SUNX

PHOTOELECTRIC SENSOR

DIGITAL FIBER SENSOR

FX-300 SERIES

CE 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)

High-function type
FX-305

Standard type
FX-301

Ultra high-speed type
FX-301-HS

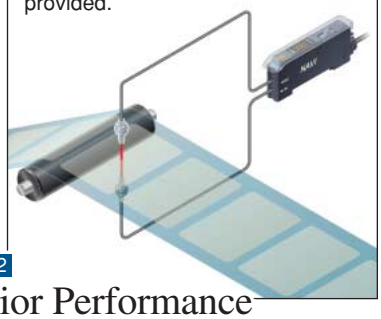
FX-300 SERIES

APC circuit has been added, in addition to the four-chemical emitting element.

Concept 1

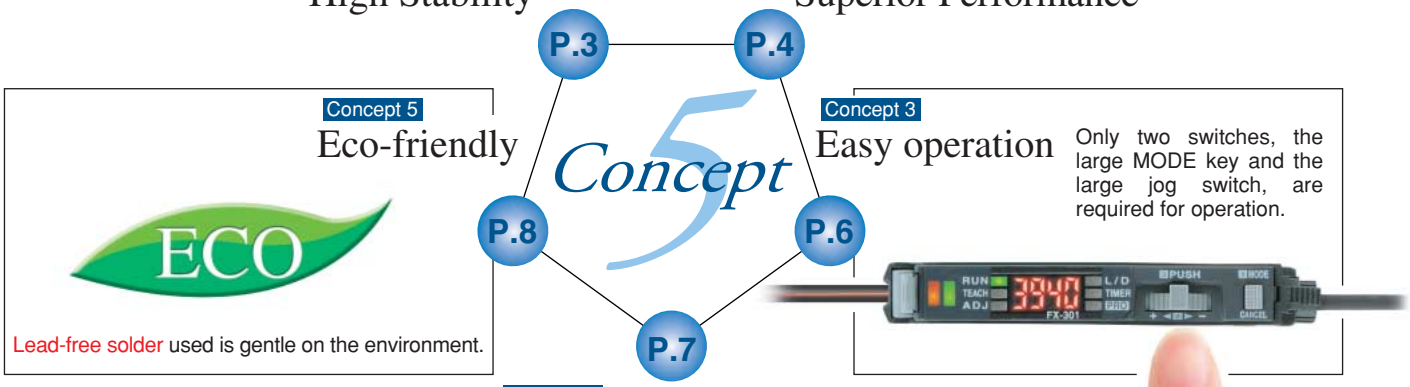
High Stability

Equipped with an light emitting amount selection function. Plus, a 4-digit full '9999' display (**FX-305**) and 35 μs ultra high-speed response (**FX-301-HS**) are also provided.



Concept 2

Superior Performance



Concept 5

Eco-friendly

ECO

Lead-free solder used is gentle on the environment.

Concept 3

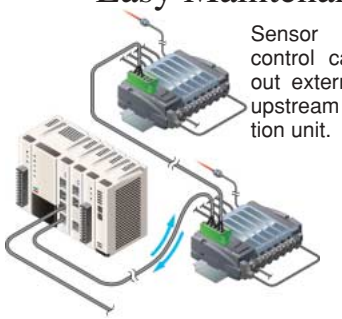
Easy operation

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

Concept 4

Easy Maintenance

Sensor setup and control can be carried out externally using an upstream communication unit.



Full range of fibers

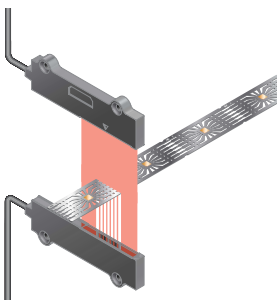
Wide lineup

P.9 Guide for each industry

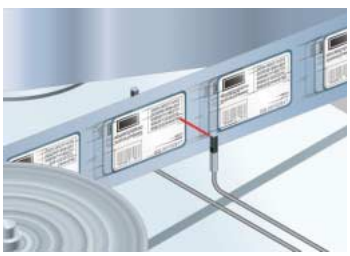
Description of different fibers and performance for each industry

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
Concept 5

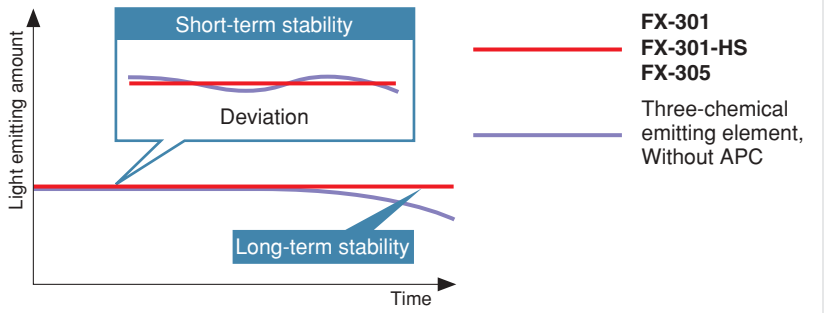
Stable sensing over long and short periods

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**

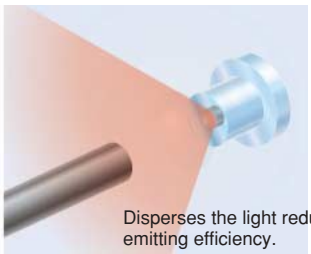


Even greater sensing range

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.

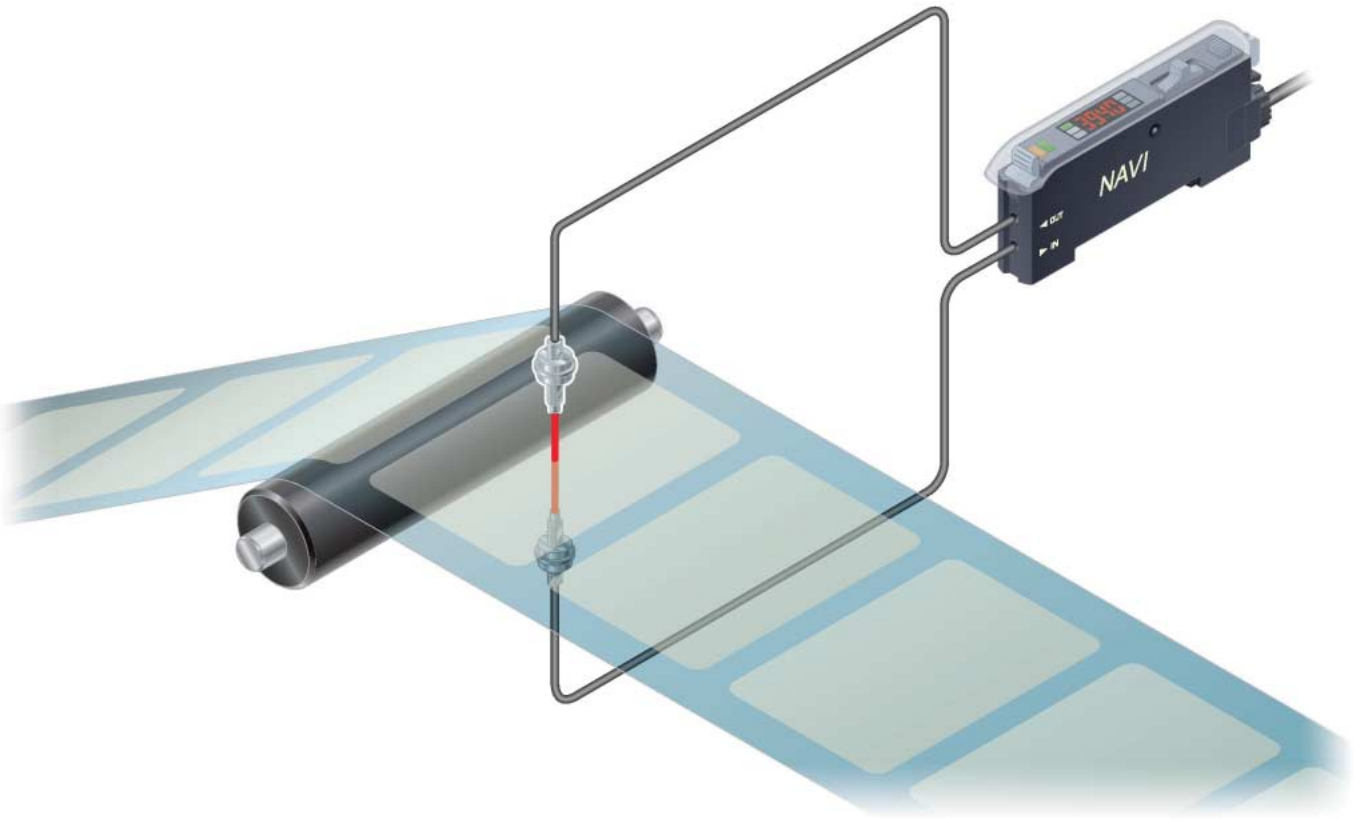
● **Conventional fiber sensors (Without lens)**



● **Double coupling lens**

Superior Performance

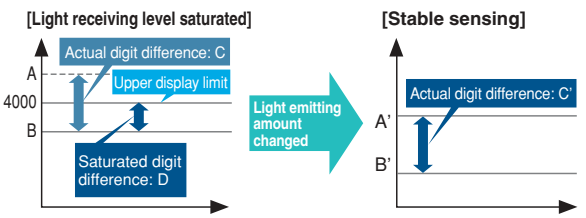
Concept 2
Superior Performance



Light-emitting amount selection

FX-301 FX-301-HS FX-305

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.



Light emitting amount can be changed without changing response time

Large display 9999

2.5 times previous models

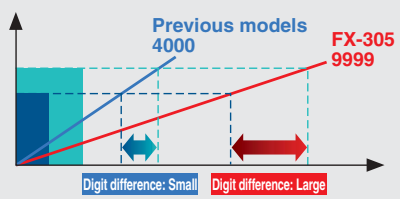
FX-305

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

Example Digit difference between object A and object B

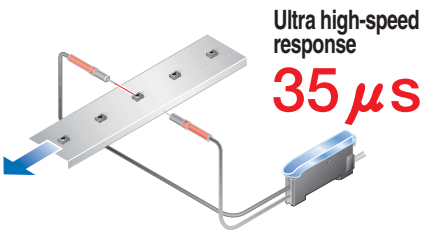


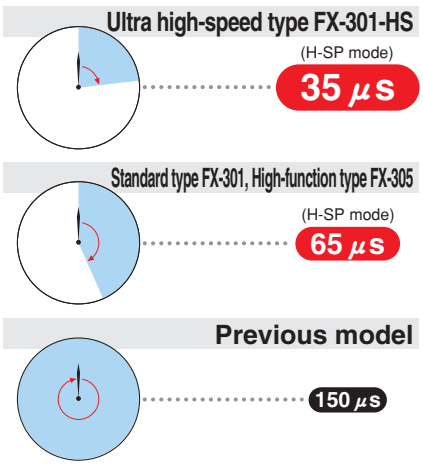
Ultra high-speed 35 μs response

4 times as fast as before

FX-301-HS

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





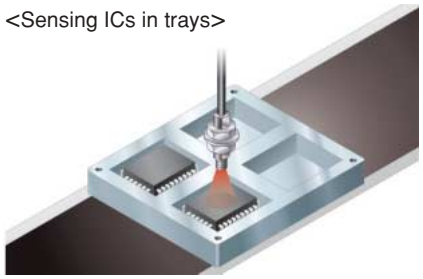
Simplified systems using new operating modes

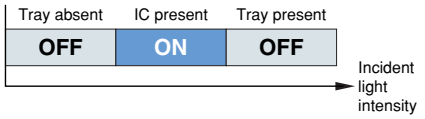
FX-305

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>

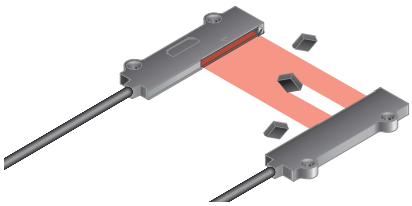


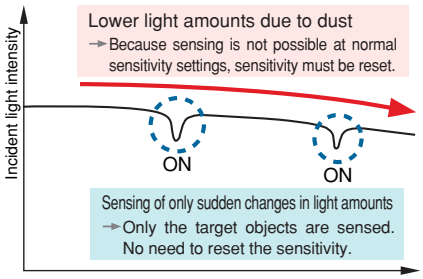


Upper and lower limits for threshold values can be set so that the incident light intensity can turn on and off within those ranges. Single output is used, so that only one cable is required, and no PLC processing is required either.

● Differential sensing mode

<Sensing of tiny moving objects>



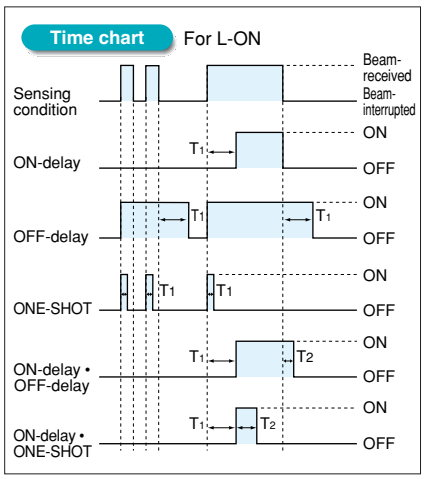


Equipped with 5 types timers

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)



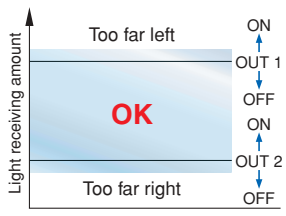
Multi-purpose 2-output

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 simple self-diagnosis and alarm output, so that ease of maintenance is improved.

● Comparison with previous models

Example Sensing meandering of sheets

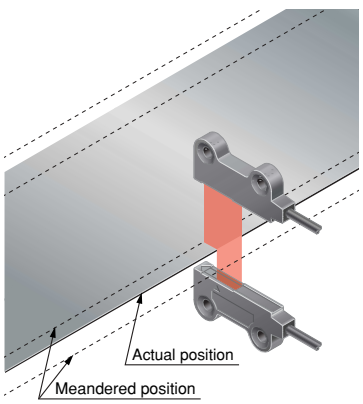


[Previous models]

2 sensors needed

[FX-305]

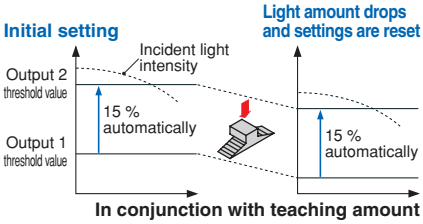
1 sensor is enough!



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

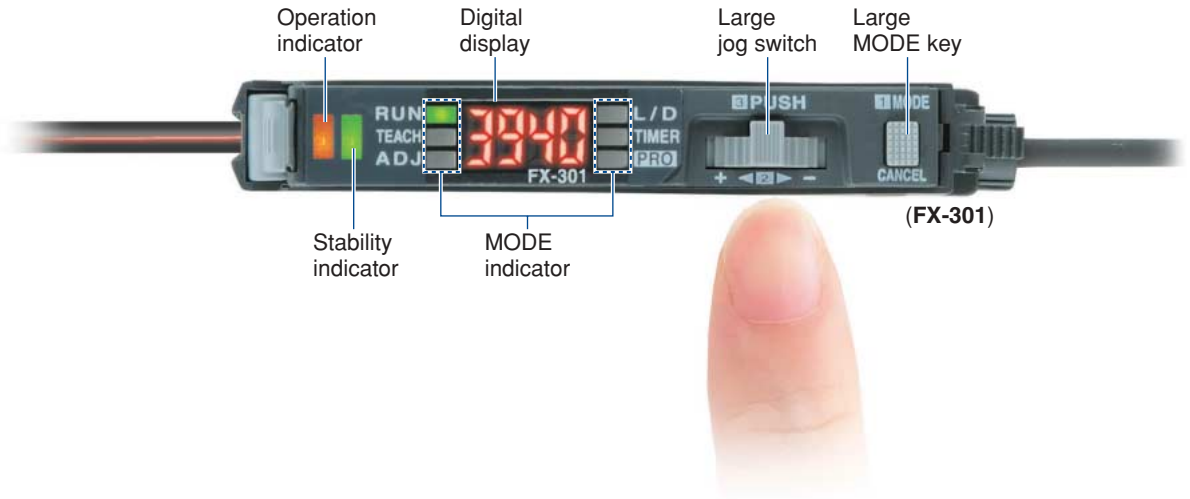
Drops in light amounts due to problems such as broken fibers or dirty tips are detected and output. When output 1 threshold value teaching is carried out with the **FX-305**, output 2 is set concurrently with the setting shifted by the amount of surplus.

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



Easy operation

Concept 5 — Concept 3 Easy Operation



(**FX-301**)

Even beginners can quickly learn how to use the MODE NAVI

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

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.

RUN→
This is the sensing mode. Incident light level is displayed in the digital display.

TEACH→
This mode is for setting the threshold value.

ADJ→
In this mode, the threshold value, once set, may be fine-tuned.

L/D ON→
This mode allows the selection of output operation as either Light-ON or Dark-ON.

TIMER→
This mode permits the choice of using or not using the timer.

PRO→
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

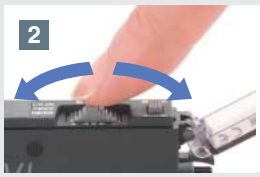
FX-301/B/G/H FX-301-HS FX-305

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**

MODE — Pressing the switch selects or cancels the operating mode

● **Large jog switch**



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

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.

