Panasonic
INDUSTRY

DIGITAL FIBER SENSOR

FX-500 SERIES Ver.2
FX-550 SERIES
FX-550L SERIES

IO-Link Compatible,
Self-Monitoring Type

CE | cULus Listing (Excluding FX-551□) | Certified (Excluding FX-551□)

At the industry's leading edge

FX-SERIES HIGH END MODEL

FX-501 / FX-502

Direct connection to open network communication units

CC-Link IE Field SC-GU3-04	CC-Link SC-GU3-01 / SC-GU2-C
DeviceNet SC-GU3-02	EtherCAT SC-GU3-03

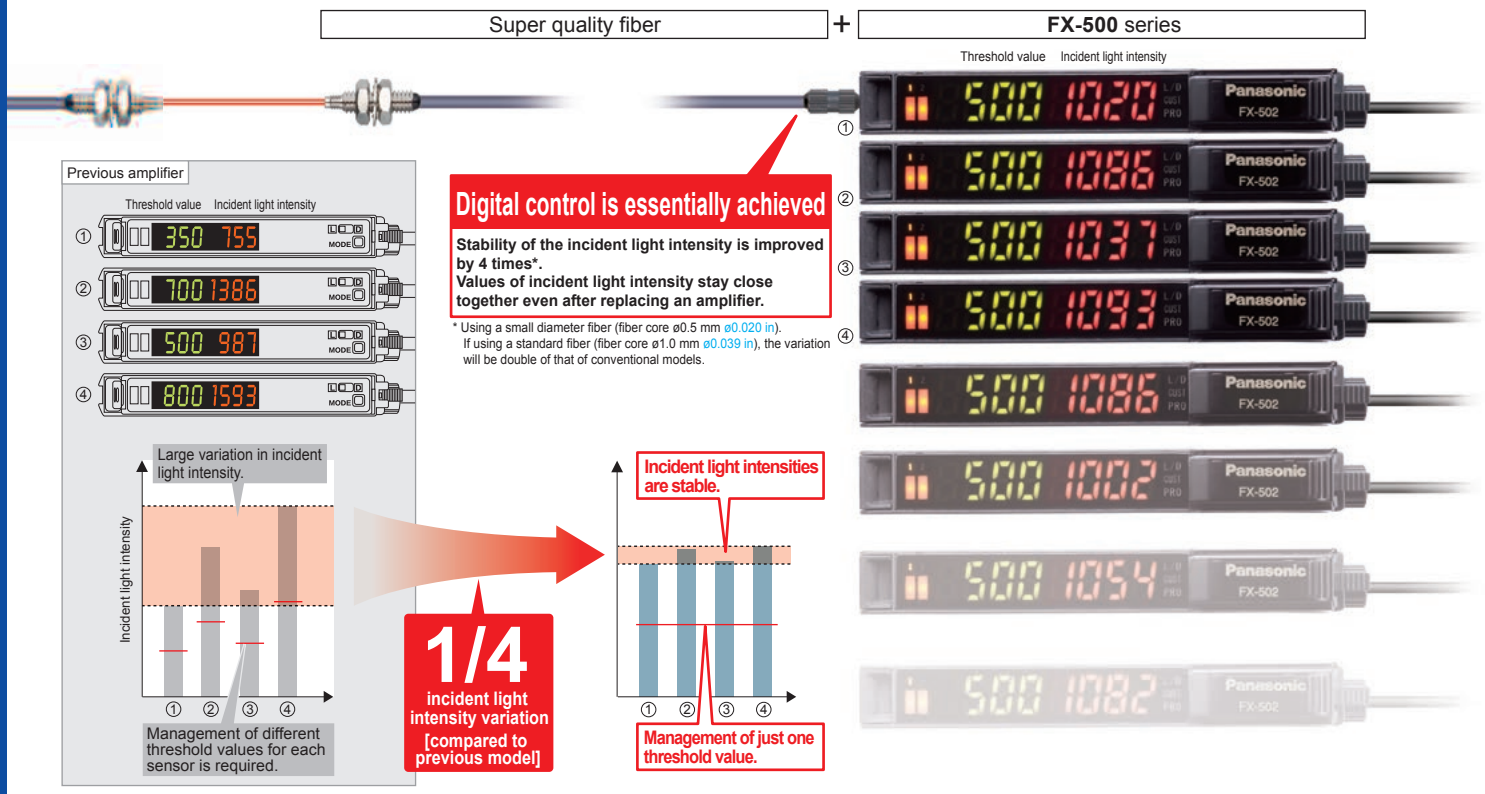
2021.06 | industrial.panasonic.com/ac/e

Stability

Industry leading stability

High stability!

We aim for absolute digitalization, focusing on the variation among fiber sensors.
When the **FX-500** series is used together with our super quality fiber, the incident light intensity variation among units is decreased to only 1/4 of that of conventional models.
Changes in detection that could not be found in the past can now be monitored.



Just one threshold value for all sensors

