention function and the PRO4 function cannot be used.
- In order to use the interference prevention function and the PRO4 function when using previous version units and the updated version units together, it is recommended that you use an arrangement such as that shown in Figure C below.

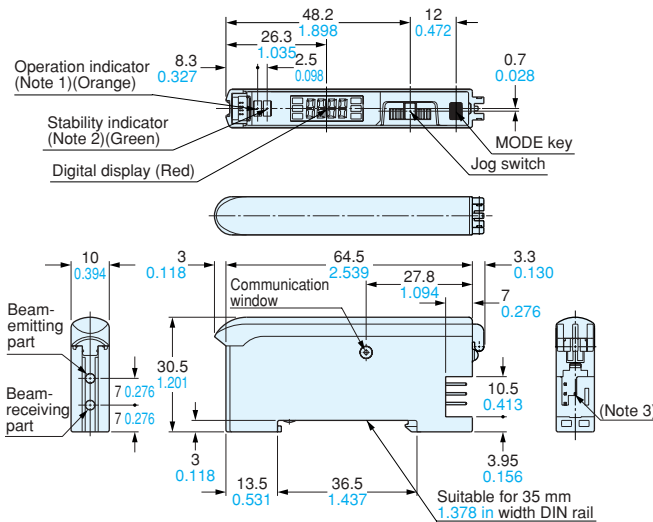


## DIMENSIONS (Unit: mm in)

Refer to the 'Sensor general catalog 2003-2004' for fiber dimensions.  
The CAD data in the dimensions can be downloaded from the website: <http://www.sunx.jp/>

**FX-301** □  
**FX-305** □

Amplifier



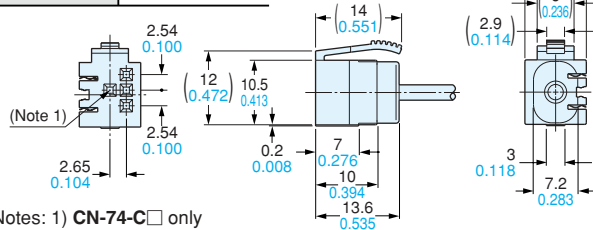
- Notes: 1) **FX-305** □; Output 1 operation indicator (Orange)  
2) **FX-305** □; Output 2 operation indicator (Orange)  
3) **FX-301** □; 3-pin, **FX-305** □; 4-pin

**CN-73-C** □  
**CN-74-C** □

Main cable (Optional)

• Length (L)

| Model No.          | Length (mm in) |
|--------------------|----------------|
| <b>CN-73/74-C1</b> | 1,000 39.370   |
| <b>CN-73/74-C2</b> | 2,000 78.740   |
| <b>CN-73/74-C5</b> | 5,000 196.850  |

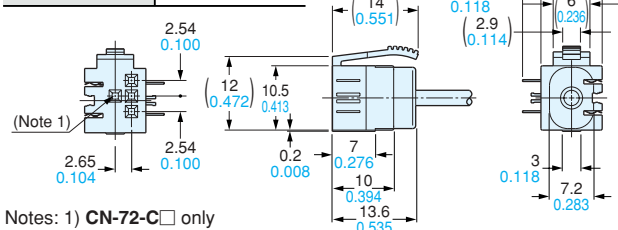


**CN-71-C** □  
**CN-72-C** □

Sub cable (Optional)

• Length (L)

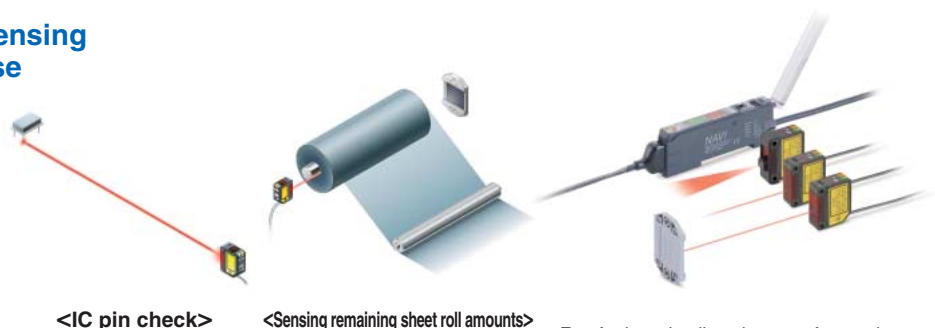
| Model No.          | Length (mm in) |
|--------------------|----------------|
| <b>CN-71/72-C1</b> | 1,000 39.370   |
| <b>CN-71/72-C2</b> | 2,000 78.740   |
| <b>CN-71/72-C5</b> | 5,000 196.850  |