Jog switch is turned

Left: **FX-301**(**-HS**) Output 1 for **FX-305** — Right: Output 2 for **FX-305**

The threshold value is displayed

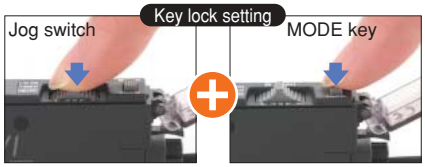
Improved workability!
Data bank switching and teaching can be carried out externally

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

Concept 4
Easy Maintenance

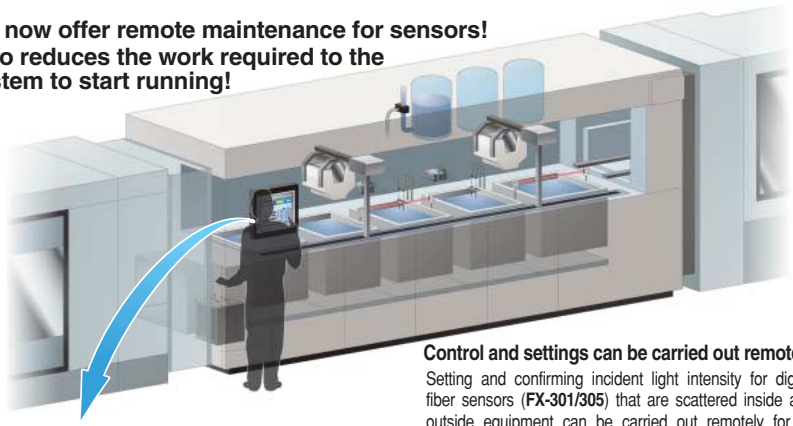
Communication unit improves equipment starting up and maintenance

upstream communication unit SC-GU1-485

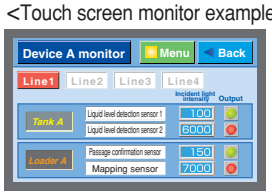
FX-301 FX-305

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>



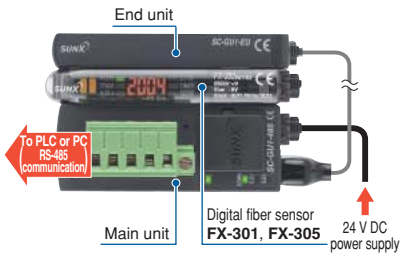
[Communicable commands]
- Sensor incident light intensity
- Sensor settings verification
- Sensor output status
- Threshold value settings, etc.

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

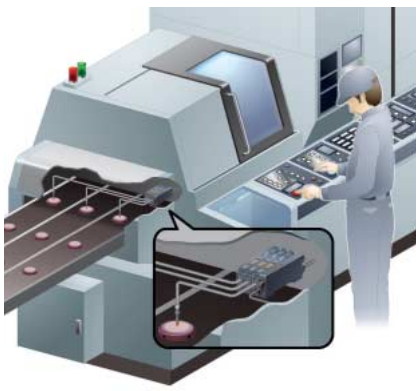
FX-301 FX-305

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

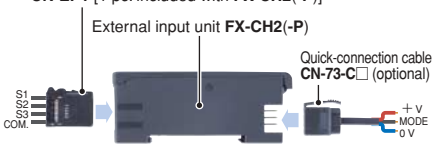
Switching between 3 channels of data banks and loading and saving of all channels at once can be carried out.

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)**]

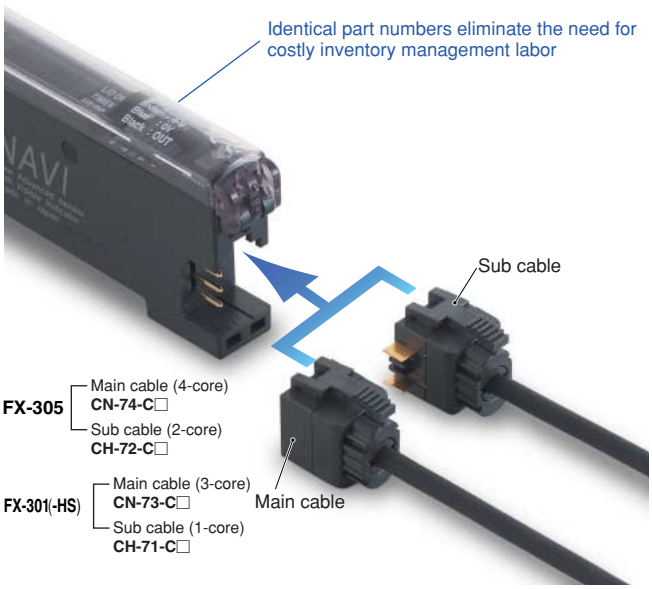


Wiring- and labor-saving design allows side-by-side configuration for up to sixteen units

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※

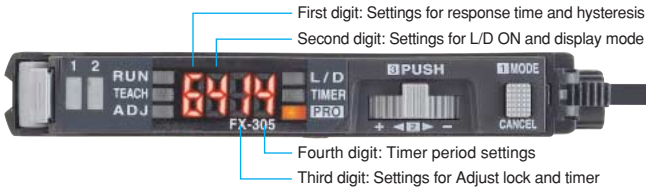
FX-301/B/G/H FX-305

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

Concept 5
Eco-friendly

Lead-free solder used is gentle on the environment ECO

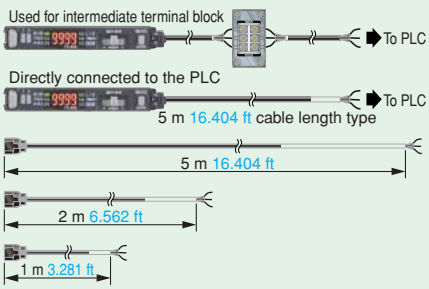
SUNX promotes the use of lead-free materials in all of its sensor manufacturing processes including those used for the **FX-300** series of digital fiber sensors.

Reduced power consumption possible (ECO mode) ECO

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.)

Selectable cable length ECO

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.



Environmentally friendly packaging ECO

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.

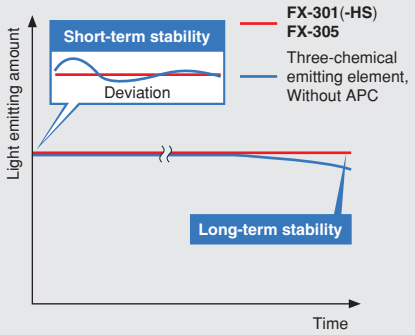
Polyethylene packaging

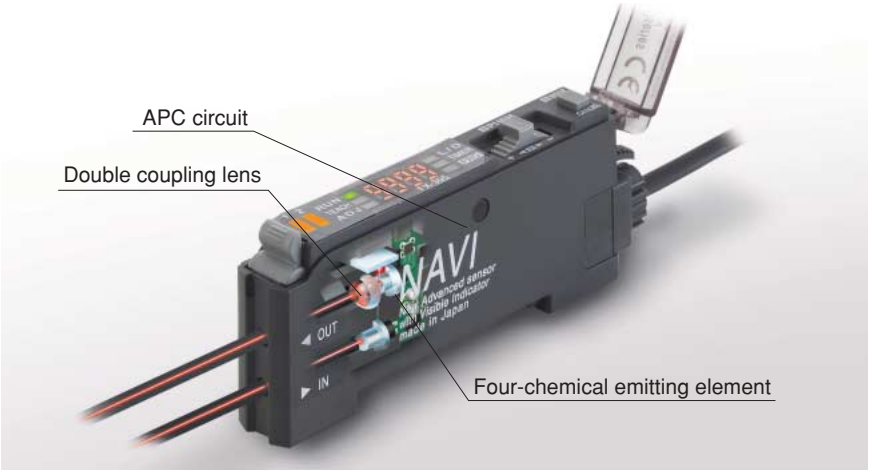
Improved stability over long and short periods

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.

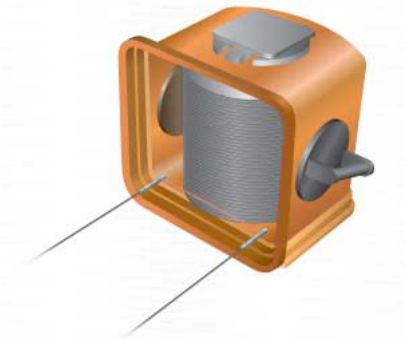
● **Stable sensing comparison**



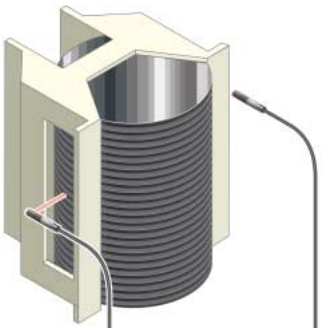


Mapping fiber — FT-KV1, FT-KV8, FR-KV1

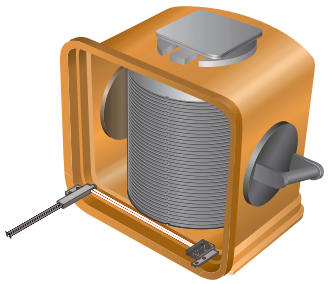
This ultra-narrow optical beam fiber is ideal for mapping wafers.



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-WKV8, 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.

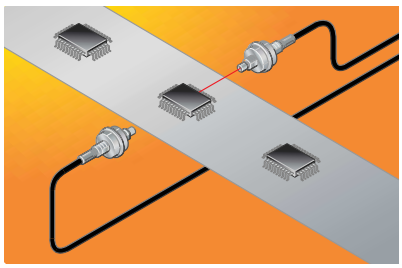


Retroreflective type FR-KV1
With a thickness of 2.3 mm 0.091 in, this fiber can be installed almost anywhere, and it is a retroreflective type so optical beam axis alignment is simple.

Heat-resistant fiber — FT-H□, FD-H□

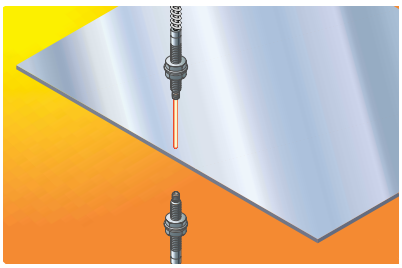
A variety of types are available, including a convergent reflective type for accurately sensing glass substrates, and a type with a bending radius of 10 mm 0.394 in that hardly takes up any space.

IC detection within a high temperature handler



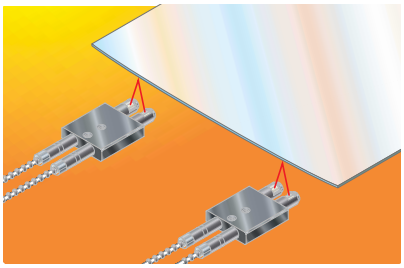
Flexible type FT-H20W-M2
Withstands temperatures of +200 °C +392 °F and has a bending radius of 10 mm 0.394 in, this fiber can be installed almost anywhere.

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



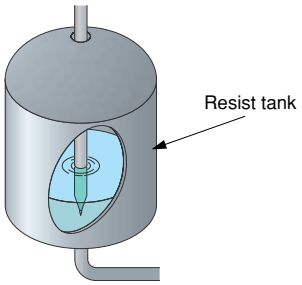
Convergent reflective type FD-H30-L32, FD-H18-L31
Accurately senses glass substrates at high temperatures of +300 °C +572 °F.

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	<digit value>	<Extra width>
Liquid absent	500	460
Liquid present	40	

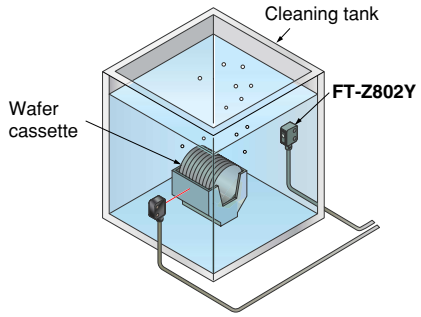
FX-305	<digit value>	<Extra width>
Liquid absent	2000	1840
Liquid present	160	

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.

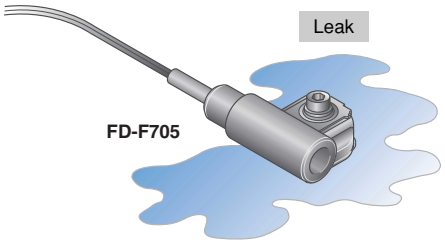
Detecting wafer cassette in cleaning tank



Chemical-resistant fiber FT-Z802Y

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

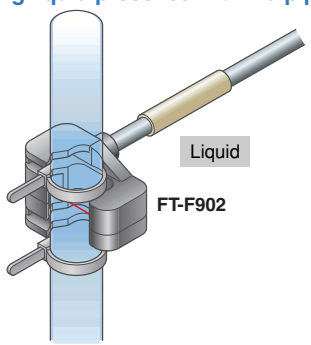
Detecting leak liquid in cleaning tank (Note)



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)



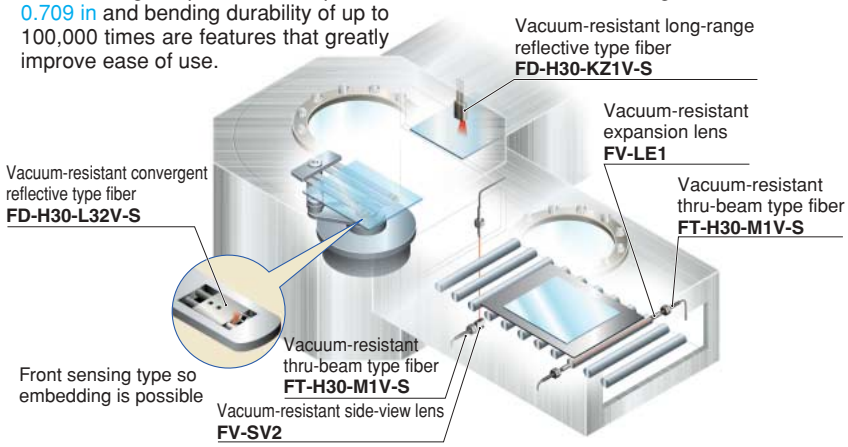
Liquid detection fiber FT-F902

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

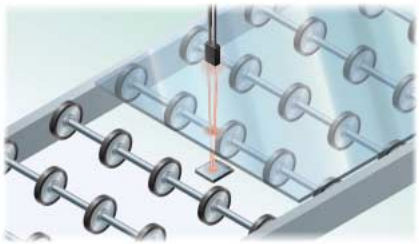
• Sensing range increased by 4 times or more

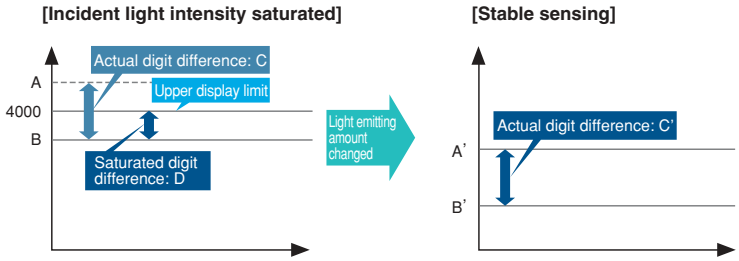
Light emitting amount selection function

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

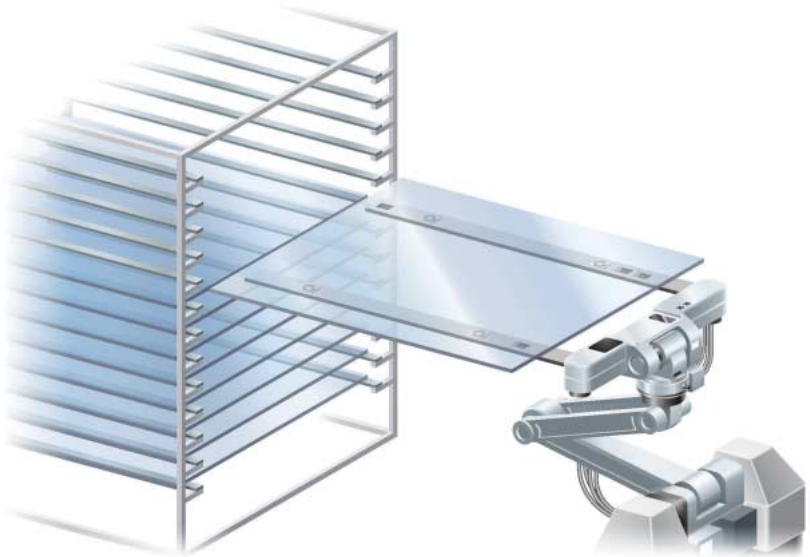
Remedy	Problem
• Changing response time	Mode selection ➡ Affects positioning precision
• Changing fiber	Change to thinner fiber to reduce light amount ➡ Cost and man-hour inefficiencies
• Changing setting position	Increase sensing range ➡ Man-hour and space inefficiencies

FX-301(-HS), FX-305

Light emitting amount selection function makes steps such as those at left unnecessary.

Fiber for glass substrate conveyor — FD-L40 series, FR-WKZ11

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

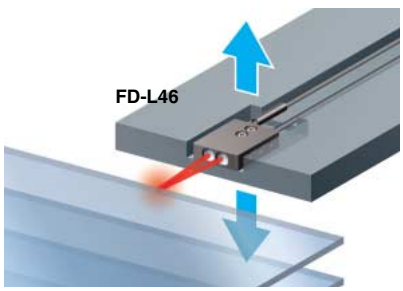


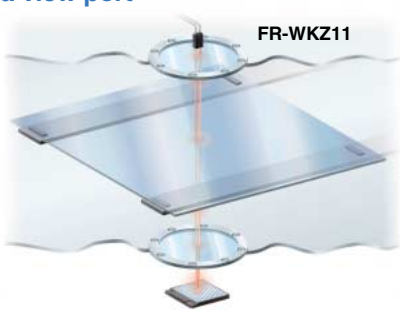
Alignment / Convergent reflective type FD-L43, FD-L45

Even glass substrates with ±8° (**FD-L45**: ±6°) of flexure can be stably sensed.

- High flexure of ±8° (**FD-L43**)
- Long sensing range 30 mm 1.181 in (**FD-L45**)

Sensing glass substrate through a view port





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.

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

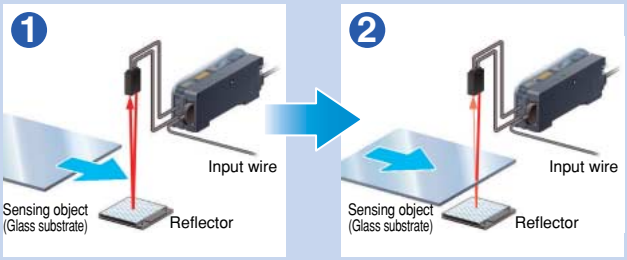
External input unit FX-CH2

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.