If multiple fiber sensors are installed in the same operating conditions, the incident light intensities are nearly identical. With the new sensor version, one exact threshold value can be managed across all sensors.

Easy maintenance with stable fiber sensors

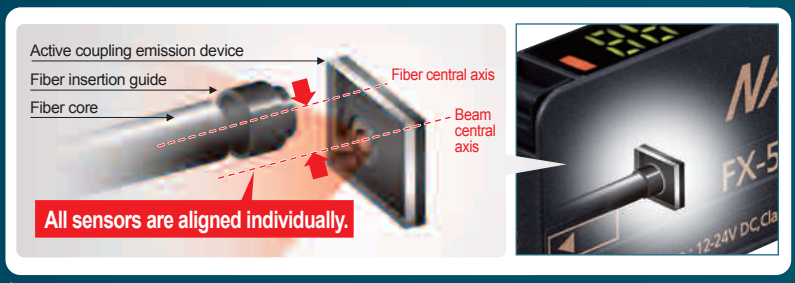
Because the incident light intensity is stable, the same threshold value can be used even when an amplifier is replaced. Also, the optical communication makes copying easier.

Confidence in beam adjustment

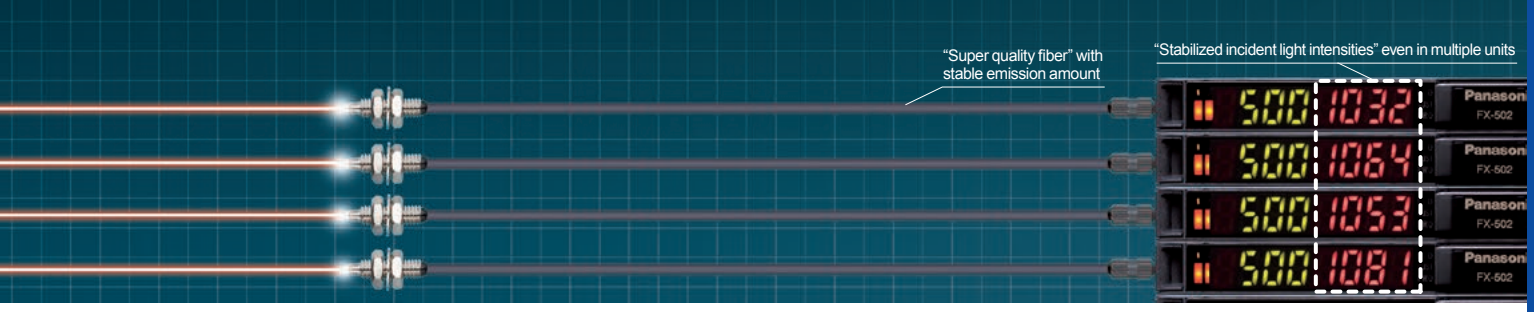
Stabilizing incident light intensity helps to raise installation precision and to make beam alignment fast and trouble-free.

Improved fiber coupling efficiency and suppressed variation among units

In each unit we have accurately aligned the central axis of the fiber with the central axis of the emitted light, which creates a high coupling efficiency that helps to reduce variation among units.