## Introducing digital laser sensor LS series

### Making high precision laser sensing more intuitive and easier to use

- Minute objects can be sensed even at removed distances.
- 3 types of laser sensor head available.
- Side-by-side placement together with fiber sensors is also possible.



For further details, please refer to the SUNX home page (<http://www.sunx.co.jp/>) or contact our office.

# External Input Unit for Digital Sensor / FX-CH2



## Support for stable sensing and smooth setup changes!

Teaching and data bank switching for up to a maximum of 16 digital fiber sensors (**FX-301** and **FX-305**) can be carried out all at once using an external device such as a PLC, touch screen or switch.



## Applications involving smooth setup operations

### ■ Setup changes (external automatic teaching / data bank switching)

Digital fiber settings can be changed using input from a touch screen or switch, so that production line setup changes can be carried out more easily.

#### ● External teaching

Full-auto teaching is recommended for teaching when the sensing object is changed without stopping the line.

#### ● Data bank switching

Settings such as output operations (L-ON / D-ON) and timer operations can be recorded in the digital fiber sensor's data bank and switching can be carried out externally.

※ Up to 3 files can be stored.



## FX-CH2 function list

### Teaching input

The following types of external teaching can be carried out.

- Full-auto teaching
- Limit teaching '—'
- Limit teaching '+'
- 2-level teaching

### Key lock setting input

The key lock function that prevents incorrect operations by operators can be set on and off.

### Data bank switching input

Switching between 3 channels of data banks and loading and saving of all channels at once can be carried out.

## Product lineup

Connector for input device

**CN-EP1** [1 pc. included with **FX-CH2(-P)**]

#### • Input signal

The types of input operations are determined by S1 and S2, and the input timing is determined by S3.

S1  
S2  
S3  
COM.  
※ **FX-CH2(-P)** does not include a cable for connecting to the input device.

External input unit **FX-CH2(-P)**

Quick-connection cable

**CN-73-C** (Optional)

#### • Mode selection

The MODE wire can be switched between high and low to select the input mode from either 'external teaching and key lock' or 'data bank switching'.

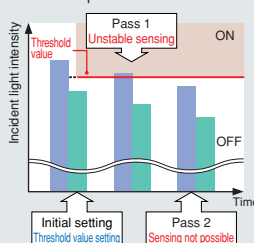
## Explanation of limit teaching

### ● Limit teaching '—'

Limit teaching '—' shifts the threshold value setting to make it less than the incident light intensity during teaching.

#### When limit teaching is not used

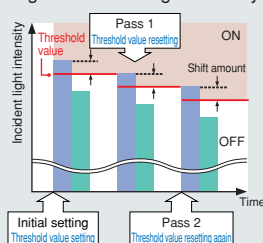
If the incident light intensity changes with respect to the initial threshold setting value because of reasons such as beam axis slippage, sensing can become unstable and incorrect operations can occur.



Incident light intensity when sensing object is not present

#### When limit teaching '—' is used

The threshold value is reset each time before the sensing object arrives, (limit teaching '—'). As a result, sensing is not affected by changes in incident light intensity.



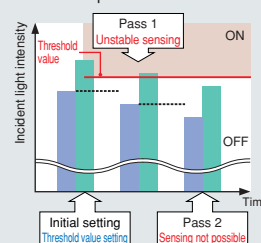
Incident light intensity when sensing object is present

### ● Limit teaching '+'

Limit teaching '+' is the opposite of limit teaching '—', so that the threshold value setting is shifted toward a higher setting to make it more than the incident light intensity during teaching.