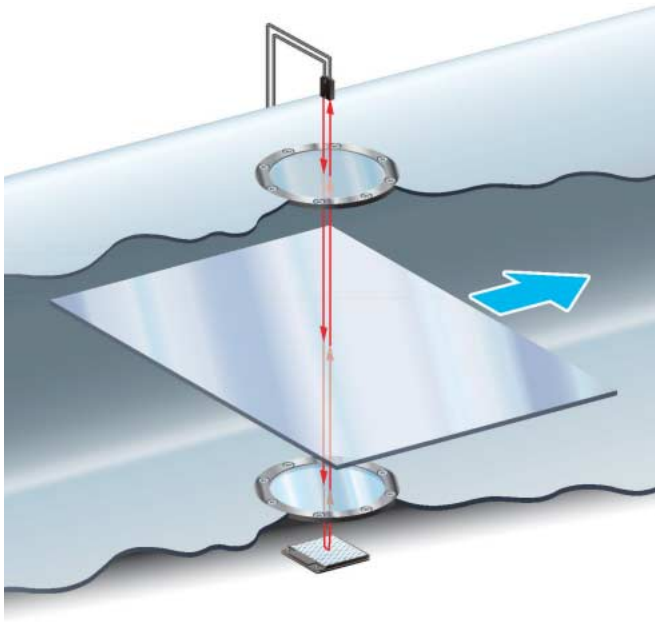
Sensing glass substrate (stable sensing of minute differences)

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.



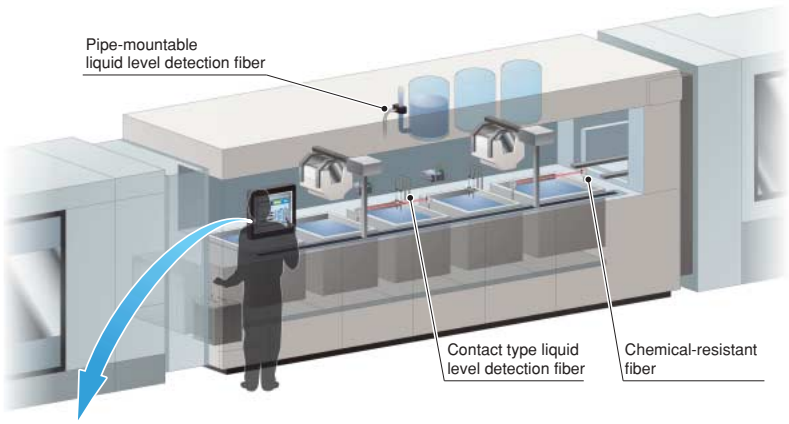
Upstream communication for reading data and teaching are also possible

Upstream communication unit SC-GU1-485

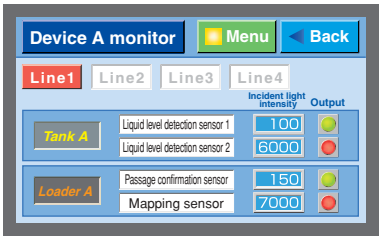
FX-301 FX-305

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



<Touch screen monitor example>



<Communicable commands>

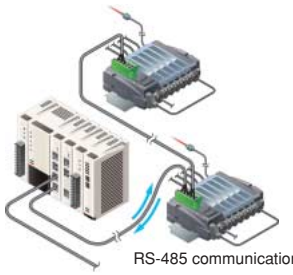
- Sensor incident light intensity
- Sensor settings verification
- Sensor output status
- Threshold value settings, etc.

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 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.

High-speed response 35 μs

FX-301-HS

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

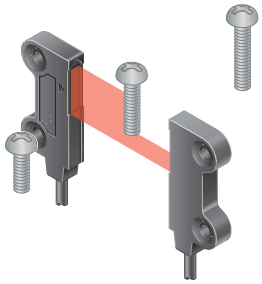
Independent dual outputs

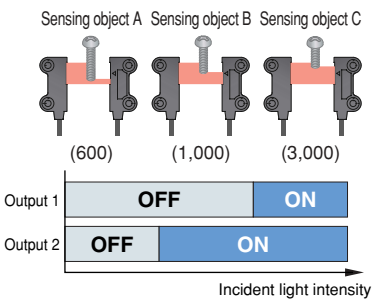
FX-305

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.

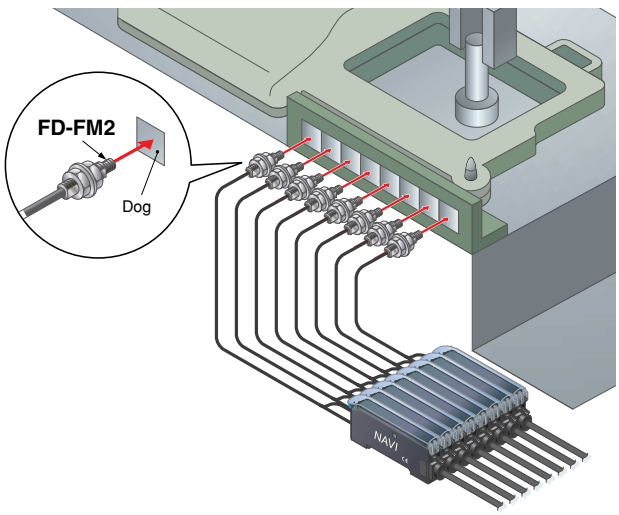
Interference prevention up to maximum of sixteen units

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 μs 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 μs	4 units	130 μs
FAST	4 units	150 μs	8 units	300 μs
STD	4 units	250 μs	8 units	500 μs
STDF	4 units	700 μs	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

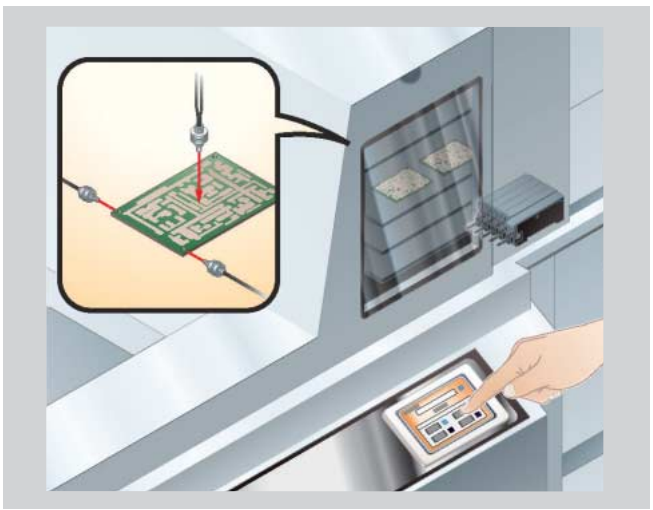
For the **FX-301/B/G/H**, up to 4 units can be set.
The **FX-301-HS** is not equipped with an interference prevention function.



Improved ease of working! External data bank switching and teaching

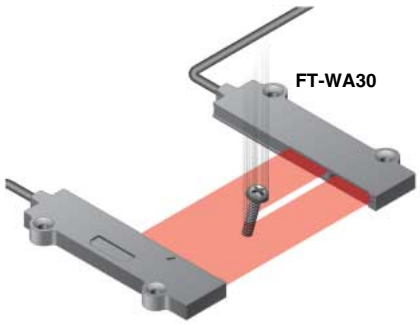
FX-301 **FX-305**

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.

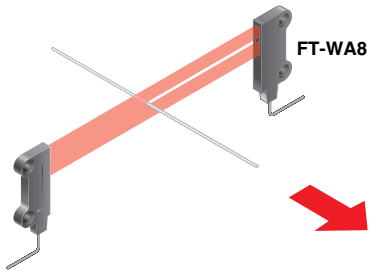


Wide beam fiber — FT-WA30/A30, FT-WA8/A8

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

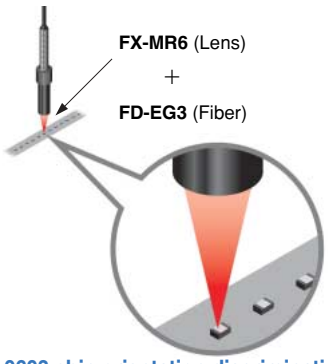
An ultra-small ϕ0.1 mm ϕ0.004 in spot size has now been made possible by combining our precision fiber with our finest spot lens. The orientation of 0603 chips can also be discriminated stably.

Finest spot lens FX-MR6

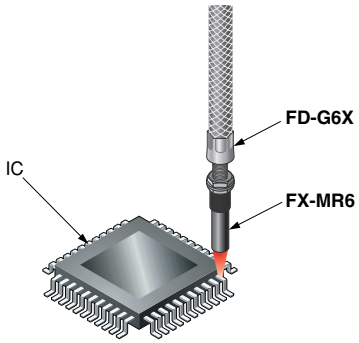
Fiber model No.	Distance to focal point	Spot diameter
FD-EG3	7±0.5 mm 0.276±0.020 in	ϕ0.1 mm ϕ0.004 in approx.
FD-EG2	7±0.5 mm 0.276±0.020 in	ϕ0.15 mm ϕ0.006 in approx.
FD-EG1	7±0.5 mm 0.276±0.020 in	ϕ0.2 mm ϕ0.008 in approx.
FD-WG4/G4/G6X/G6	7±0.5 mm 0.276±0.020 in	ϕ0.4 mm ϕ0.016 in approx.

Finest spot lens FX-MR3

Fiber model No.	Distance to focal point	Spot diameter
FD-EG3	7.5±0.5 mm 0.295±0.020 in	ϕ0.15 mm ϕ0.006 in approx.
FD-EG2	7.5±0.5 mm 0.295±0.020 in	ϕ0.2 mm ϕ0.008 in approx.
FD-EG1	7.5±0.5 mm 0.295±0.020 in	ϕ0.3 mm ϕ0.012 in approx.
FD-WG4/G4/G6X/G6	7.5±0.5 mm 0.295±0.020 in	ϕ0.5 mm ϕ0.020 in approx.



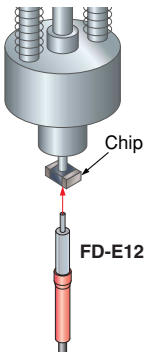
0603 chip orientation discrimination



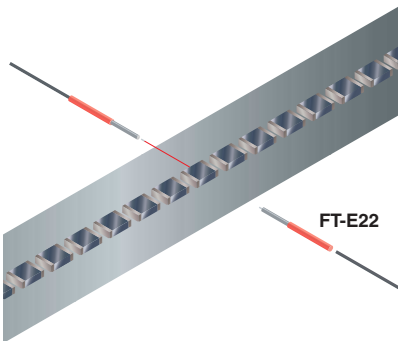
IC pin sensing

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.



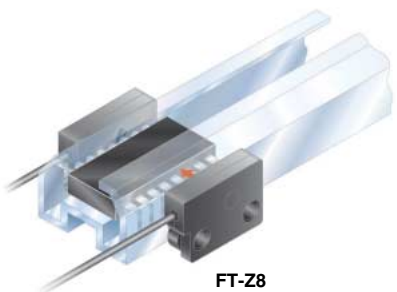
Sensing of chip components during suction transport



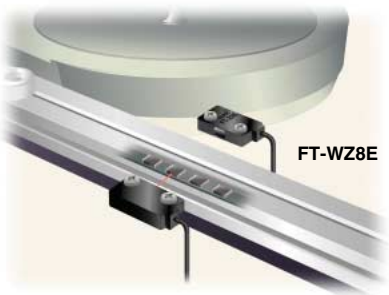
Confirming passage of chip components

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.



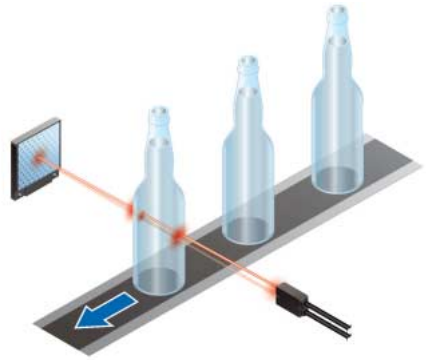
Detecting ICs in tranceparent stick



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.

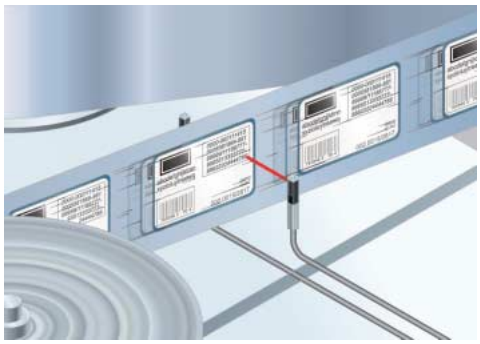


With polarizing filters FR-WKZ11

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

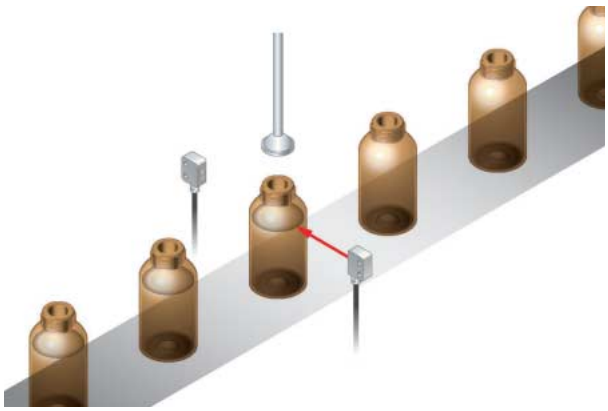
Side-view fiber — FT-V10

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.



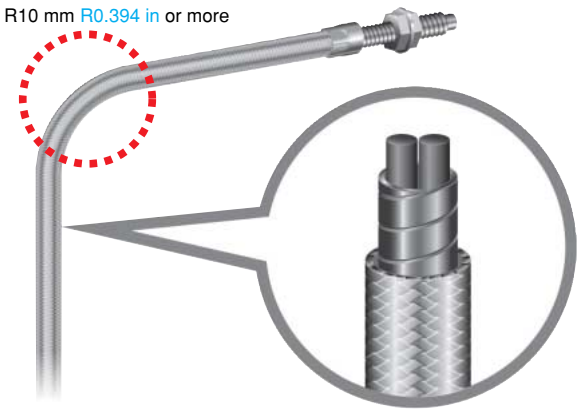
Chemical-resistant fiber — FT-Z802Y

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.



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	Sub cable (1-core)	**CN-71-C1**	1 m 3.281 ft
		FX-301H	Infrared LED	NPN open-collector transistor		**CN-71-C2**	2 m 6.562 ft
		FX-301HP		PNP open-collector transistor			
High-speed type		**FX-301-HS**	Red LED	NPN open-collector transistor		**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

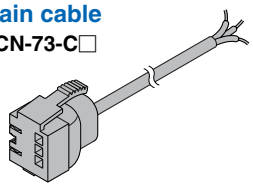
ORDER GUIDE

Quick-connection cables

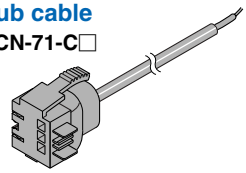
For FX-301(-HS)/B/G/H **Quick-connection cable is not supplied with the amplifier. Please order it separately.**

Type	Model No.	Description	
Main cable (3-core)	**CN-73-C1**	Length: 1 m 3.281 ft	0.15 mm² 3-core cabtyre cable, with connector on one end Cable outer diameter: ϕ3.0 mm ϕ0.118 in
	CN-73-C2	Length: 2 m 6.562 ft	
	CN-73-C5	Length: 5 m 16.404 ft	
Sub cable (1-core)	**CN-71-C1**	Length: 1 m 3.281 ft	0.15 mm² 1-core cabtyre cable, with connector on one end Cable outer diameter: ϕ3.0 mm ϕ0.118 in
	CN-71-C2	Length: 2 m 6.562 ft	
	CN-71-C5	Length: 5 m 16.404 ft	

Main cable
• **CN-73-C□**



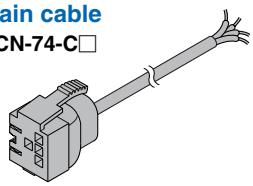
Sub cable
• **CN-71-C□**



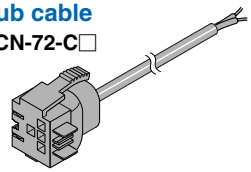
For FX-305 **Quick-connection cable is not supplied with the amplifier. Please order it separately.**

Type	Model No.	Description	
Main cable (4-core)	**CN-74-C1**	Length: 1 m 3.281 ft	0.15 mm² 4-core cabtyre cable, with connector on one end Cable outer diameter: ϕ3.0 mm ϕ0.118 in
	CN-74-C2	Length: 2 m 6.562 ft	
	CN-74-C5	Length: 5 m 16.404 ft	
Sub cable (2-core)	**CN-72-C1**	Length: 1 m 3.281 ft	0.15 mm² 2-core cabtyre cable, with connector on one end Cable outer diameter: ϕ3.0 mm ϕ0.118 in
	CN-72-C2	Length: 2 m 6.562 ft	
	CN-72-C5	Length: 5 m 16.404 ft	

Main cable
• **CN-74-C□**

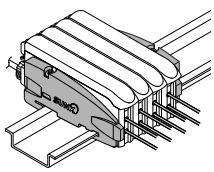


Sub cable
• **CN-72-C□**



End plates

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

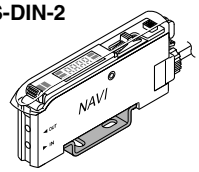
Appearance	Model No.	Description
	**MS-DIN-E**	When cascading multiple amplifiers, or when it moves depending on the way it is installed on a DIN rail, these end plates ensure that all amplifiers are mounted together in a secure and fully connected manner. Two pcs. per set