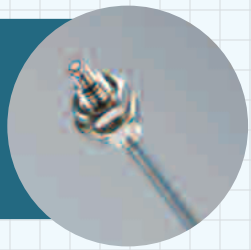


* Image



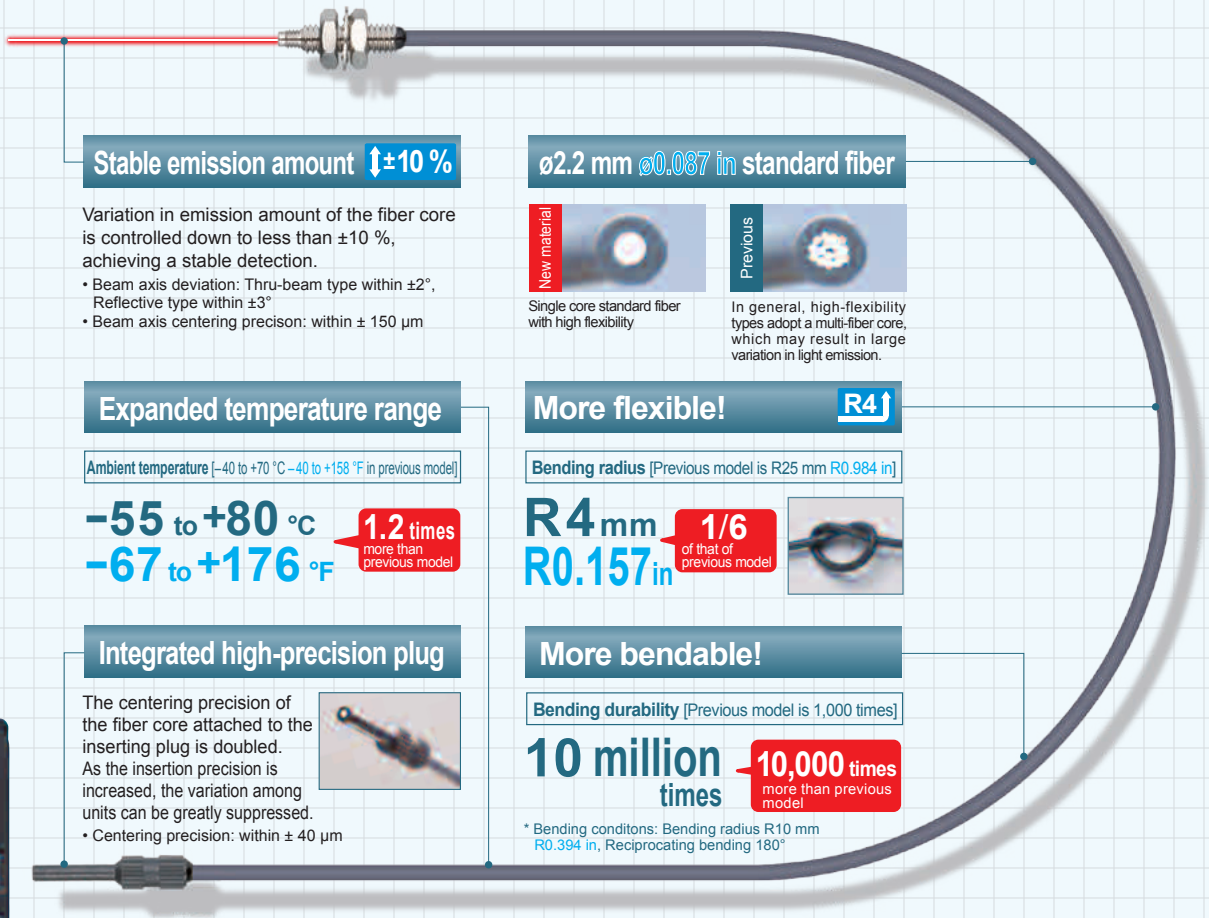
A quality that surpassed that of standard fibers

Introducing the super quality fiber



New fibers developed using a new manufacturing method adopted by our own factory along with a persistent quality control system

The basic performance of a standard fiber is greatly enhanced!