#### When limit teaching is not used

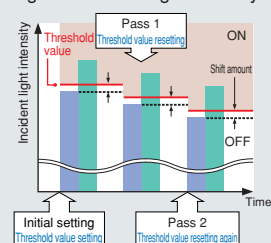
If dust or other particles cause changes in the incident light intensity with respect to the initial threshold setting value, sensing can become unstable and incorrect operations can occur.



※ When limit teaching is used, use the SHIFT function in PRO mode of the amplifier to set the shift amount beforehand.

#### When limit teaching '+' is used

The threshold value is reset each time before the sensing object arrives, (limit teaching '+'). As a result, sensing is not affected by changes in incident light intensity.



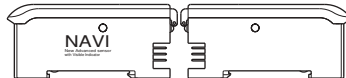
## ORDER GUIDE

| Designation                                                                         |                              | Model No.                         |
|-------------------------------------------------------------------------------------|------------------------------|-----------------------------------|
| External input unit                                                                 | NPN input type               | <b>FX-CH2</b>                     |
|                                                                                     | PNP input type               | <b>FX-CH2-P</b>                   |
| Connector for input device<br>(1 pc. included as standard with external input unit) |                              | <b>CN-EP1</b><br>5 pcs. per set   |
| Quick-connection cable<br>(Main cable)                                              | Length: 1 m <b>3.281 ft</b>  | <b>CN-73-C1</b>                   |
|                                                                                     | Length: 2 m <b>6.562 ft</b>  | <b>CN-73-C2</b>                   |
|                                                                                     | Length: 5 m <b>16.404 ft</b> | <b>CN-73-C5</b>                   |
| End plate                                                                           |                              | <b>MS-DIN-E</b><br>2 pcs. per set |

## SPECIFICATIONS

| Item                             | Type<br>Model No. | NPN input type<br><b>FX-CH2</b>                                                                                                                                                                                                                                                                 | PNP input type<br><b>FX-CH2-P</b>                                                                                        |
|----------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Applicable sensor                |                   | <b>FX-301(P)</b> (Note 1), <b>FX-305(P)</b>                                                                                                                                                                                                                                                     |                                                                                                                          |
| Supply voltage                   |                   | 12 to 24 V DC $\pm 10\%$ Ripple P-P 10 % or less                                                                                                                                                                                                                                                |                                                                                                                          |
| Power consumption                |                   | 600 mW or less (when all indicators light up)                                                                                                                                                                                                                                                   |                                                                                                                          |
| Input                            |                   | Low: 0 to +2 V DC<br>Source current 0.5 mA<br>Input impedance 10 k $\Omega$ approx.<br>High: +5 V to +V DC, or open                                                                                                                                                                             | Low: +4 V to +V DC<br>Sink current 0.5 to 3 mA<br>Input impedance 10 k $\Omega$ approx.<br>High: 0 to +0.6 V DC, or open |
| Power indicator                  |                   | Green LED (Lights up when the power is ON)                                                                                                                                                                                                                                                      |                                                                                                                          |
| Transmission operation indicator |                   | Green LED (Lights up when loaded, and 2-level / Limit teaching, blinks→lights up when saved, and Full-auto teaching)                                                                                                                                                                            |                                                                                                                          |
| Ambient temperature              |                   | -10 to +55 °C <b>+14 to +131 °F</b> (if 4 to 7 sensors are connected in cascade: -10 to +50 °C <b>+14 to +122 °F</b> , if 8 to 16 sensors are connected in cascade: -10 to +45 °C <b>+14 to +113 °F</b> )(No dew condensation or icing allowed),<br>Storage: -20 to +70 °C <b>-4 to +158 °F</b> |                                                                                                                          |
| Material                         |                   | Enclosure: Heat-resistant ABS                                                                                                                                                                                                                                                                   |                                                                                                                          |
| Cable extension                  |                   | Extension up to total 10 m <b>32.808 ft</b> is possible with 0.3 mm <sup>2</sup> , or more, cable.                                                                                                                                                                                              |                                                                                                                          |
| Weight                           |                   | Net weight: 20 g approx., Gross weight: 40 g approx.                                                                                                                                                                                                                                            |                                                                                                                          |
| Accessory                        |                   | <b>CN-EP1</b> (Connector for input device)(Note 2): 1 pc.                                                                                                                                                                                                                                       |                                                                                                                          |