OPTIONS

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

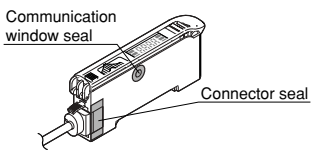
Amplifier mounting bracket

• **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 (mm in)	Sensing range (mm in)(Note 2) : U-LG : LONG : STDF : STD / : FAST : H-SP : S-D	Min. sensing object (Note 3)	Fiber cable length ✂: Free-cut	Bending radius	Model No.
Threaded type / M4	Lens mountable M4	1,600 62.992 1,100 43.307 700 27.559 530 20.866 / 400 15.748 200 7.874 180 7.087	ϕ0.04 mm ϕ0.0016 in opaque object		R25 mm R0.984 in	FT-B8
	Lens mountable M4					FT-FM2
	Sleeve 90 mm 3.543 in M4 ϕ1.48 ϕ0.058	1,000 39.370 780 30.709 500 19.685 400 15.748 / 280 11.024 150 5.906 130 5.118	ϕ0.03 mm ϕ0.0012 in opaque object	✂ 2 m 6.562 ft	Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	FT-FM2S
	Sleeve 40 mm 1.575 in M4 ϕ1.48 ϕ0.058					FT-FM2S4
	Lens mountable M4	750 29.528 570 22.441 350 13.780 290 11.417 / 200 7.874 90 3.543 100 3.937	ϕ0.03 mm ϕ0.0012 in opaque object		R1 mm R0.039 in	FT-W8
	Lens mountable M4	900 35.433 650 25.591 400 15.748 320 12.598 / 230 9.055 100 3.937 110 4.331	ϕ0.04 mm ϕ0.0016 in opaque object		R4 mm R0.157 in Flexible	FT-P80
	Lens mountable M4 Tough flexible	900 35.433 650 25.591 380 14.961 320 12.598 / 230 9.055 100 3.937 110 4.331	ϕ0.05 mm ϕ0.0020 in opaque object	1 m 3.281 ft	R10 mm R0.394 in	FT-P81X
	Lens mountable M4	550 21.654 400 15.748 250 9.843 190 7.480 / 140 5.512 70 2.756 80 3.150	ϕ0.04 mm ϕ0.0016 in opaque object	✂ 2 m 6.562 ft	R4 mm R0.157 in Flexible	FT-P60
Nut type	M4 W7 × H9 × D13.9 W0.276 × H0.354 × D0.547	750 29.528 570 22.441 350 13.780 290 11.417 / 200 7.874 90 3.543 100 3.937	ϕ0.06 mm ϕ0.0024 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	NEW FT-WR80
	With lens M4 W7 × H9 × D14.6 W0.276 × H0.354 × D0.575	1,500 59.055 1,200 47.244 750 29.528 600 23.622 / 420 16.535 200 7.874 210 8.268	ϕ0.04 mm ϕ0.0016 in opaque object			NEW FT-WR80L
Elbow	Lens mountable M4	740 29.134 530 20.866 320 12.598 230 9.055 / 150 5.906 75 2.953 80 3.150	ϕ0.04 mm ϕ0.0016 in opaque object	✂ 2 m 6.562 ft	R25 mm R0.984 in	FT-R80
M3	Lens mountable (except **FX-LE2**) M3	1,000 39.370 780 30.709 500 19.685 400 15.748 / 280 11.024 150 5.906 130 5.118	ϕ0.03 mm ϕ0.0012 in opaque object		R25 mm R0.984 in	FT-T80
	M3		ϕ0.025 mm ϕ0.0010 in opaque object	✂ 2 m 6.562 ft		FT-NFM2
	Sleeve 90 mm 3.543 in M3 ϕ0.88 ϕ0.035	400 15.748 270 10.630 200 7.874 140 5.512 / 100 3.937 55 2.165 49 1.929			Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	FT-NFM2S
	Sleeve 40 mm 1.575 in M3 ϕ0.88 ϕ0.035					FT-NFM2S4
	M3	220 8.661 160 6.299 100 3.937 80 3.150 / 55 2.165 25 0.984 28 1.102	ϕ0.02 mm ϕ0.0008 in opaque object		R1 mm R0.039 in	FT-W4
	M3	350 13.780 250 9.843 150 5.906 100 3.937 / 75 2.953 30 1.181 35 1.378			R4 mm R0.157 in Flexible	FT-P40
Long sensing range	With lens M14	19,500 767.715 19,500 767.715 19,500 767.715 14,000 551.180 / 10,000 393.700 3,500 137.795 3,800 149.606	ϕ0.4 mm ϕ0.016 in opaque object	✂ 10 m 32.808 ft	R25 mm 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 (mm in)	Sensing range (mm in)(Note 2) : U-LG : LONG : STDF : STD : FAST : H-SP : S-D	Min. sensing object (Note 3)	Fiber cable length ✂: Free-cut	Bending radius	Model No.
Cylindrical type, ϕ3 ϕ0.118	With lens · Long sensing range ϕ3 ϕ0.118	1,500 59.055 / 1,200 47.244 / 750 29.528 / 600 23.622 — 420 16.535 / 200 7.874 / 210 8.268	ϕ0.02 mm ϕ0.0008 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	FT-WS8L
	ϕ3 ϕ0.118	780 30.709 / 570 22.441 / 340 13.386 / 290 11.417 — 200 7.874 / 90 3.543 / 100 3.937	ϕ0.05 mm ϕ0.0020 in opaque object			FT-WS3
Cylindrical type, ϕ2.5 ϕ0.098	With lens · Long sensing range ϕ2.5 ϕ0.098	2,000 78.740 / 1,600 62.992 / 600 23.622 / 800 31.496 — 580 22.835 / 170 6.693 / 280 11.024	ϕ0.02 mm ϕ0.0008 in opaque object		R25 mm R0.984 in	FT-SFM2L
	ϕ2.5 ϕ0.098	1,000 39.370 / 780 30.709 / 500 19.685 / 400 15.748 — 280 11.024 / 150 5.906 / 130 5.118	ϕ0.03 mm ϕ0.0012 in opaque object	✂ 2 m 6.562 ft		FT-SFM2
	ϕ2.5 ϕ0.098	750 29.528 / 570 22.441 / 350 13.780 / 290 11.417 — 200 7.874 / 90 3.543 / 100 3.937			R1 mm R0.039 in	FT-WS8
Cylindrical type, ϕ1.5 ϕ0.059	ϕ1.5 ϕ0.059	400 15.748 / 270 10.630 / 200 7.874 / 140 5.512 — 100 3.937 / 55 2.165 / 49 1.929	ϕ0.025 mm ϕ0.0010 in opaque object	✂ 2 m 6.562 ft	R25 mm R0.984 in	FT-SNFM2
	ϕ1.5 ϕ0.059	220 8.661 / 160 6.299 / 100 3.937 / 80 3.150 — 55 2.165 / 25 0.984 / 28 1.102	ϕ0.02 mm ϕ0.0008 in opaque object		R1 mm R0.039 in	FT-WS4
	ϕ1.5 ϕ0.059	350 13.780 / 280 11.024 / 160 6.299 / 120 4.724 — 90 3.543 / 40 1.575 / 42 1.654		1 m 3.281 ft	R4 mm R0.157 in	FT-P2
Cylindrical type, ϕ1 ϕ0.039	ϕ1 ϕ0.039	100 3.937 / 80 3.150 / 50 1.969 / 40 1.575 — 30 1.181 / 13 0.512 / 17 0.669	ϕ0.02 mm ϕ0.0008 in opaque object	500 mm 19.685 in	Flexible	FT-PS1
Ultra-small diameter	Beam diameter ϕ0.125 mm ϕ0.005 in — ϕ0.25 ϕ0.010 ϕ3 ϕ0.118 — Sleeve part cannot be bent.	20 0.787 / 18 0.709 / 13 0.512 / 10 0.394 — 8 0.315 / 3 0.118 / 3 0.118	ϕ0.02 mm ϕ0.0008 in opaque object	500 mm 19.685 in	R5 mm R0.197 in	FT-E12
	Beam diameter ϕ0.25 mm ϕ0.010 in — ϕ0.4 ϕ0.016 ϕ3 ϕ0.118 — Sleeve part cannot be bent.	130 5.118 / 80 3.150 / 60 2.362 / 50 1.969 — 36 1.417 / 18 0.709 / 15 0.591		1 m 3.281 ft		FT-E22
Side-view	ϕ4 ϕ0.157 — 3 0.118	2,350 92.520 / 2,000 78.740 / 1,400 55.118 / 1,000 39.370 — 800 31.496 / 340 13.386 / 350 13.780	ϕ0.05 mm ϕ0.0020 in opaque object	✂ 2 m 6.562 ft	R25 mm R0.984 in	FT-V10
	ϕ1.5 ϕ0.059 — 0.8 0.031 — ϕ2.5 ϕ0.098 — Sleeve part cannot be bent.	550 21.654 / 400 15.748 / 240 9.449 / 200 7.874 — 140 5.512 / 65 2.559 / 70 2.756	ϕ0.02 mm ϕ0.0008 in opaque object			FT-SFM2SV2
	ϕ1 ϕ0.039 — 0.6 0.024 — ϕ2 ϕ0.079 — Sleeve part cannot be bent.	410 16.142 / 390 15.354 / 220 8.661 / 180 7.087 — 125 4.921 / 60 2.362 / 63 2.480		1 m 3.281 ft		FT-V22
	ϕ1 ϕ0.039 — 0.6 0.024 — ϕ2.5 ϕ0.098 — Sleeve part cannot be bent.	220 8.661 / 175 6.890 / 100 3.937 / 80 3.150 — 60 2.362 / 25 0.984 / 27 1.063		✂ 2 m 6.562 ft		FT-V41
	ϕ1 ϕ0.039 — 1 0.039 — ϕ2 ϕ0.079 — Sleeve part cannot be bent.	120 4.724 / 90 3.543 / 55 2.165 / 40 1.575 — 30 1.181 / 13 0.512 / 15 0.591			R1 mm R0.039 in	FT-WV42

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) : U-LG : LONG : STDF : STD / : FAST : H-SP : S-D	Min. sensing object (Note 3)	Fiber cable length ✂: Free-cut	Bending radius	Model No.
Rectangular	Compact	Easy mounting · Top sensing W3×H8×D12 W0.118×H0.315×D0.472	3,500 137.795 2,500 98.425 1,600 62.992 1,200 47.244	850 33.465 400 15.748 410 16.142	ϕ0.08 mm ϕ0.0032 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	FT-WZ8H
			3,100 122.047 2,700 106.299 1,550 61.024 1,400 55.118	1,000 39.370 420 16.535 490 19.291	ϕ0.03 mm ϕ0.0012 in opaque object		R4 mm R0.157 in Flexible	FT-Z8H
		Easy mounting · Side sensing W3×H12×D8 W0.118×H0.472×D0.315	2,100 82.677 1,500 59.055 950 37.402 700 27.559	500 19.685 200 7.874 210 8.268	ϕ0.05 mm ϕ0.0020 in opaque object		R1 mm R0.039 in	FT-WZ8E
			1,850 72.835 1,600 62.992 950 37.402 800 31.496	600 23.622 250 9.843 280 11.024	ϕ0.03 mm ϕ0.0012 in opaque object		R4 mm R0.157 in Flexible	FT-Z8E
		Easy mounting · Front sensing W8.5×H12×D3 W0.335×H0.472×D0.118	950 37.402 700 27.559 420 16.535 330 12.992	240 9.449 100 3.937 120 4.724	ϕ0.04 mm ϕ0.0016 in opaque object		R1 mm R0.039 in	FT-WZ8
			1,100 43.307 800 31.496 500 19.685 400 15.748	300 11.811 120 4.724 140 5.512	ϕ0.03 mm ϕ0.0012 in opaque object		R4 mm R0.157 in Flexible	FT-Z8
		Front sensing W10×H7×D2 W0.394×H0.276×D0.079	300 11.811 200 7.874 140 5.512 100 3.937	70 2.756 40 1.575 40 1.575	ϕ0.08 mm ϕ0.0032 in opaque object	✂ 1 m 3.281 ft	R1 mm R0.039 in	NEW FT-WZ4
		Fiber bending type W2×H10×D10 W0.079×H0.394×D0.394	220 8.661 150 5.906 105 4.134 75 2.953	50 1.969 30 1.181 30 1.181	ϕ0.08 mm ϕ0.0032 in opaque object			NEW FT-WZ4HB
		Front sensing W14×H7×D3.5 W0.551×H0.276×D0.138	660 25.984 440 17.323 308 12.126 220 8.661	150 5.906 80 3.150 80 3.150	ϕ0.08 mm ϕ0.0032 in opaque object	✂ 2 m 6.562 ft		NEW FT-WZ7
		Fiber bending type W3.5×H14×D11 W0.138×H0.551×D0.433	870 34.252 580 22.835 406 15.984 290 11.417	210 8.268 110 4.331 110 4.331	ϕ0.03 mm ϕ0.0012 in opaque object			NEW FT-WZ7HB
Special	Narrow beam	ϕ3.5 ϕ0.138 ϕ3.7 ϕ0.146	3,000 118.110 2,000 78.740 1,500 59.055 1,000 39.370	800 31.496 300 11.811 350 13.780			R25 mm R0.984 in	FT-K8
		Side-view type with small light dispersion ϕ4 ϕ0.157 3 0.118	2,200 86.614 1,700 66.929 1,000 39.370 700 27.559	600 23.622 280 11.024 300 11.811	ϕ0.06 mm ϕ0.0024 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	FT-WKV8
			3,000 118.110 2,000 78.740 1,500 59.055 1,000 39.370	800 31.496 300 11.811 350 13.780			R25 mm R0.984 in	FT-KV8
		W2×H1.5×D20 W0.079×H0.059×D0.787 2 0.079	600 23.622 500 19.685 300 11.811 250 9.843	180 7.087 90 3.543 100 3.937	ϕ0.02 mm ϕ0.0008 in opaque object		R10 mm R0.394 in	FT-KV1
	Wide beam	Wide area sensing Sensing width 32 mm 1.260 in W5×H69×D20 W0.197×H2.717×D0.787	(Note 4) 3,500 137.795 (Note 4) 3,500 137.795 (Note 4) 3,500 137.795 (Note 4) 3,500 137.795	(Note 4) 3,500 137.795 (Note 4) 3,000 118.110 (Note 4) 3,500 137.795	ϕ0.3 mm ϕ0.012 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	FT-WA30
							R10 mm R0.394 in	FT-A30
		Wide area sensing Sensing width 11 mm 0.433in W4.2×H31×D13.5 W0.165×H1.220×D0.531	(Note 4) 3,500 137.795 (Note 4) 3,500 137.795 3,500 137.795 1,500 59.055	1,100 43.307 1,080 42.520 750 29.528	ϕ0.25 mm ϕ0.010 in opaque object		R1 mm R0.039 in	FT-WA8
							R10 mm R0.394 in	FT-A8
	Array	Top sensing W5×H15×D15 W0.197×H0.591×D0.591	850 33.465 650 25.591 380 14.961 330 12.992	220 8.661 100 3.937 115 4.528	Horizontal: ϕ0.025 mm ϕ0.0010 in opaque object Vertical: ϕ0.45 mm ϕ0.018 in opaque object	✂ 2 m 6.562 ft	R25 mm R0.984 in	FT-AFM2
		Side sensing W5×H15×D15 W0.197×H0.591×D0.591	800 31.496 590 23.228 350 13.780 290 11.417	200 7.874 90 3.543 100 3.937				FT-AFM2E

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) : U-LG : LONG : STDF : STD	: FAST : H-SP : S-D	Min. sensing object (Note 3)	Fiber cable length ✂: Free-cut	Bending radius	Model No.
Special	Heat-resistant	350 °C 662 °F Lens mountable M4	750 29.528 550 21.654	200 7.874 85 3.346	ϕ0.04 mm ϕ0.0016 in opaque object	2 m 6.562 ft	R25 mm R0.984 in	**FT-H35-M2**
		350 °C 662 °F Sleeve 60 mm 2.362 in M4 ϕ2.1 ϕ0.083	330 12.992 280 11.024	90 3.543			Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	**FT-H35-M2S6**
		Allows flexible wiring 200 °C 392 °F Lens mountable M4	420 16.535 310 12.205 180 7.087 140 5.512	100 3.937 40 1.575 50 1.969	ϕ0.02mm ϕ0.0008 in opaque object	1 m 3.281 ft	R10 mm R0.394 in	**FT-H20W-M1**
		200 °C 392 °F Lens mountable M4	750 29.528 550 21.654 320 12.598 280 11.024	200 7.874 85 3.346 90 3.543	ϕ0.04 mm ϕ0.0016 in opaque object	1 m 3.281 ft	R25 mm R0.984 in	**FT-H20-M1**
		130 °C 266 °F Lens mountable (**FX-LE2** only) M4	1,200 47.244 880 34.646 550 21.654 440 17.323	300 11.811 150 5.906 155 6.102	ϕ0.06 mm ϕ0.0024 in opaque object	✂ 2 m 6.562 ft		**FT-H13-FM2**
	Heat-resistant · Joint	Lens mountable (**FX-LE1**) M4	530 20.866 390 15.354 225 8.858 200 7.874	140 5.512 60 2.362 60 2.362	ϕ0.12 mm ϕ0.005 in opaque object	✂ 200 mm 7.874 in (Note 4)	Heat-resistant fiber R18 mm R0.709 in (Note 5)	NEW **FT-H20-J20-S** (Note 6)
						✂ 300 mm 11.811 in (Note 4)		NEW **FT-H20-J30-S** (Note 6)
						✂ 500 mm 19.685 in (Note 4)		NEW **FT-H20-J50-S** (Note 6)
		Side-view ϕ3.8 ϕ0.150 ϕ4 ϕ0.157	840 33.071 550 21.654 370 14.567 280 11.024	200 7.874 90 3.543 90 3.543	ϕ0.16 mm ϕ0.006 in opaque object	✂ 500 mm 19.685 in (Note 4)		NEW **FT-H20-VJ50-S** (Note 6)
						✂ 800 mm 31.496 in (Note 4)		NEW **FT-H20-VJ80-S** (Note 6)
	Chemical-resistant	Easy mounting · Rectangular head SEMI S2 compliant W7 × H15 × D13 W0.276 × H0.591 × D0.512	3,500 137.795 3,500 137.795 3,000 118.110 1,500 59.055	1,000 39.370 500 19.685 530 20.866	ϕ4 mm ϕ0.157 in opaque object	✂ 2 m 6.562 ft	R25 mm R0.984 in	**FT-Z802Y**
		ϕ5.5 ϕ0.217	3,500 137.795 3,500 137.795 2,000 78.740 1,500 59.055	1,000 39.370 500 19.685 530 20.866	ϕ0.2 mm ϕ0.008 in opaque object	✂ 2 m 6.562 ft (Note 7)	R30 mm R1.181 in	**FT-L80Y**
		Side-view ϕ5.5 ϕ0.217	1,000 39.370 800 31.496 500 19.685 400 15.748	280 11.024 120 4.724 140 5.512				**FT-V80Y**
	Vacuum-resistant	300 °C 572 °F Lens mountable (**FV-LE1/SV2** only) M4	350 13.780 250 9.843 150 5.906 125 4.921	90 3.543 50 1.969 40 1.575	ϕ0.03 mm ϕ0.0012 in opaque object	1 m 3.281 ft	R18 mm R0.709 in	**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-VJ50** (one pair set)
- **FT-H20-VJ80** (one pair set)

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

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

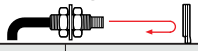
LIST OF FIBERS

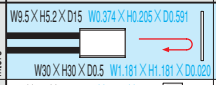
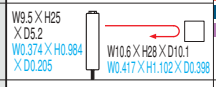
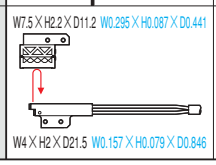
Pliable fibers (flexible and sharp bending fibers) are marked with light blue in the table.