Stable emission amount ↕±10 %

Variation in emission amount of the fiber core is controlled down to less than ±10 %, achieving a stable detection.

- Beam axis deviation: Thru-beam type within ±2°, Reflective type within ±3°
- Beam axis centering precison: within ± 150 µm

ø2.2 mm ø0.087 in standard fiber

Single core standard fiber with high flexibility

In general, high-flexibility types adopt a multi-fiber core, which may result in large variation in light emission.

Expanded temperature range

Ambient temperature [–40 to +70 °C –40 to +158 °F in previous model]

–55 to +80 °C
–67 to +176 °F

1.2 times more than previous model

More flexible! R4↑

Bending radius [Previous model is R25 mm R0.984 in]

R4 mm
R0.157 in

1/6 of that of previous model

Integrated high-precision plug

The centering precision of the fiber core attached to the inserting plug is doubled. As the insertion precision is increased, the variation among units can be greatly suppressed.

- Centering precision: within ± 40 µm

More bendable!

Bending durability [Previous model is 1,000 times]

10 million times

10,000 times more than previous model

* Bending conditons: Bending radius R10 mm R0.394 in, Reciprocating bending 180°

↕±10 %

Variation in emission intensity is down to less than ±10 %

Under our new manufacturing method and quality control system, we have developed fiber heads that have a stabilized light emission. When used with the **FX-500** amplifier, a complete digital control is essentially achieved.

Super quality fiber reduces individual variation in optical transmission loss to less than ±10 %

Point ❶

The beam axis deviation of each unit is kept within ±2 ° (thru-beam type) or ±3°(reflective type) and the beam axis centering precision is kept within ±150 µm ±5.906 mil.

Point ❷

High precision polishing is accomplished by using the PCTM polishing technique. The specularity of the end face of the fiber is 5 times greater.

Point ❸

A high-precision integrated plug is achieved with the centering precision of the fiber core being ±40 µm 1.575 mil.

Approx. 2 times more than previous

The length of super quality fibers can be customized. Contact the sales office.

Speed & Distance

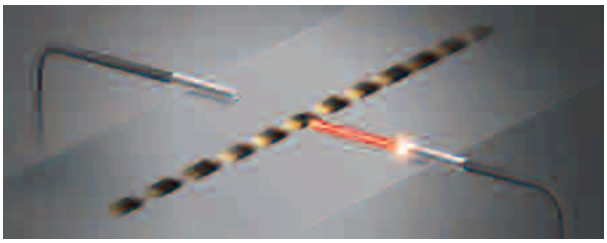
Industry leading sensing performance

High-speed response & Ultra long range detection

The exclusive detection IC combined with the high-intensity beam emitted from the active coupling emission device provides the capability of offering high-speed response time over a longer sensing range, opening up new possibilities for fiber sensor detection.

Max. 25 µs response time

FX-500 with its high response time contributes to improve productivity.



Performing minute object detection when using a small diameter fiber is now possible with a high response time and longer sensing range.

Hyper HYPR mode incorporated

FX-500 in combination with small diameter fibers which can handle challenging detections, allows long sensing range.

Max. **5.7** times! longer than the previous model

Note: When using **FD-NFM2**.

Detecting minute objects

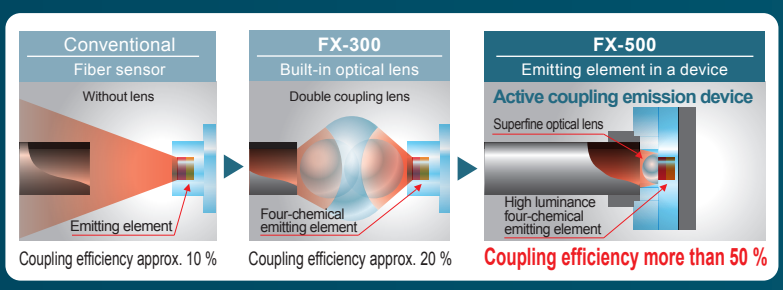
Small diameter fibers can perform detection in long range and with stability even for minute objects.