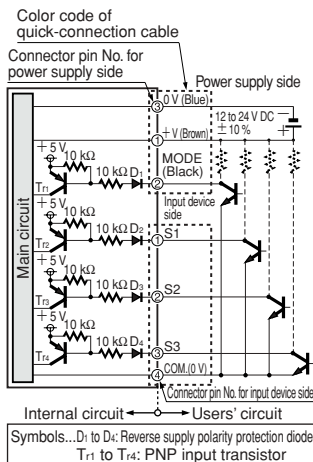
Notes: 1) Only updated version of **FX-301(P)** can be used. Do not use the previous version of **FX-301(P)**.  
The updated version of **FX-301(P)** have 'NAVI' printed on one side.  
(See the right figure.)



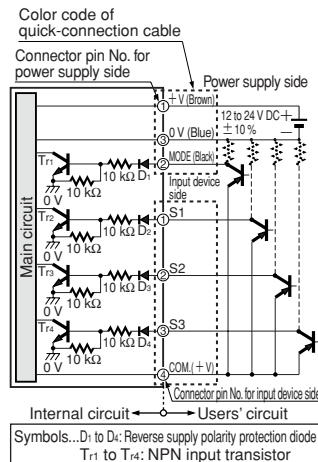
2) The applicable wire is 0.08 mm<sup>2</sup> (AWG 28) to 0.5 mm<sup>2</sup> (AWG 20) and the wire sheath diameter should be  $\phi 1.5$  mm  $\phi 0.059$  in or less.

## I/O CIRCUIT DIAGRAMS

### FX-CH2

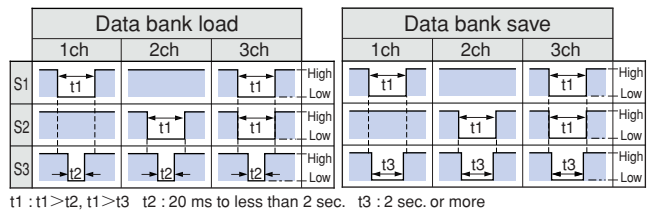


### FX-CH2-P

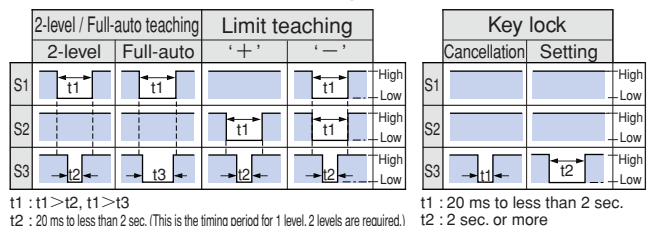


## OPERATION TIMING CHART

When MODE is set to High (Low for FX-CH2-P) or open



When MODE is set to Low (High for FX-CH2-P)

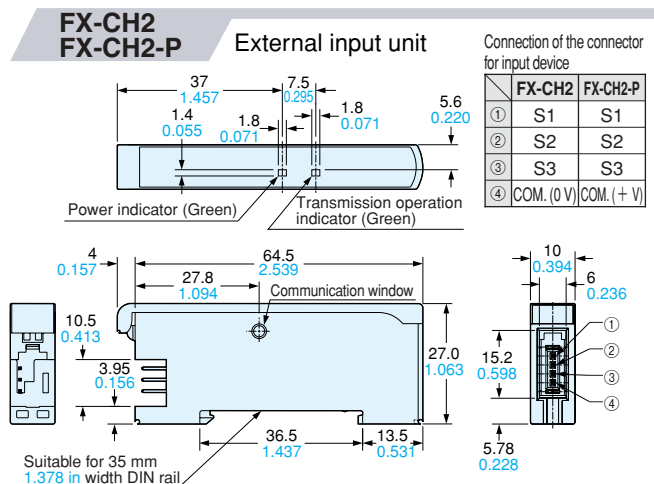


Notes: 1) The above diagrams show the **FX-CH2** (NPN input type).