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

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)

Retroreflective type



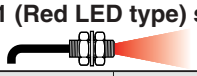
Type	Shape of fiber head (mm in)	Sensing range (mm in)(Note 2, 3) : U-LG : LONG : STDF : STD : FAST : H-SP : S-D	Min. sensing object (Note 4)	Fiber cable length ✂: Free-cut	Bending radius	Model No.
Sharp bending / With polarizing filters	 W9.5 X H5.2 X D15 W0.374 X H0.205 X D0.591 W30 X H30 X D0.5 W1.181 X H1.181 X D0.020	100 to 910 3.937 to 35.827 100 to 730 3.937 to 28.740 100 to 600 3.937 to 23.622 100 to 520 3.937 to 20.472	Cannot use Cannot use 100 to 460 3.937 to 18.110	ϕ0.3 mm ϕ0.012 in opaque object	2 m 6.562 ft	R1 mm R0.039 in	**FR-WKZ11**
Narrow beam / Top sensing	W9.5 X H5.2 X D21 W0.374 X H0.205 X D0.827 W10.6 X H28 X D10.1 W0.417 X H1.102 X D0.398	200 7.874 200 7.874 200 7.874 200 7.874	200 7.874 200 7.874 200 7.874	Horizontal: ϕ5.5 mm ϕ0.217 in opaque object Vertical: ϕ0.06 mm ϕ0.0024 in opaque object	2 m 6.562 ft	R10 mm R0.394 in	**FR-KZ21**
Narrow beam / Side sensing	 W9.5 X H25 X D5.2 W0.374 X H0.984 X D0.205 W10.6 X H28 X D10.1 W0.417 X H1.102 X D0.398						**FR-KZ21E**
Wafer mapping	 W7.5 X H2.2 X D11.2 W0.295 X H0.087 X D0.441 W4 X H2 X D21.5 W0.157 X H0.079 X D0.846	15 to 370 0.591 to 14.567 15 to 330 0.591 to 12.992 15 to 240 0.591 to 9.449 15 to 210 0.591 to 8.268	15 to 170 0.591 to 6.693 15 to 80 0.591 to 3.150 15 to 90 0.591 to 3.543	ϕ0.12 mm ϕ0.005 in opaque object	2 m 6.562 ft	R10 mm R0.394 in	**FR-KV1**

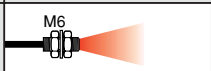
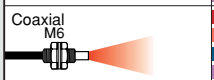
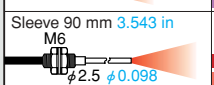
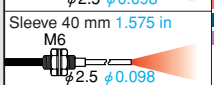
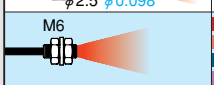
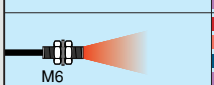
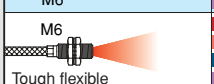
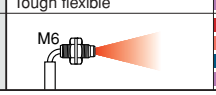
Notes: 1) Please contact our office for the sensing ranges for the **FX-301-HS** in H-SP mode and for the **FX-301B/G/H**.
2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
The sensing range of **FR-WKZ11** is specified 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)

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)

Reflective type



Type	Shape of fiber head (mm in)	Sensing range (mm in)(Note 2, 3) : U-LG : LONG : STDF : STD : FAST : H-SP : S-D	Min. sensing object (Note 4)	Fiber cable length ✂: Free-cut	Bending radius	Model No.
Threaded type / M6	 M6	600 23.622 480 18.898 280 11.024 220 8.661	160 6.299 85 3.346 75 2.953	ϕ0.02 mm ϕ0.0008 in gold wire	2 m 6.562 ft	R25 mm R0.984 in	**FD-B8**
	 Coaxial M6	410 16.142 310 12.205 200 7.874 140 5.512	100 3.937 55 2.165 47 1.850				**FD-FM2**
	 Sleeve 90 mm 3.543 in M6 ϕ2.5 ϕ0.098	370 14.567 270 10.630 170 6.693 110 4.331	85 3.346 45 1.772 39 1.535			Fiber R25 mm R0.984 in	**FD-FM2S**
	 Sleeve 40 mm 1.575 in M6 ϕ2.5 ϕ0.098					Sleeve R10 mm R0.394 in	**FD-FM2S4**
	 M6	250 9.843 190 7.480 110 4.331 90 3.543	60 2.362 25 0.984 32 1.260			R1 mm R0.039 in	**FD-W8**
	 M6	300 11.811 220 8.661 130 5.118 100 3.937	70 2.756 30 1.181 35 1.378			R4 mm R0.157 in Flexible	**FD-P80**
	 M6 Tough flexible	270 10.630 185 7.283 100 3.937 80 3.150	60 2.362 30 1.181 35 1.378		1 m 3.281 ft	R10 mm R0.394 in	**FD-P81X**
Elbow	 M6	240 9.449 185 7.283 110 4.331 85 3.346	60 2.362 25 0.984 30 1.181	ϕ0.02 mm ϕ0.0008 in gold wire	2 m 6.562 ft	R25 mm 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 (mm in)	Sensing range (mm in)(Note 2, 3) : U-LG : LONG : STDF : STD	: FAST : H-SP : S-D	Min. sensing object (Note 4)	Fiber cable length ✂: Free-cut	Bending radius	Model No.
Threaded type	M4	M4	370 14.567 270 10.630 170 6.693 110 4.331	85 3.346 45 1.772 39 1.535			R25 mm R0.984 in	**FD-T80**
		M4						**FD-NFM2**
		Sleeve 90 mm 3.543 in M4 ϕ1.48 ϕ0.058	140 5.512 90 3.543 60 2.362 45 1.772	35 1.378 16 0.630 16 0.630			Fiber R25 mm R0.984 in	**FD-NFM2S**
		Sleeve 40 mm 1.575 in M4 ϕ1.48 ϕ0.058					Sleeve R10 mm R0.394 in	**FD-NFM2S4**
		Sleeve 40 mm 1.575 in M4 ϕ1.48 ϕ0.058	40 1.575 30 1.181 18 0.709 15 0.591	12 0.472 4.5 0.177 5 0.197	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	Fiber R1 mm R0.039 in Sleeve R10 mm R0.394 in	**FD-W44**
		M4	250 9.843 190 7.480 110 4.331 90 3.543	60 2.362 25 0.984 32 1.260			R1 mm R0.039 in	**FD-WT8**
		Coaxial · Lens mountable M4	85 3.346 65 2.559 37 1.457 32 1.260	25 0.984 10 0.394 11 0.433			R2 mm R0.079 in	**FD-WG4**
		M4	150 5.906 110 4.331 65 2.559 55 2.165	42 1.654 15 0.591 19 0.748			R25 mm R0.984 in	**FD-G4**
		M4	130 5.118 90 3.543 55 2.165 45 1.772	30 1.181 13 0.512 16 0.630			R4 mm R0.157 in Flexible	**FD-P60**
	M3	Small diameter M3	140 5.512 90 3.543 60 2.362 45 1.772	35 1.378 16 0.630 16 0.630			R25 mm R0.984 in	**FD-T40**
		M3	40 1.575 30 1.181 18 0.709 15 0.591	12 0.472 4.5 0.177 5 0.197	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R1 mm R0.039 in	**FD-WT4**
		M3	50 1.969 36 1.417 20 0.787 18 0.709	14 0.551 5.5 0.217 6 0.236			R4 mm R0.157 in Flexible	**FD-P40**
		Lens mountable (**FX-MR3**, **FX-MR6**) M3 Coaxial	150 5.906 110 4.331 65 2.559 55 2.165	42 1.654 15 0.591 19 0.748			R25 mm R0.984 in	**FD-G6**
		Lens mountable (**FX-MR3**, **FX-MR6**) M3 Coaxial Tough flexible	150 5.906 90 3.543 48 1.890 45 1.772	35 1.378 12 0.472 20 0.787		✂ 1 m 3.281 ft (Note 5)	R10 mm R0.394 in	**FD-G6X**
		Coaxial · Lens mountable (**FX-MR3**, **FX-MR6**) M3 High precision	50 1.969 38 1.496 25 0.984 18 0.709	14 0.551 5 0.197 6 0.236		500 mm 19.685 in	R25 mm R0.984 in	**FD-EG1**
		Coaxial · Lens mountable (**FX-MR3**, **FX-MR6**) M3 Light emitting fiber element High precision ϕ0.175 ϕ0.007	40 1.575 25 0.984 14 0.551 12 0.472	9 0.354 3 0.118 5 0.197	ϕ0.04 mm ϕ0.0016 in gold wire		R10 mm R0.394 in	**FD-EG2**
		Coaxial · Lens mountable (**FX-MR3**, **FX-MR6**) M3 Light emitting fiber element High precision ϕ0.125 ϕ0.005	20 0.787 15 0.591 9 0.354 8 0.315	5 0.197 2.5 0.098 3 0.118				**FD-EG3**
		M3 ϕ0.5 ϕ0.020 Sleeve part cannot be bent.	6.5 0.256 5 0.197 3 0.118 3 0.118	2 0.079 Cannot use Cannot use	ϕ0.02 mm ϕ0.0008 in gold wire		R25 mm R0.984 in	**FD-EN500S1**
		Coaxial M3 ϕ0.8 ϕ0.031 Sleeve part cannot be bent.	50 1.969 38 1.496 20 0.787 18 0.709	14 0.551 5 0.197 6 0.236		1 m 3.281 ft		**FD-ENM1S1**

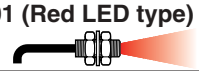
Notes: 1) Refer to p.27 for the sensing ranges for the **FX-301-HS** in H-SP mode and for the **FX-301B/G/H**.
2) The sensing range is specified for white non-glossy paper [200 × 200 mm 7.874 × 7.874 in (**FD-T80**, **FD-WT8**: 400 × 400 mm 15.748 × 15.748 in, **FD-W44**, **FD-WT4**, **FD-P40**, **FD-G6**, **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) : U-LG : LONG : STDF : STD	: FAST : H-SP : S-D	Min. sensing object (Note 4)	Fiber cable length ✂: Free-cut	Bending radius	Model No.
Cylindrical type, ϕ3 ϕ0.118	ϕ3 ϕ0.118	370 14.567 270 10.630 170 6.693 110 4.331	85 3.346 45 1.772 39 1.535			R25 mm R0.984 in	**FD-S80**
	ϕ3 ϕ0.118	250 9.843 190 7.480 110 4.331 90 3.543	60 2.362 25 0.984 32 1.260	ϕ0.02 mm ϕ0.0008 in gold wire	2 m 6.562 ft	R1 mm R0.039 in	**FD-WS8**
	Coaxial ϕ3 ϕ0.118	85 3.346 65 2.559 37 1.457 32 1.260	25 0.984 10 0.394 11 0.433			R2 mm R0.079 in	**FD-WSG4**
	ϕ3 ϕ0.118	130 5.118 90 3.543 55 2.165 45 1.772	30 1.181 13 0.512 16 0.630			R4 mm R0.157 in Flexible	**FD-P50**
Cylindrical type, ϕ2.5 ϕ0.098	ϕ2.5 ϕ0.098	140 5.512 90 3.543 60 2.362 45 1.772	35 1.378 16 0.630 16 0.630	ϕ0.02 mm ϕ0.0008 in gold wire	2 m 6.562 ft	R25 mm R0.984 in	**FD-SNFM2**
Cylindrical type, ϕ1.5 ϕ0.059	ϕ1.5 ϕ0.059	80 3.150 50 1.969 30 1.181 25 0.984	19 0.748 7.5 0.295 9 0.354	ϕ0.02 mm ϕ0.0008 in gold wire	1 m 3.281 ft	R4 mm R0.157 in Flexible	**FD-P2**
Ultra-small diameter	ϕ1.5 ϕ0.059 ϕ0.5 ϕ0.020 Sleeve part cannot be bent.	15 0.591 11 0.433 8 0.315 6 0.236	4 0.157 2 0.079 1 0.039	ϕ0.02 mm ϕ0.0008 in gold wire	1 m 3.281 ft	R10 mm R0.394 in	**FD-E12**
Ultra-small diameter	Coaxial ϕ3 ϕ0.118 ϕ0.65 ϕ0.026 Sleeve part cannot be bent.	65 2.559 45 1.772 28 1.102 23 0.906	17 0.669 8 0.315 7 0.276	ϕ0.02 mm ϕ0.0008 in gold wire		R25 mm R0.984 in	**FD-E22**
Side-view	Small diameter ϕ1.5 ϕ0.059 ϕ3 ϕ0.118 0.7 0.028 Sleeve part cannot be bent.	80 3.150 55 2.165 30 1.181 25 0.984	17 0.669 8 0.315 9 0.354			R25 mm R0.984 in	**FD-V41**
Side-view	ϕ3 ϕ0.118 ϕ2 ϕ0.079 1 0.039 Sleeve part cannot be bent.	20 0.787 15 0.591 8.5 0.335 7 0.276	5 0.197 Cannot use Cannot use	ϕ0.02 mm ϕ0.0008 in gold wire	2 m 6.562 ft	R1 mm R0.039 in	**FD-WV42**
Side-view	ϕ5 ϕ0.197 ϕ2 ϕ0.079 0.8 0.031 Sleeve part cannot be bent.	170 6.693 100 3.937 55 2.165 45 1.772	32 1.260 15 0.591 16 0.630			R25 mm R0.984 in	**FD-SFM2SV2**
Rectangular, Convergent reflective type	Glass substrate detection · Mapping W25 × H7.3 × D30 W0.984 × H0.287 × D1.181	12 to 50 0.472 to 1.969 12.5 to 37.5 0.492 to 1.476 15 to 36 0.591 to 1.417 15 to 35 0.591 to 1.378	16 to 29 0.630 to 1.142 Cannot use Cannot use	ϕ0.3 mm ϕ0.012 in gold wire	4 m 13.123 ft	R25 mm R0.984 in	**FD-L46**
Rectangular, Convergent reflective type	Glass substrate detection · Alignment W20 × H29 × D3.8 W0.787 × H1.142 × D0.150	0 to 50 0 to 1.969 0 to 36 0 to 1.417 0 to 33 0 to 1.299 0 to 30 0 to 1.181	0 to 30 0 to 1.181 0 to 15 0 to 0.591 0 to 21 0 to 0.827	(LCD glass)	3 m 9.843 ft	R4 mm R0.157 in	**FD-L45**
Rectangular, Convergent reflective type	Glass substrate detection · Alignment W17 × H29 × D3.8 W0669 × H1.142 × D0.150	0 to 23 0 to 0.906			2 m 6.562 ft		**FD-L43**
Rectangular, Convergent reflective type	Glass substrate detection · Seating W12 × H19 × D3 W0.472 × H0.748 × D0.118	0 to 8.2 0 to 0.323 0 to 7 0 to 0.276 0 to 6.5 0 to 0.256 0 to 6 0 to 0.236	0 to 5.7 0 to 0.224 0 to 5 0 to 0.197 0 to 5.2 0 to 0.205	ϕ0.03 mm ϕ0.0012 in gold wire	2 m 6.562 ft	R10 mm R0.394 in	**FD-L44**
		0 to 4.7 0 to 0.185 0 to 4.5 0 to 0.177 0 to 4 0 to 0.157 0 to 4 0 to 0.157	0 to 3.8 0 to 0.150 0 to 3 0 to 0.118 0 to 3.5 0 to 0.138				**FD-L44S**
Rectangular, Convergent reflective type	Glass substrate detection W24 × H21 × D4 W0.945 × H0.827 × D0.157	6.5 to 14.5 0.256 to 0.571 (Convergent point 8 0.315) 6.5 to 14 0.256 to 0.551 (Convergent point 8 0.315) 7 to 14 0.276 to 0.551 (Convergent point 8 0.315) 7 to 12 0.276 to 0.472 (Convergent point 8 0.315)	7.5 to 12 0.295 to0.472 (Convergent point 8 0.315) Cannot use Cannot use	ϕ1.9 mm ϕ0.075 in metal pipe (gray)		R1 mm R0.039 in	**FD-WL41**
		2 to 19 0.079 to 0.748 (Convergent point 8 0.315) 2.5 to 18 0.098 to 0.709 (Convergent point 8 0.315) 3 to 16 0.118 to 0.630 (Convergent point 8 0.315) 3 to 16 0.118 to 0.630 (Convergent point 8 0.315)	3.5 to 15 0.138 to 0.591 (Convergent point 8 0.315) Cannot use Cannot use	ϕ0.06 mm ϕ0.024 in gold wire	2 m 6.562 ft	R10 mm R0.394 in	**FD-L41**
Rectangular, Convergent reflective type	W6 × H18 × D14 W0.236 × H0.709 × D0.551	2 to 20 0.079 to 0.787 (Convergent point 6 0.236) 2.5 to 18 0.098 to 0.709 (Convergent point 6 0.236) 4 to 12 0.157 to 0.472 (Convergent point 6 0.236) 4 to 12 0.157 to 0.472 (Convergent point 6 0.236)	4.5 to 11 0.177 to 0.433 (Convergent point 6 0.236) 5 to 8.5 0.197 to 0.335 (Convergent point 6 0.236) 4.8 to 9.5 0.189 to 0.374 (Convergent point 6 0.236)	ϕ0.02 mm ϕ0.0008 in gold wire			**FD-L4**
Rectangular, Convergent reflective type	W7.2 × H7.5 × D2 W0.283 × H0.295 × D0.079	0.5 to 8.5 0.020 to 0.335 0.5 to 7.5 0.020 to 0.295 1 to 6.5 0.039 to 0.256 1 to 5.5 0.039 to 0.217	1 to 5 0.039 to 0.197 Cannot use Cannot use	ϕ0.3 mm ϕ0.012 in copper wire	1 m 3.281 ft	R1 mm R0.039 in	**FD-WL48**