High-speed mode

A high speed response time of 25 µs, which is 2.6 times faster than the previous model, as well as a long sensing range are both achieved in high-speed mode.

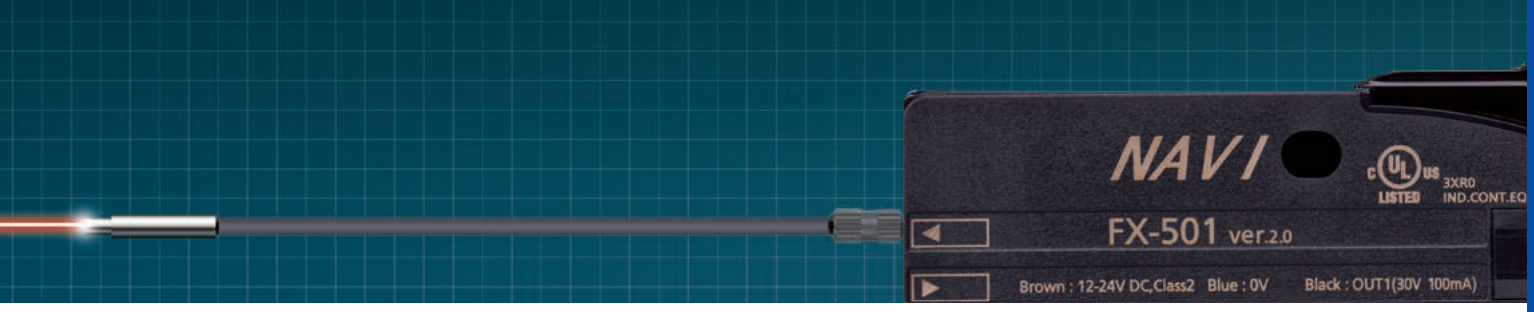
The active coupling emission device efficiently focuses the beam through small diameter fibers

The super fine optical lens and emitting element are combined into one device enabling the beam emitted from the emitting element to be focused directly into the fiber.
Coupling efficiency is therefore increased by 50 % compared to standard fiber (core ø1 mm ø0.039 in). In particular, the small diameter fibers (core ø0.5 mm ø0.020 in) see a dramatic increase in light intensity, making challenging detections possible.



Coupling efficiency = (light intensity directed into the fiber / emission intensity of active coupling emission device) × 100