For the **FX-CH2-P** (PNP input type), High and Low are reversed.

2) After each operation has been confirmed, the fiber sensor cannot be reset for a period of approximately 50 ms.

## DIMENSIONS (Unit: mm in)



# Upper Communication Unit for Digital Sensors / SC-GU1-485

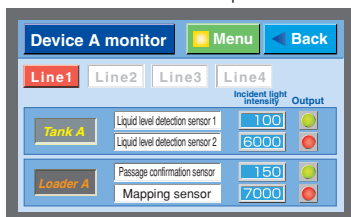


**We now offer remote maintenance for sensors!**  
**Also reduces the work required to the system to start running!**

**Centralized control and setting of scattered digital sensors (FX-301/305) is possible using a PLC or personal computer**



<Touch screen monitor example>

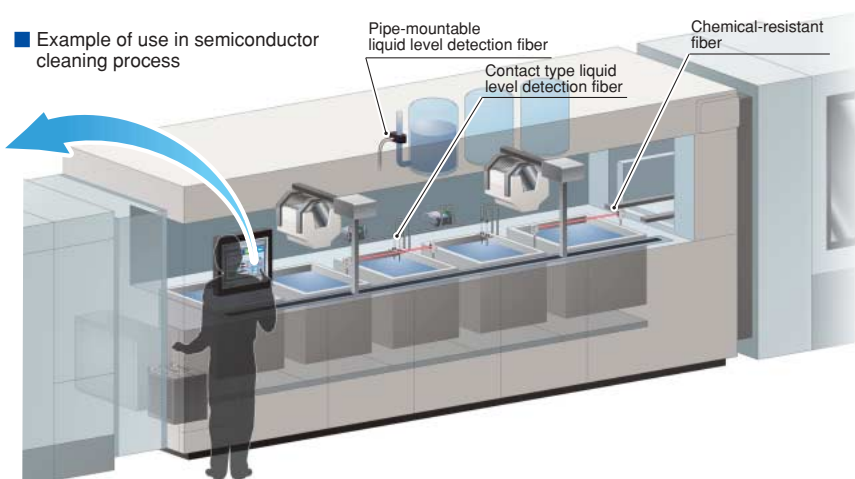


[Communicable commands]  
 • Sensor incident light intensity  
 • Sensor settings verification  
 • Sensor output status  
 • Threshold value settings, etc.

The sensor settings and operation can be checked on the touch screen, greatly improving ease of operation!

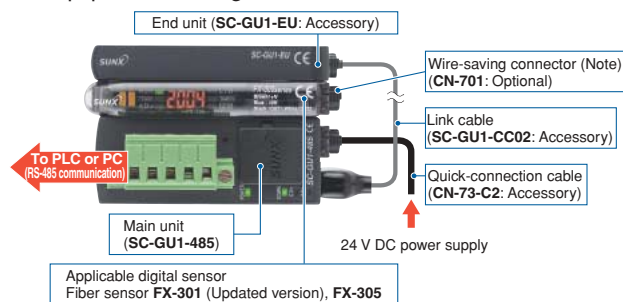
Ideal for workplaces such as semiconductor and LCD manufacturing lines where there are restrictions on operators entering and exiting

■ Example of use in semiconductor cleaning process



## Control and settings can be carried out remotely

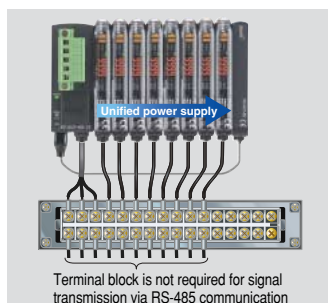
Setting and checking incident light intensity for digital sensors (FX-301/305) that are scattered inside and outside equipment can be carried out remotely for all sensors by using the SC-GU1-485, which greatly improves ease of operations such as monitoring equipment that is running and also equipment starting and maintenance.



Note: Used when the output signal is sent via a SC-GU1-485 to the PLC. If the output signal is sent directly to the PLC, a quick-connection cable (CN-72-C□, CN-71-C□) should be used.