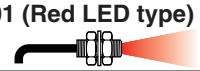
Notes: 1) Refer to p.27 for the sensing ranges for the **FX-301-HS** in H-SP mode and for the **FX-301B/G/H**.
2) The sensing range is specified for white non-glossy paper (**FD-S80**, **FD-WS8**: 400 × 400 mm 15.748 × 15.748 in, **FD-WSG4**, **FD-P50**, **FD-SNFM2**, **FD-V41**, **FD-SFM2SV2**: 200 × 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 covergent 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) : U-LG : LONG : STDF : STD : FAST : H-SP : S-D		Min. sensing object (Note 4)	Fiber cable length ✂: Free-cut	Bending radius	Model No.
Rectangular	Small	Front sensing W10 × H7 × D2 W0.394 × H0.276 × D0.079	1 to 50 0.039 to 1.969 1.5 to 34 0.059 to 1.339 2 to 24 0.079 to 0.945 3 to 17 0.098 to 0.906	3 to 10 0.118 to 0.394 Cannot use Cannot use	ϕ0.16 mm ϕ0.006 in copper wire	✂ 1 m 3.281 ft	R1 mm R0.039 in	NEW FD-WZ4
		Fiber bending type W2 × H10 × D10 W0.079 × H0.394 × D0.394	1 to 70 0.039 to 2.756 1 to 46 0.039 to 1.811 1 to 32.2 0.039 to 1.268 2.5 to 23 0.098 to 0.906	2.5 to 15 0.098 to 0.591 3 to 7 0.118 to 0.276 3 to 7 0.118 to 0.276				NEW FD-WZ4HB
		Front sensing W14 × H7 × D3.5 W0.551 × H0.276 × D0.138	200 7.874 120 4.724 1 to 84 0.039 to 3.307 1 to 60 0.039 to 2.362	1.5 to 35 0.059 to 1.378 2.5 to 18 0.098 to 0.709 2.5 to 18 0.098 to 0.709	ϕ0.03 mm ϕ0.0012 in gold wire	✂ 2 m 6.562 ft		NEW FD-WZ7
		Fiber bending type W3.5 × H14 × D11 W0.138 × H0.551 × D0.433	0.5 to 270 0.002 to 10.630 0.5 to 180 0.002 to 7.087 1 to 126 0.039 to 4.961 1 to 90 0.039 to 3.543	1 to 70 0.039 to 2.756 1 to 35 0.039 to 1.378 1 to 35 0.039 to 1.378				NEW FD-WZ7HB
Special	Long sensing range	Long sensing range · Rectangular head W5.2 × H9.5 × D15 W0.205 × H0.374 × D0.591	20 to 660 0.787 to 25.984 20 to 480 0.787 to 18.898 20 to 300 0.787 to 11.811 20 to 230 0.787 to 9.055	20 to 170 0.787 to 6.693 25 to 90 0.984 to 3.543 25 to 100 0.984 to 3.937	ϕ0.3 mm ϕ0.012 in copper wire	✂ 2 m 6.562 ft	R1 mm R0.039 in	FD-WKZ1
	Wide beam	W7 × H15 × D30 W0.276 × H0.591 × D1.181	230 9.055 200 7.874 150 5.906 150 5.906	100 3.937 45 1.772 50 1.969	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R25 mm R0.984 in	FD-A15
	Array	Top sensing W5 × H20 × D20 W0.197 × H0.787 × D0.787	290 11.417 220 8.661 135 5.315 110 4.331	78 3.071 35 1.378 39 1.535	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R25 mm R0.984 in	FD-AFM2
		Side sensing W5 × H20 × D20 W0.197 × H0.787 × D0.787						FD-AFM2E
	Liquid level sensing	Contact type ϕ6 ϕ0.236	—		(Liquid)	✂ 2 m 6.562 ft (Note 5)	Protective tube R40 mm R1.575 in Fiber R15 mm R0.591 in	FD-F8Y
		Mountable on pipe · Standard W25 × H13 × D20 W0.984 × H0.512 × D0.787	Applicable pipe diameter: Outer dia. ϕ6 to ϕ26 mm ϕ0.236 to ϕ1.024 in transparent pipe [PVC (vinyl chloride), fluorine resin, polycarbonate, acrylic, glass, wall thickness 1 to 3 mm 0.039 to 0.118 in]			✂ 2 m 6.562 ft	R10 mm R0.394 in	FD-F41
		Mountable on pipe · For PFA, wall thickness 1 mm 0.039 in pipe W25 × H13 × D20 W0.984 × H0.512 × D0.787	Applicable pipe diameter: Outer dia. ϕ6 to ϕ26 mm ϕ0.236 to ϕ1.024 in transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1 mm 0.039 in]					FD-F4

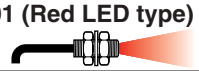
Notes: 1) Refer to p.27 for the sensing ranges for the **FX-301-HS** in H-SP mode and for the **FX-301B/G/H**.
2) The sensing range is specified for white non-glossy paper [200 × 200 mm 7.874 × 7.874 in (**FD-WKZ1**, **FD-AFM2**, **FD-AFM2E**: 400 × 400 mm 15.478 × 15.478 in)] as the object.
3) Please 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)

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)

Reflective type

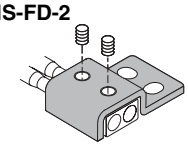


Type		Shape of fiber head (mm in)	Sensing range (mm in)(Note 2, 3) : U-LG : LONG : STDF : STD	: FAST : H-SP : S-D	Min. sensing object (Note 4)	Fiber cable length ✂: Free-cut	Bending radius	Model No.
Special	Heat-resistant	350 °C 662 °F · Coaxial M6			ϕ0.02 mm ϕ0.0008 in gold wire	2 m 6.562 ft	R25 mm R0.984 in	**FD-H35-M2**
		350 °C 662 °F · Sleeve 60 mm 2.362 in M6 ϕ2.8 ϕ0.110	300 11.811 270 10.630 150 5.906 140 5.512	100 3.937 35 1.378 47 1.850			Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	**FD-H35-M2S6**
		200 °C 392 °F · Coaxial M6				1 m 3.281 ft	R25 mm R0.984 in	**FD-H20-M1**
		350 °C 662 °F · Sleeve 90 mm 3.543 in M4 ϕ2.1 ϕ0.083	190 7.480 160 6.299 80 3.150 80 3.150	57 2.244 20 0.787 26 1.024			Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	**FD-H35-20S**
		200 °C 392 °F · Coaxial M4	300 11.811 270 10.630 150 5.906 140 5.512	100 3.937 35 1.378 47 1.850			R25 mm R0.984 in	**FD-H20-21**
		300 °C 572 °F · Glass substrate detection Convergent reflective type W19 X H27 X D5 W0.748 X H1.063 X D0.197	0 to 20 0 to 0.787 0 to 15 0 to 0.591 0 to 10 0 to 0.394 0 to 10 0 to 0.394	1 to 8 0.039 to 0.315 Cannot use 2 to 6 0.079 to 0.236		2 m 6.562 ft		**FD-H30-L32**
		180 °C 356 °F · Glass substrate detection Convergent reflective type W19 X H27 X D5 W0.748 X H1.063 X D0.197	0 to 20 0 to 0.787 0 to 15 0 to 0.591 0 to 10 0 to 0.394 0 to 10 0 to 0.394	1 to 8 0.039 to 0.315 Cannot use 2 to 6 0.079 to 0.236		✂ 2 m 6.562 ft		**FD-H18-L31**
		130 °C 266 °F M6	410 16.142 310 12.205 200 7.874 140 5.512	100 3.937 55 2.165 47 1.850				**FD-H13-FM2**
	Vacuum-resistant	300 °C 572 °F · Rectangular head W9.5 X H5.2 X D15 W0.374 X H0.205 X D0.591	20 to 300 0.787 to 11.811 20 to 200 0.787 to 7.874 20 to 150 0.787 to 5.906 25 to 130 0.984 to 5.118	30 to 100 1.181 to 3.937 Cannot use Cannot use	ϕ0.8 mm ϕ0.031 in gold wire	1 m 3.281 ft	R18 mm R0.709 in	**FD-H30-KZ1V-S** (Note 5)
		300 °C 572 °F · Glass substrate detection Convergent reflective type W19 X H5 X D27 W0.748 X H0.197 X D1.063	0 to 11 0 to 0.433 0 to 8 0 to 0.315 1.5 to 6 0.059 to 0.236 1.5 to 5 0.059 to 0.197	2 to 4 0.079 to 0.157 Cannot use Cannot use		3 m 9.843 ft		**FD-H30-L32V-S** (Note 5)

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)

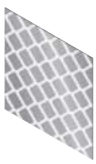
RF-003 (**FR-KZ21/KZ21E** exclusive mirror)
RF-13 (Reflective tape)
FX-CT1 (Fiber cutter)
FX-CT2 (Fiber cutter)
FX-AT2 (Attachment for fixed-length fiber, Orange)
FX-AT3 (Attachment for ϕ2.2 mm ϕ0.087 in fiber, Clear orange)
FX-AT4 (Attachment for ϕ1 mm ϕ0.039 in fiber, Black)
FX-AT5 (Attachment for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

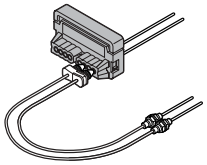
- **RF-003**

- **RF-13**

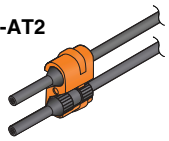


- **FX-CT1**

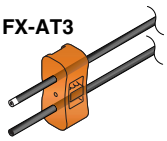
- **FX-CT2**



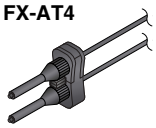
- **FX-AT2**



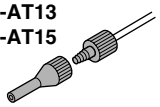
- **FX-AT3**



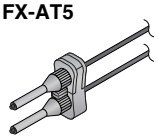
- **FX-AT4**



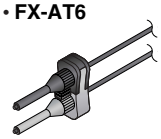
- **FX-AT10**
- **FX-AT13**
- **FX-AT15**



- **FX-AT5**



- **FX-AT6**



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 μs)(Typical model)

	Fiber model No.	Sensing range (mm in) (Note)
Thru-beam type	**FT-B8**	160 6.299
	FT-FM2	120 4.724
	FT-NFM2	40 1.575
	FT-E12	2 0.079
	FT-E22	10 0.394

	Fiber model No.	Sensing range (mm in) (Note)
Reflective type	**FD-B8**	60 2.362
	FD-FM2	35 1.378
	FD-NFM2	14 0.551
	FD-E12	1 0.039
	FD-E22	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**
FX-301B	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
FX-301G	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
FX-301H (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**
FX-301B	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
FX-301G	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
FX-301H (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.

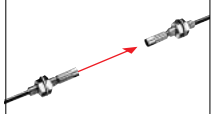
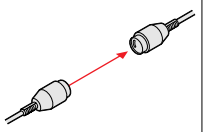
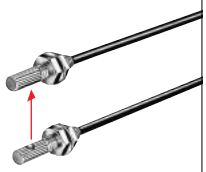
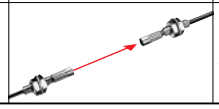
(mm in)

RF-230	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)
RF-220	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)
RF-210	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 (Note 1)	**FX-LE1**		Increases the sensing range by 5 times or more. • Ambient temperature: −60 to +350 °C −76 to +662 °F
	Super-expansion lens (Note 1)	**FX-LE2**		Tremendously increases the sensing range with large diameter lenses. • Ambient temperature: −60 to +350 °C −76 to +662 °F
	Side-view lens	**FX-SV1**		Beam axis is bent by 90 °. • Ambient temperature: −60 to +300 °C −76 to +572 °F
	Expansion lens for vacuum fiber (Note 1)	**FV-LE1**		Sensing range increases by 10 times or more. • Ambient temperature: −40 to +120 °C −40 to +248 °F

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 (Note 2)	3,500 (Note 2)	3,000	2,500	2,000	1,000	1,000
FT-FM2	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	2,500	1,300	1,000
FT-T80	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	2,500	1,300	1,000
FT-R80	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	2,300	1,600	800	750
FT-W8	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	2,900	2,000	1,000	900
FT-P80	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	2,500	1,100	1,000
FT-P60	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	1,500	900	800
FT-P81X	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,100	950
FT-H35-M2	3,500 (Note 2)	3,500 (Note 2)	2,500	2,000	1,500	750	700
FT-H20W-M1	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,300	900	500	400
FT-H20-M1	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	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 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)
FT-FM2	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)
FT-R80	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)
FT-W8	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)
FT-P80	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)
FT-P60	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)
FT-P81X	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)
FT-H35-M2	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)
FT-H20W-M1	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,500	1,600 (Note 2)
FT-H20-M1	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)
FT-H13-FM2	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)

Sensing range for red LED type (mm) [Lens on both sides] (Note 3)

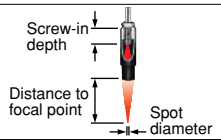
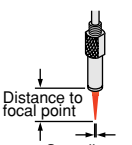
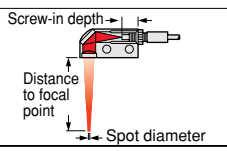
Fiber \ Mode	LONG	STD	FAST	S-D
FT-B8	1,100	530	400	186
FT-FM2	1,200	600	440	210
FT-T80	1,200	600	440	210
FT-W8	900	450	330	160
FT-P80	1,200	600	440	210
FT-P60	650	300	200	130
FT-P81X	1,200	600	440	200
FT-H35-M2	550	280	200	90
FT-H20W-M1	310	140	100	50
FT-H20-M1	550	280	200	90

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
For reflective type fiber	Pinpoint spot lens	**FX-MR1**		Pinpoint spot of ϕ0.5 mm ϕ0.020 in. Enables detection of minute objects or small marks. • Distance to focal point: 6±1 mm 0.236 ± 0.039 in • Applicable fibers: **FD-WG4**, **FD-G4** • Ambient temperature: −40 to +70 °C −40 to +158 °F
	Zoom lens	**FX-MR2**		The spot diameter is adjustable from ϕ0.7 mm to ϕ2 mm ϕ0.028 in to ϕ0.079 in according to how much the fiber is screwed in. • Applicable fibers: **FD-WG4**, **FD-G4** • Ambient temperature: −40 to +70 °C −40 to +158 °F • Accessory: **MS-EX-3** (mounting bracket)
	Finest spot lens	**FX-MR3**		Extremely fine spot of ϕ0.3 mm ϕ0.012 in approx. achieved. • Applicable fibers: **FD-WG4**, **FD-G4**, **FD-EG1**, **FD-EG2**, **FD-EG3**, **FD-G6X**, **FD-G6** • Ambient temperature: −40 to +70 °C −40 to +158 °F
	Finest spot lens	**FX-MR6**		Extremely fine spot of ϕ0.1 mm ϕ0.004 in approx. achieved. • Applicable fibers: **FD-WG4**, **FD-G4**, **FD-EG1**, **FD-EG2**, **FD-EG3**, **FD-G6X**, **FD-G6** • Ambient temperature: −20 to +60 °C −4 to +140 °F
	Zoom lens (Side-view type)	**FX-MR5**		**FX-MR2** is converted into a side-view type and can be mounted in a very small space. • Applicable fibers: **FD-WG4**, **FD-G4** • Ambient temperature: −40 to +70 °C −40 to +158 °F

Sensing range for red LED type (Note)

Screw-in depth	Distance to focal point	Spot diameter
7 mm	18.5 mm approx.	ϕ0.7 mm
12 mm	27 mm approx.	ϕ1.2 mm
14 mm	43 mm approx.	ϕ2.0 mm

Sensing range for red LED type (Note)

Fiber model No.	Distance to focal point	Spot diameter
FD-EG3	7.5±0.5 mm	ϕ0.15 mm approx.
FD-EG2	7.5±0.5 mm	ϕ0.2 mm approx.
FD-EG1	7.5±0.5 mm	ϕ0.3 mm approx.
FD-WG4/G4/G6X/G6	7.5±0.5 mm	ϕ0.5 mm approx.

Sensing range for red LED type (Note)

Fiber model No.	Distance to focal point	Spot diameter
FD-EG3	7±0.5 mm	ϕ0.1 mm approx.
FD-EG2	7±0.5 mm	ϕ0.15 mm approx.
FD-EG1	7±0.5 mm	ϕ0.2 mm approx.
FD-WG4/G4/G6X/G6	7±0.5 mm	ϕ0.4 mm approx.

Sensing range for red LED type (Note)

Screw-in depth	Distance to focal point	Spot diameter
8 mm	13 mm approx.	ϕ0.5 mm
10 mm	15 mm approx.	ϕ0.8 mm
14 mm	30 mm approx.	ϕ3.0 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

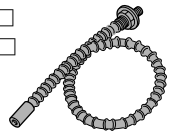
Others

Designation	Model No.	Description			
Protective tube (For thru-beam) type fiber	**FTP-500** (0.5 m 1.640 ft)	For M4 thread	Applicable fibers	**FT-B8 FT-P80 FT-FM2 FT-P60 FT-FM2S FT-FM2S4 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 M3 thread		**FT-T80 FT-P40 FT-NFM2 FD-T40 FT-NFM2S FD-P40 FT-NFM2S4**	
	FTP-N1000 (1 m 3.281 ft)				
	FTP-N1500 (1.5 m 4.921 ft)				
Protective tube (For reflective) type fiber	**FDP-500** (0.5 m 1.640 ft)	For M6 thread		**FD-B8 FD-P80 FD-FM2 FT-H13-FM2 FD-FM2S 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 M4 thread		**FD-T80 FD-NFM2 FD-NFM2S 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 (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. Accessory. **FX-CT1** is attached with the **FT-P80** or the **FD-P80**. 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 ϕ2.2 mm ϕ0.087 in fiber	**FX-AT3**	This is the attachment for the ϕ2.2 mm ϕ0.087 in fiber. (Accessory. Does not attach with the **FT-P80** or the **FD-P80**.)			
Attachment for ϕ1 mm ϕ0.039 in fiber	**FX-AT4**	This is the attachment for the ϕ1 mm ϕ0.039 in fiber. (Accessory)			
Attachment for ϕ1.3 mm ϕ0.051 in fiber	**FX-AT5**	This is the attachment for the ϕ1.3 mm ϕ0.051 in fiber. (Accessory)			
Attachment for ϕ1 mm ϕ0.039 in / ϕ1.3 mm ϕ0.051 in mixed fiber	**FX-AT6**	This is the attachment for the ϕ1 mm ϕ0.039 in / ϕ1.3 mm ϕ0.051 in mixed fiber. (Accessory)			

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

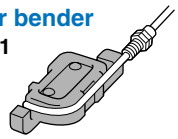
Protective tube

- **FTP-□**
- **FDP-□**



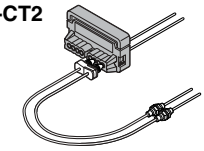
Fiber bender

- **FB-1**

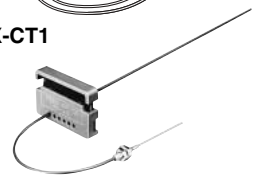


Fiber cutter

- **FX-CT2**



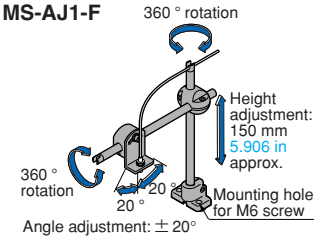
- **FX-CT1**



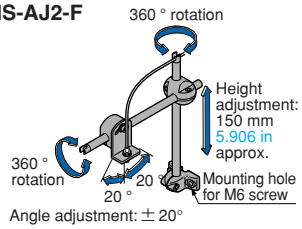
Universal sensor mounting stand

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

- **MS-AJ1-F**



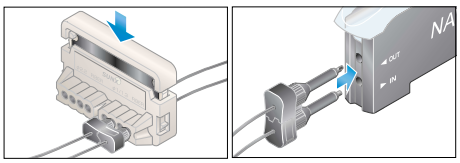
- **MS-AJ2-F**



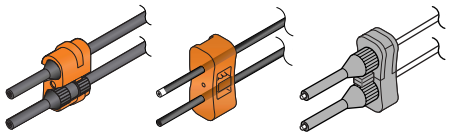
Fiber attachment

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

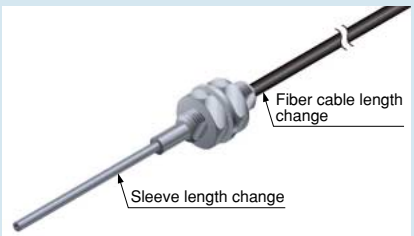
Each fiber (with some exceptions) has a newly developed two-in-one fiber attachment (**FX-AT3/AT4/AT5/AT6**) which enables two fibers to be cut simultaneously to the same length with the new fiber cutter (**FX-CT2**). Also, since the fibers can be attached to the amplifier while being fixed in position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



FX-AT2 **FX-AT3** **FX-AT4/AT5/AT6**



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.

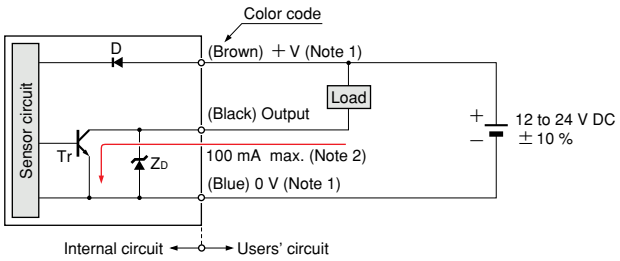
Item \ Type		Standard type				High-speed type	High-function type
		Red LED	Blue LED	Green LED	Infrared LED		
Model No.	NPN output	**FX-301**	**FX-301B**	**FX-301G**	**FX-301H**	**FX-301-HS**	**FX-305**
	PNP output	**FX-301P**	**FX-301BP**	**FX-301GP**	**FX-301HP**	**FX-301P-HS**	**FX-305P**
Supply voltage		12 to 24 V DC ± 10 % Ripple P-P 10 % or less					
Power consumption		<Red LED / Infrared LED type> Normal operation: 960 mW or less (Current consumption 40 mA or less at 24 V supply voltage) ECO mode: 600 mW or less (Current consumption 25 mA or less at 24 V supply voltage)				<Blue LED / Green LED type> Normal operation: 720 mW or less (Current consumption 30 mA or less at 24 V supply voltage) ECO mode: 430 mW or less (Current consumption 18 mA or less at 24 V supply voltage)	
Output		<NPN output type> NPN open-collector transistor • Maximum sink current:100 mA (50 mA, if five, or more, amplifiers are connected in cascade.) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less [at 100 mA (at 50 mA, if five, or more, amplifiers are connected in cascade) sink current.] <PNP output type> PNP open-collector transistor • Maximum source current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade.) • Applied voltage: 30 V DC or less (between output and + V) • Residual voltage: 1.5 V or less [at 100 mA (at 50 mA, if five, or more, amplifiers are connected in cascade) source current.]					<NPN output type> NPN open-collector transistor 2 outputs • Maximum sink current: 50 mA each (Note 1) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less [at 50 mA (Note 1)] <PNP output type> PNP open-collector transistor 2 outputs • Maximum source current: 50 mA each (Note 1) • Applied voltage: 30 V DC or less (between output and + V) • 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 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. [Timer period: Red LED type; 0.5 ms approx., 1 ms to 9999 ms (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. (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) FAST, STD, LONG: 4 level, H-SP: 3 level, S-D: 2 level				Incorporated (Note 2) FAST, STD, LONG: 4 level H-SP, S-D: 2 level	Incorporated (Note 2) FAST, STD, STDF, LONG, U-LG: 4 level 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^2 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^2, 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 'ｲﾝﾀｰ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

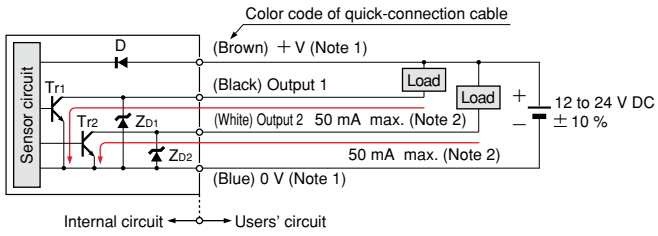
FX-301(-HS) NPN output type



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_D: Surge absorption zener diode
Tr : NPN output transistor

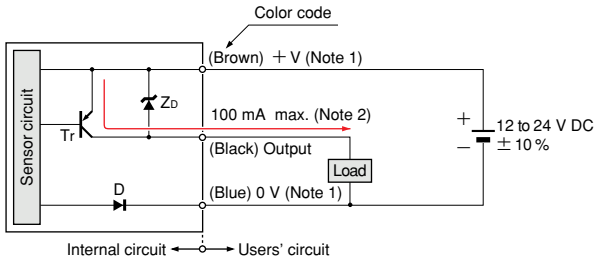
FX-305 NPN output type



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
Z_{D1}, Z_{D2}: Surge absorption zener diode
Tr_1, Tr_2 : NPN output transistor

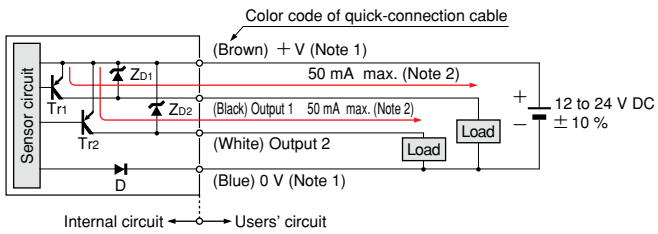
FX-301P(-HS) PNP output type



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_D: Surge absorption zener diode
Tr : PNP 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.

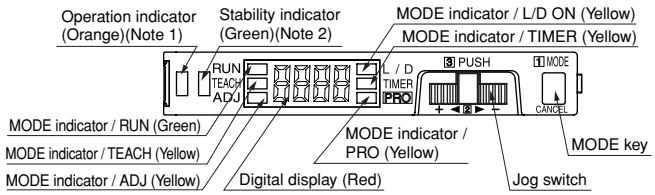
Symbols … D: Reverse supply polarity protection diode
Z_{D1}, Z_{D2}: Surge absorption zener diode
Tr_1, Tr_2 : PNP output transistor

PRECAUTIONS FOR PROPER USE

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

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.

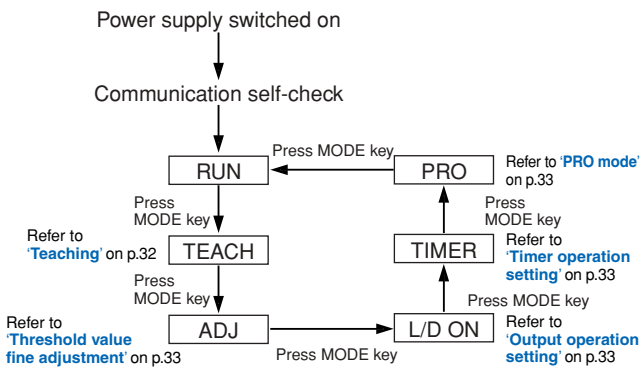
Part description



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

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

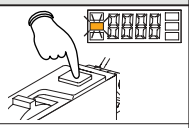
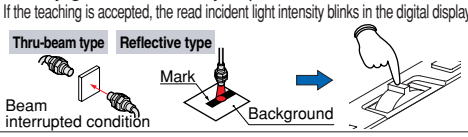
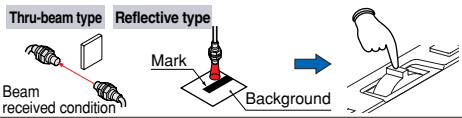
Refer to the 'Sensor general catalog 2003-2004' for fiber precautions.

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

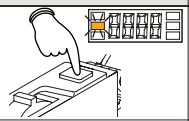
• This is the method of setting the threshold value by teaching two levels, corresponding to the object present and object absent conditions. Normally, setting is done by this method.

Step	Description	Display
①	Set the fiber within the sensing range. Press the MODE key to light up MODE indicator / TEACH (yellow). 	1234
②	For the **FX-305**(**P**), select '8uto1' or '8uto2' beforehand. Press jog switch in the object present condition. If the teaching is accepted, the read incident light intensity blinks in the digital display. Thru-beam type Reflective type 	561
③	MODE indicator / TEACH (yellow) blinks. Press the jog switch in the object absent condition. Thru-beam type Reflective type 	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. • In case stable sensing is possible: '8ood' is displayed. • In case stable sensing is not possible: 'unst' blinks.	8ood unst
⑤	The threshold value is displayed.	500
⑥	'- - - -' blinks in the digital display. (**FX-301B/G/H** 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

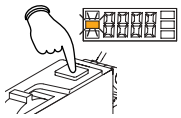
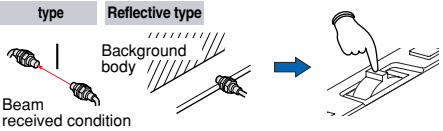
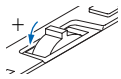
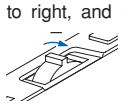
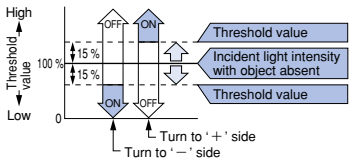
• Full-auto teaching is used when it is desired to set the threshold value without stopping the assembly line, with the object in the moving condition.

Step	Description	Display
①	Set the fiber within the sensing range. Press MODE key to light up MODE indicator / TEACH (yellow). 	1234
②	For the **FX-305**(**P**), select '8uto1' or '8uto2' beforehand. 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	'8uto' is displayed on the digital display. Release the jog switch when the object has passed.	8uto
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. • In case stable sensing is possible: '8ood' is displayed. • In case stable sensing is not possible: 'unst' blinks.	8ood unst
⑤	The threshold value is displayed.	500
⑥	'- - - -' blinks in the digital display. (**FX-301B/G/H** 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.

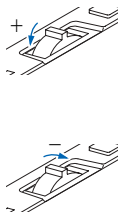
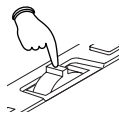
Step	Description	Display
①	Set the fiber within the sensing range. Press the MODE key to light up MODE indicator / TEACH (yellow). 	1234
②	For the **FX-305**(**P**), select '8uto1' or '8uto2' beforehand. Press the jog switch in the object absent condition. If the teaching is accepted, the read incident light intensity blinks in the digital display. type Reflective type 	1234
③	MODE indicator / TEACH (yellow) blinks. 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) This is used in case of reflective type fibers.  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) 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. • In case shifting is possible: '8ood' blinks. • In case shifting is not possible: 'unst' blinks.	8ood unst
⑥	The threshold value is displayed.	500
⑦	'- - - -' blinks in the digital display. (**FX-301B/G/H** 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.

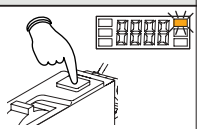
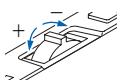
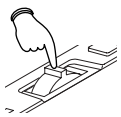
Please refer to the 'Sensor general catalog 2003-2004' or website (http://www.sunx.jp) for setting of threshold value when used in combination with contact type liquid level detection fiber **FD-F8Y,** and for setting of threshold value when used in combination with pipe-mountable liquid level detection 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).	
②	For the **FX-305**(**P**), select 'Out1' or 'Out2' beforehand. 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. 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. 	1234 → 1235 or 1234 → 1233
③	When the jog switch is pressed, the threshold value is confirmed. 	

Output operation setting

Step	Description	Display
①	Press the MODE key to light up MODE indicator / L/D ON (yellow). 	L-on Displays present setting
②	For the **FX-305**(**P**), select 'Out1' or 'Out2' beforehand. If the jog switch is turn to the '+' or '−' direction, the output operation setting will change. 	L-on ↓ Light state ↑ d-on Dark state
③	When the jog switch is pressed, the threshold value is confirmed. 	d-on 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' ② Timer setting function 'dELY' ③ Hysteresis function 'HYS' ④ Stability function 'Stb' ⑤ Shift function 'SHFt' ⑥ Emitting power selection function 'PoWr' (Note 1)
PRO2	Pro2	① Digital display setting function 'diSP' ② Digital display inversion function 'turn' ③ ECO mode setting function 'Eco'
PRO3	Pro3	① Data bank load setting function 'chLd' ② Data bank save setting function 'chSA'
PRO4	Pro4	① Setting condition copy function 'CoPY' ② Remote data bank load setting function 'chLd' ③ Remote data bank save setting function 'chSA' ④ Communication condition confirmation function 'CESt' (Note 2) ⑤ Communication lock function 'C-Lc' ⑥ Back-up function 'b-uP' (Note 3)
PRO5	Pro5	① Code setting function 'CodE' ② Adjust lock setting function 'A.Lc' ③ Setting reset function 'rSEt' 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^2, 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.

PRECAUTIONS FOR PROPER USE

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

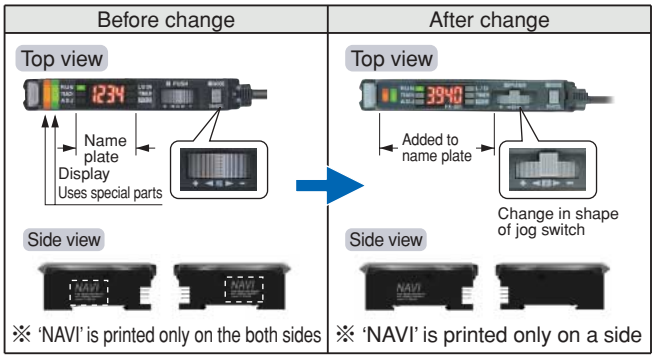
Function table for FX-300 series

	Previous models			New models		
	FX-301(P) (Previous version unit)	**FX-302(P)**	**FX-303(P)**	**FX-301(P)** (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 μs	300 μs	90 μs	65 μs	35 μs	65 μs
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	×	○	×	×	×	○
Peripheral units that can be combined						
FX-CH(-P)	○	○	×	×	×	×
FX-CH2(-P)	×	×	×	○	×	○
SC-GU1-485	×	×	×	○	×	○

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

A difference between the updated version unit and the previous version unit for FX-301 (Red LED type)

Changes in appearance

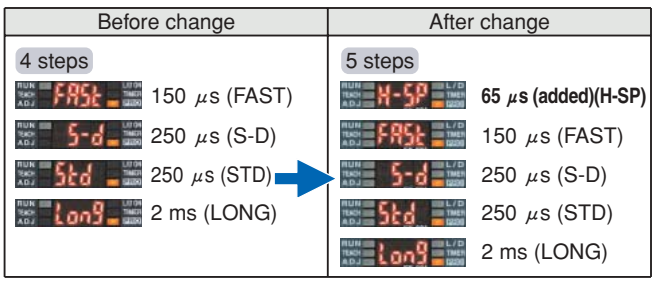


Checking minor changes between previous and new models can be done by checking whether the printing is on both sides or only one side.

Upgraded functions

1. Response times added

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'.



2. Extension of timer period

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

3. Light emitting amount selection function

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

4. Backup, copy lock and key lock functions added

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.

Changes in operation

1. Timer selection method

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.

2. Checking threshold value in RUN mode

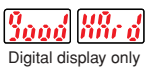
The threshold values can be checked by turning the jog switch.

Display changes

1. Checking blinking of sensitivity surplus

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

2. Initial direct code value changed

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.

Internal circuit changes

1. Addition of an APC circuit

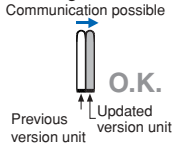
A four-chemical emitting element which provides stable sensing over long periods has been added, as well as an APC (Auto Power Control) circuit that improves stability during short periods.

Points to note when combining sensor types

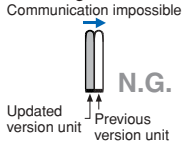
When using the newer sensors together with previous version units (including the **FX-301B/G/H**), note the following.

- 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.