## Less wiring and installation work

Up to a maximum of 16 sensors can be connected side by side. Power can be supplied to all of them at once, so that less wiring and installation work is required. Wire-saving connectors also makes it possible to send output signals to the PLC in a single batch.

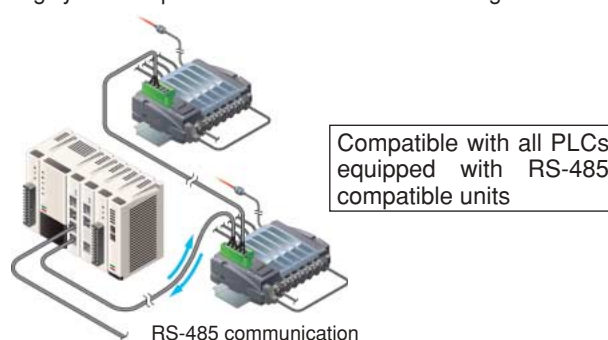


## Communication speed 57.6 kbps

High-speed communication at a maximum speed of 57.6 kbps allows the operator to instantly check information such as the incident light intensity and output statuses of the digital sensors.

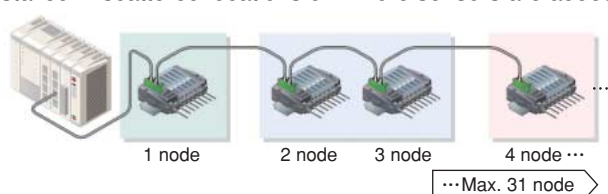
## High general applicability so that any type of PLC can be used

RS-485 communication provides a high level of general compatibility so that any type of PLC can be used. Integration with existing systems is possible without the need to change PLCs.



## Series connection of a maximum of 31 nodes is possible

A maximum of 31 nodes can be connected in series. This is ideal for flexible handling when the sensors are to be installed in scattered locations or if more sensors are added.

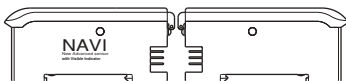


## SPECIFICATIONS

| Type                      | Main unit                                                                                                                                                                                                                                                                                     |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Item                      | Model No.                                                                                                                                                                                                                                                                                     |
| Applicable sensor         | <b>FX-301(P)</b> (Note), <b>FX-305(P)</b>                                                                                                                                                                                                                                                     |
| Connectable units         | Max. 16 units of sensor per <b>SC-GU1-485</b>                                                                                                                                                                                                                                                 |
| Connectable nodes         | Max. 31 nodes                                                                                                                                                                                                                                                                                 |
| Supply voltage            | 24 V DC $\pm 10\%$ Ripple P-P10 % or less                                                                                                                                                                                                                                                     |
| Current consumption       | 45 mA or less (10 mA or less for <b>SC-GU1-EU</b> )                                                                                                                                                                                                                                           |
| Communication method      | 2 wire half duplex method                                                                                                                                                                                                                                                                     |
| Communication speed       | 57,600 bps / 38,400 bps / 19,200 bps / 9,600 bps Selectable by DIP switch                                                                                                                                                                                                                     |
| Synchronization method    | Asynchronous communication method                                                                                                                                                                                                                                                             |
| Electrical characteristic | Conforming to EIA RS-485                                                                                                                                                                                                                                                                      |
| Total extension length    | Communication cable: 100 m <b>328.084 ft</b> or less [ <b>SC-GU1-485</b> (termination) to PLC].<br>Power supply cable: Less than 10 m <b>32.808 ft</b>                                                                                                                                        |
| Ambient temperature       | -10 to +55 °C <b>+14 to +131 °F</b> (If 4 to 7 sensors are connected in cascade: -10 to +50 °C <b>+14 to +122 °F</b> , if 8 to 16 sensors are connected in cascade: -10 to +45 °C <b>+14 to +113 °F</b> ) (No dew condensation or icing allowed), Storage: -20 to +70 °C <b>-4 to +158 °F</b> |
| Material                  | Enclosure: Heat-resistant ABS                                                                                                                                                                                                                                                                 |
| Weight                    | 35 g approx. (10 g approx. for <b>SC-GU1-EU</b> )                                                                                                                                                                                                                                             |
| Accessories               | <b>SC-GU1-EU</b> (End unit): 1 pc.<br><b>CN-73-C2</b> [Quick-connection cable (cable length 2 m <b>6.562 ft</b> ): 1 pc.<br><b>SC-GU1-CC02</b> [Link cable (cable length 0.2 m <b>0.656 ft</b> ): 1 pc.                                                                                       |

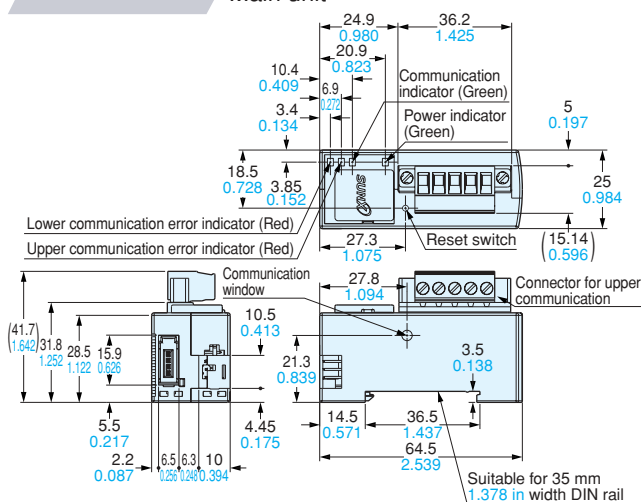
Note: Applicable units are for the **FX-301(P)** after version update. Do not use the previous version of **FX-301(P)**.

The updated version of **FX-301(P)** has the 'NAVI' printed only on single side. (See the right figure.)



## DIMENSIONS (Unit: mm in)

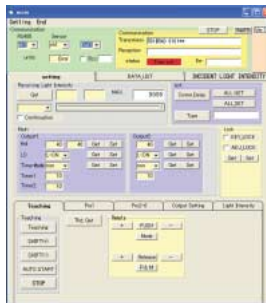
### SC-GU1-485 Main unit



## OPERATION VERIFICATION PROGRAM DOWNLOAD SERVICE

The SUNX website download data service lets you download operation verification programs to a personal computer. (<http://www.sunx.co.jp/>)

### Monitoring example



### Operating environment

OS: Windows 98 Second Edition  
(standard English language installation only) or later  
CPU: Pentium II 400 MHz processor or higher  
(Pentium III 450 MHz or higher recommended)  
Memory: 64 MB or more  
(128 MB or more recommended)  
Free hard disk space: 10 MB or more  
Serial port: RS-232C compatible

### Details that can be checked:

Sensor threshold values, output statuses, configuration settings, teaching and timer period setting changes, etc.

Notes: 1) Note the following when using this software.

The software is supplied as freeware. Copyright is retained by SUNX Limited. You must agree to the following conditions before using the software.

### Conditions of use

• SUNX does not guarantee the correct operation of this software. SUNX takes no responsibility for any direct or indirect losses, damage, loss of profit or any other problems arising as a result of using or operating this software.

2) When connecting the **SC-GU1-485** to a personal computer, you will need obtain a interface converter (RS-232C  $\leftrightarrow$  RS-485 converter) and cable to connect between the computer and the interface converter.

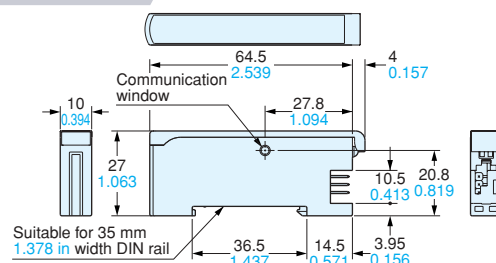
## OPTION

### CN-701 (Wire-saving connector)

Note: Used when the output signal is sent via a **SC-GU1-485** to the PLC.

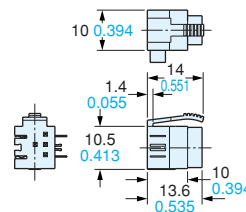


### SC-GU1-EU End unit (Accessory)



### CN-701

### Wire-saving connector (Optional)



All information is subject to change without prior notice.



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