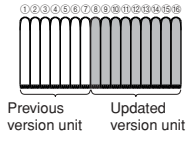
<Figure A>



<Figure B>



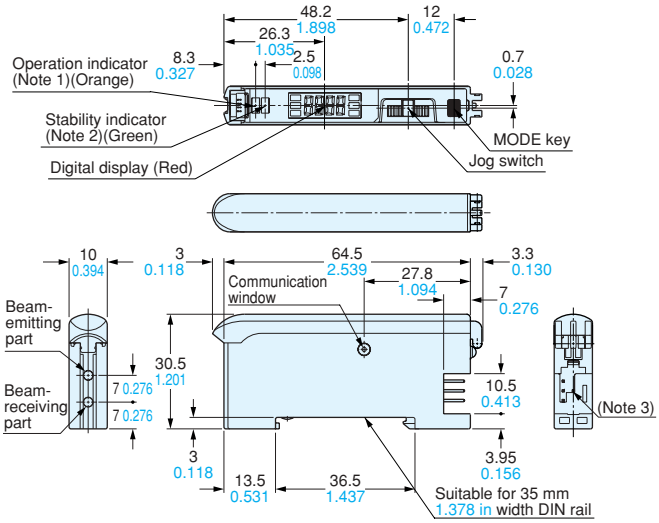
<Figure C>



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

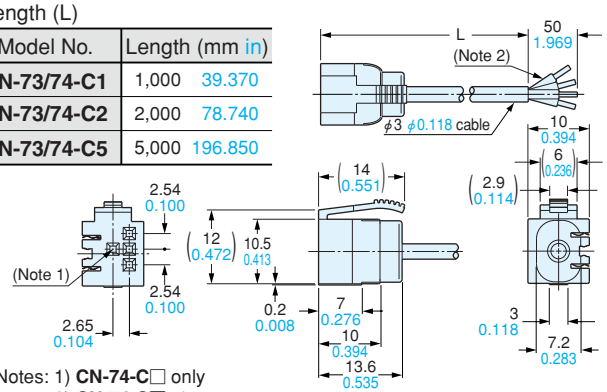


Notes: 1) **FX-305**□; Output 1 operation indicator (Orange)
2) **FX-305**□; Output 2 operation indicator (Orange)
3) **FX-301**□; 3-pin, **FX-305**□; 4-pin

CN-73-C□ CN-74-C□ Main cable (Optional)

• Length (L)

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

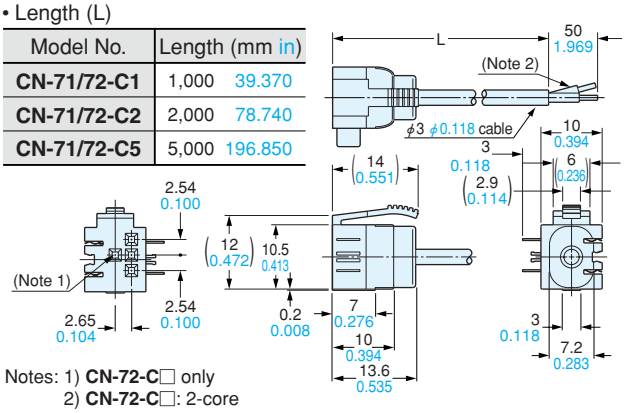


Notes: 1) **CN-74-C**□ only
2) **CN-74-C**□: 4-core

CN-71-C□ CN-72-C□ Sub cable (Optional)

• Length (L)

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

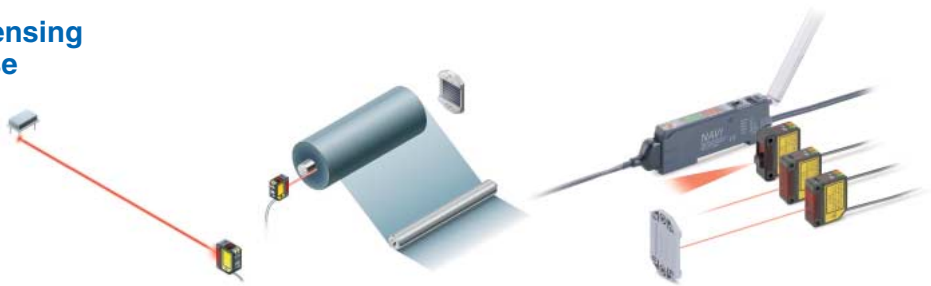


Notes: 1) **CN-72-C**□ only
2) **CN-72-C**□: 2-core

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.



<IC pin check> **<Sensing remaining sheet roll amounts>**

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

CE Conforming to EMC Directive

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

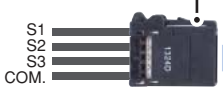
Switching between 3 channels of data banks and loading and saving of all channels at once can be carried out.

Product lineup

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

• Input signal

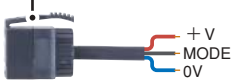
The types of input operations are determined by S1 and S2, and the input timing is determined by S3.



※ **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'.

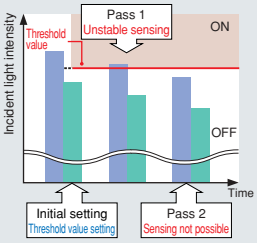
Explanation of limit teaching

● Limit teaching '－'

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

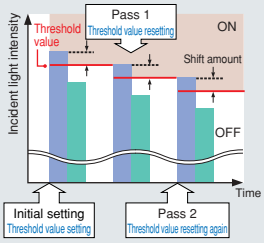
When limit teaching is not used

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.



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 not present

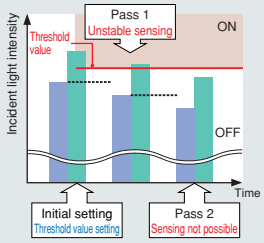
Incident light intensity when sensing object is present

● 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.

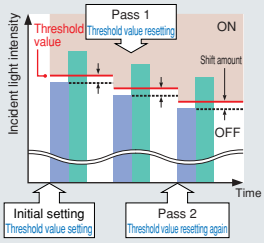
When limit teaching is not used

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

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.



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

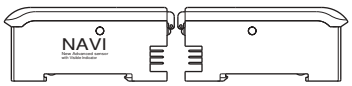
ORDER GUIDE

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

SPECIFICATIONS

Item \ Type / Model No.	NPN input type **FX-CH2**	PNP input type **FX-CH2-P**
Applicable sensor	**FX-301**(**P**)(Note 1), **FX-305**(**P**)	
Supply voltage	12 to 24 V DC ± 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 Source current 0.5 mA Input impedance 10 kΩ approx. High: + 5 V to + V DC, or open	Low: + 4 V to + V DC Sink current 0.5 to 3 mA Input impedance 10 kΩ approx. 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 + 14 to + 131 °F (if 4 to 7 sensors are connected in cascade: − 10 to + 50 °C + 14 to + 122 °F, if 8 to 16 sensors 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	
Material	Enclosure: Heat-resistant ABS	
Cable extension	Extension up to total 10 m 32.808 ft is possible with 0.3 mm², or more, cable.	
Weight	Net weight: 20 g approx., Gross weight: 40 g approx.	
Accessory	**CN-EP1** (Connector for input device)(Note 2): 1 pc.	

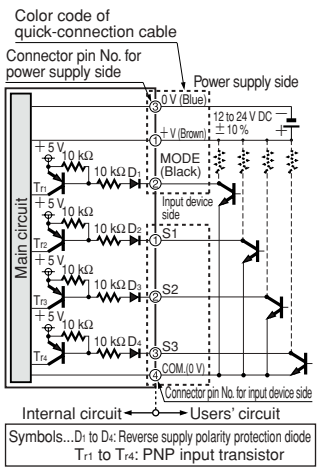
Notes: 1) Only updated version of **FX-301**(**P**) can be used. Do not use the previous version of **FX-301**(**P**).
The updated version of **FX-301**(**P**) have 'NAVI' printed on one side. (See the right figure.)



2) The applicable wire is 0.08 mm² (AWG 28) to 0.5 mm² (AWG 20) and the wire sheath diameter should be ϕ1.5 mm ϕ0.059 in or less.

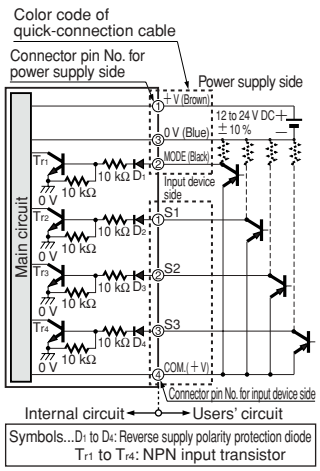
I/O CIRCUIT DIAGRAMS

FX-CH2



Symbols...D_1 to D_4: Reverse supply polarity protection diode
Tr_1 to Tr_4: PNP input transistor

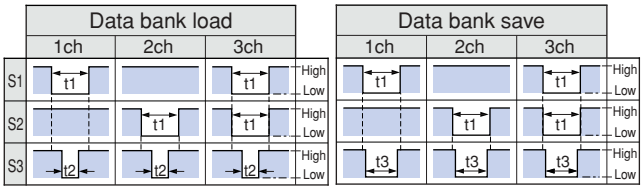
FX-CH2-P



Symbols...D_1 to D_4: Reverse supply polarity protection diode
Tr_1 to Tr_4: NPN input transistor

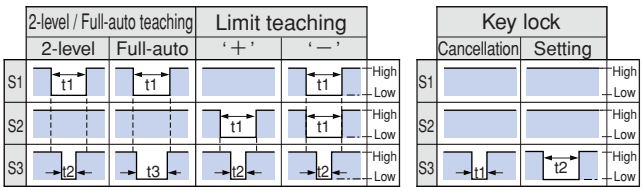
OPERATION TIMING CHART

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



t1 : t1 > t2, t1 > t3 t2 : 20 ms to less than 2 sec. t3 : 2 sec. or more

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



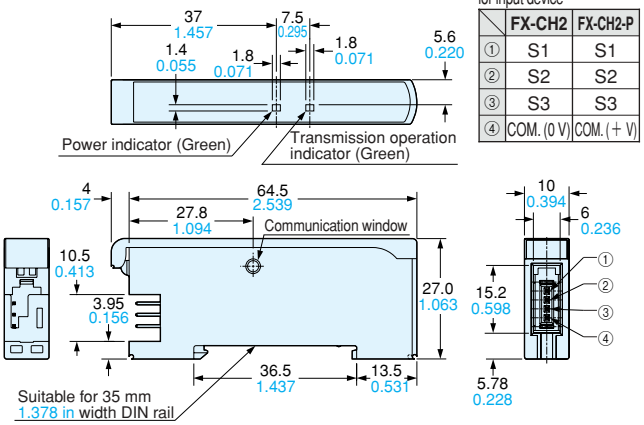
t1 : t1 > t2, t1 > t3
t2 : 20 ms to less than 2 sec. (This is the timing period for 1 level. 2 levels are required.)
t3 : 0.5 sec. or more (Sampling starts after 0.5 sec.)

t1 : 20 ms to less than 2 sec.
t2 : 2 sec. or more

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)

FX-CH2 FX-CH2-P External input unit



Connection of the connector for input device

	FX-CH2	FX-CH2-P
①	S1	S1
②	S2	S2
③	S3	S3
④	COM. (0 V)	COM. (+ V)

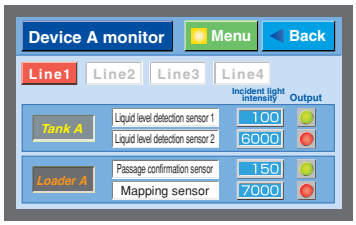
Upper Communication Unit for Digital Sensors / SC-GU1-485

CE Conforming to EMC Directive

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>

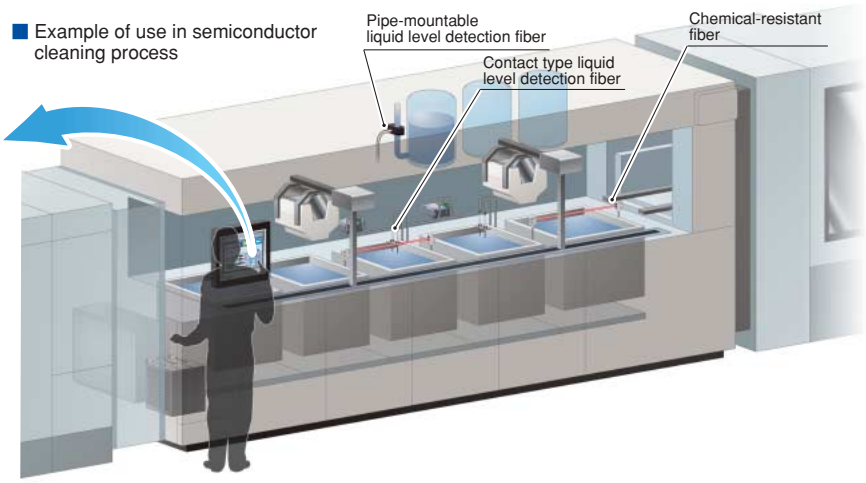


[Communicable commands]
- Sensor incident light intensity
- Sensor settings verification
- Sensor output status
- Threshold value settings, etc.

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

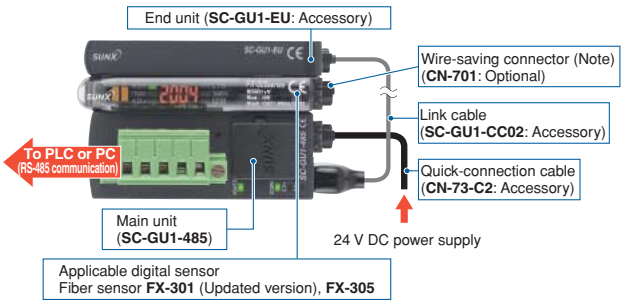
Ideal for workplaces such as semiconductor and LCD manufacturing lines where there are restrictions on operators entering and exiting

■ 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.



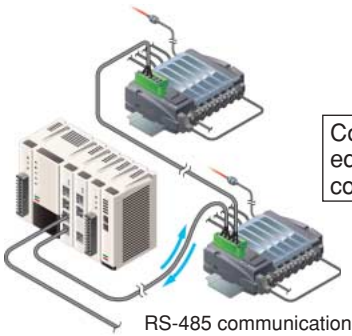
Note: Used when the output signal is sent via a **SC-GU1-485** to the PLC. If the output signal is sent directly to the PLC, a quick-connection cable (**CN-72-C**□, **CN-71-C**□) should be used.

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

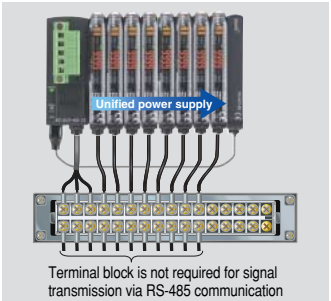
RS-485 communication provides a high level of general compatibility so that any type of PLC can be used. Integration with existing systems is possible without the need to change PLCs.



Compatible with all PLCs equipped with RS-485 compatible units

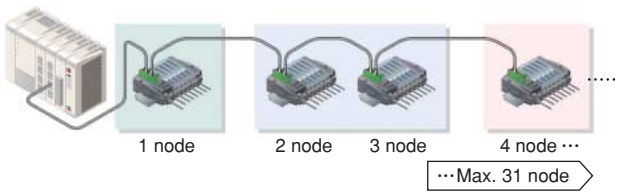
Less wiring and installation work

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.



Series connection of a maximum of 31 nodes is possible

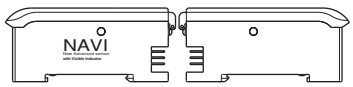
A maximum of 31 nodes can be connected in series. This is ideal for flexible handling when the sensors are to be installed in scattered locations or if more sensors are added.



SPECIFICATIONS

Item \ Type	Main unit
Model No.	**SC-GU1-485**
Applicable sensor	**FX-301**(**P**)(Note), **FX-305**(**P**)
Connectable units	Max. 16 units of sensor per **SC-GU1-485**
Connectable nodes	Max. 31 nodes
Supply voltage	24 V DC ± 10 % Ripple P-P10 % or less
Current consumption	45 mA or less (10 mA or less for **SC-GU1-EU**)
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 328.084 ft or less [**SC-GU1-485** (termination) to PLC], Power supply cable: Less than 10 m 32.808 ft
Ambient temperature	−10 to +55 °C +14 to +131 °F (If 4 to 7 sensors are connected in cascade: −10 to +50 °C +14 to +122 °F, if 8 to 16 sensors 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
Material	Enclosure: Heat-resistant ABS
Weight	35 g approx. (10 g approx. for **SC-GU1-EU**)
Accessories	**SC-GU1-EU** (End unit): 1 pc. **CN-73-C2** [Quick-connection cable (cable length 2 m 6.562 ft)]: 1 pc. **SC-GU1-CC02** [Link cable (cable length 0.2 m 0.656 ft)]: 1 pc.

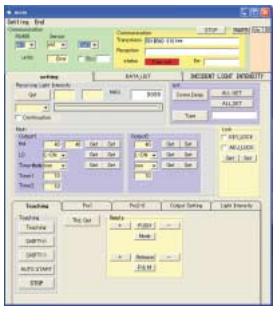
Note: Applicable units are for the **FX-301**(**P**) after version update. Do not use the previous version of **FX-301**(**P**).
The updated version of **FX-301**(**P**) has the 'NAVI' printed only on single side. (See the right figure.)



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.

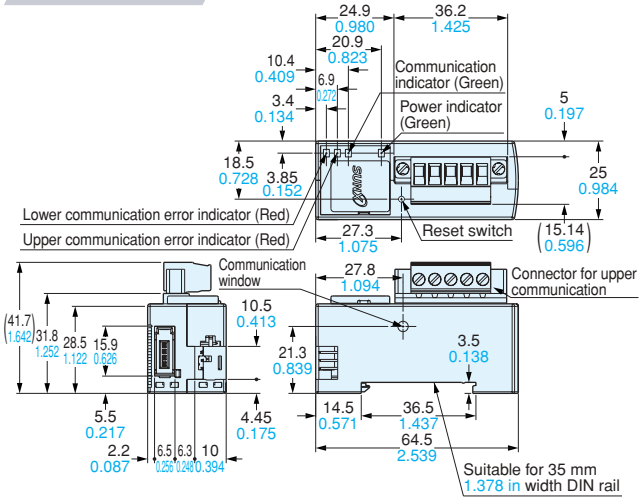
2) When connecting the **SC-GU1-485** to a personal computer, you will need obtain a interface converter (RS-232C ⇔ RS-485 converter) and cable to connect between the computer and the interface converter.

OPTION

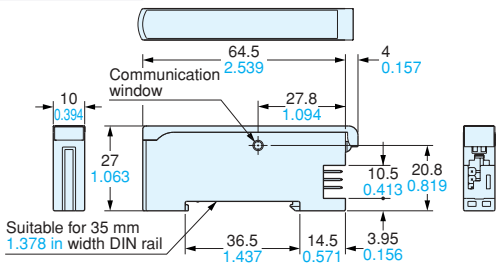
CN-701 (Wire-saving connector)
Note: Used when the output signal is sent via a **SC-GU1-485** to the PLC.

DIMENSIONS (Unit: mm in)

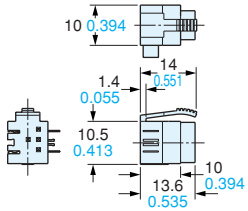
SC-GU1-485 Main unit



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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