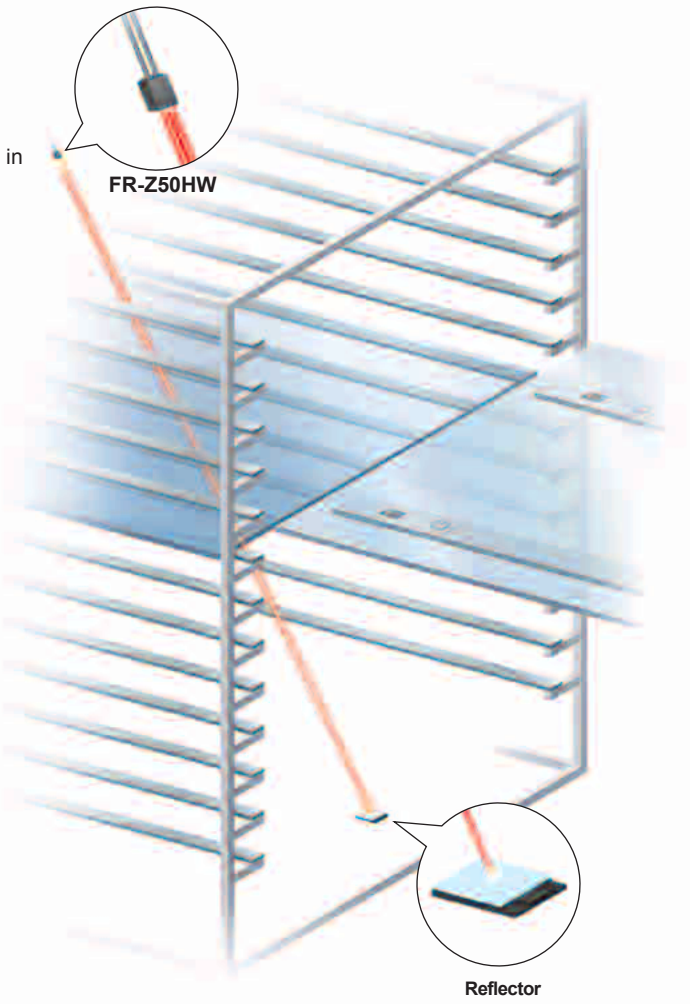
* Image



Sharp detection with suppressed hysteresis

So accurate!

The **FX-500** with its accurate detection catches fractional differences in light intensity, achieving high precision and solving low-hysteresis applications.

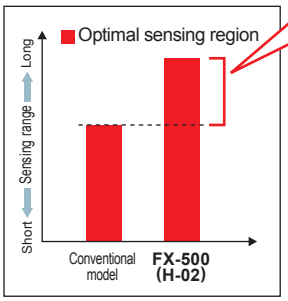


H-02 mode

Long range detection of small objects with small difference in light intensity

The **FX-500** series achieves a long sensing range by its high intensity beam in addition to suppressed hysteresis. Detection of minute objects over a long range is now more accurate than before.

■Comparison image

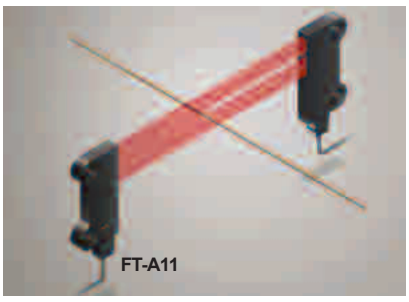


The light intensity difference caused by one sheet of glass can be detected from a more distant point.

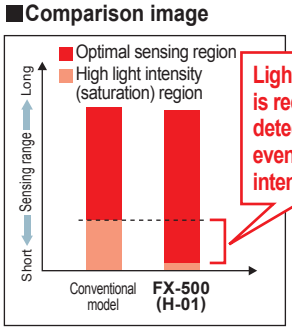
H-01 mode

Highly accurate detection while avoiding saturation

Even the light is so strong that it causes saturation, the **FX-500** series cuts down hysteresis to the utmost limit in order to produce the optimal margin for detection.



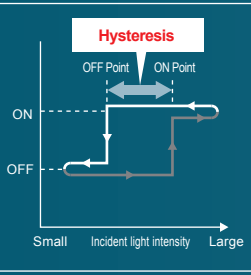
■Comparison image



Light saturated region is reduced, and detection is possible even under high light intensity.

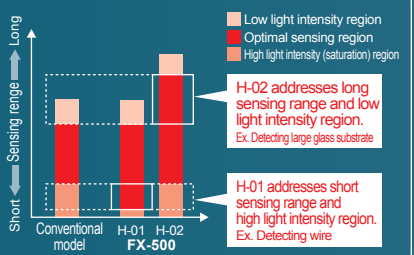
Three hysteresis modes

Hysteresis is the difference in incident light intensity at the points when the output turns ON and when the output turns OFF. Hysteresis was originally intended to be used as a measure against vibrations. Three hysteresis modes are available to support the wide variety of applications for which fiber sensors are optimally suited.



Mode table

Mode	Hysteresis amount	Light intensity	Description
H-01	Minimal	Small	Sharp detection with high accuracy is possible in this mode. Optimal for minute object detection where light saturates easily.
H-02	Small	Large	Initial setting mode. Accurate detection such as long range detection of a large glass substrate is possible.
H-03	Large	Large	A mode used for prevention of chattering. Works in adverse environments such as vibration or dirt.

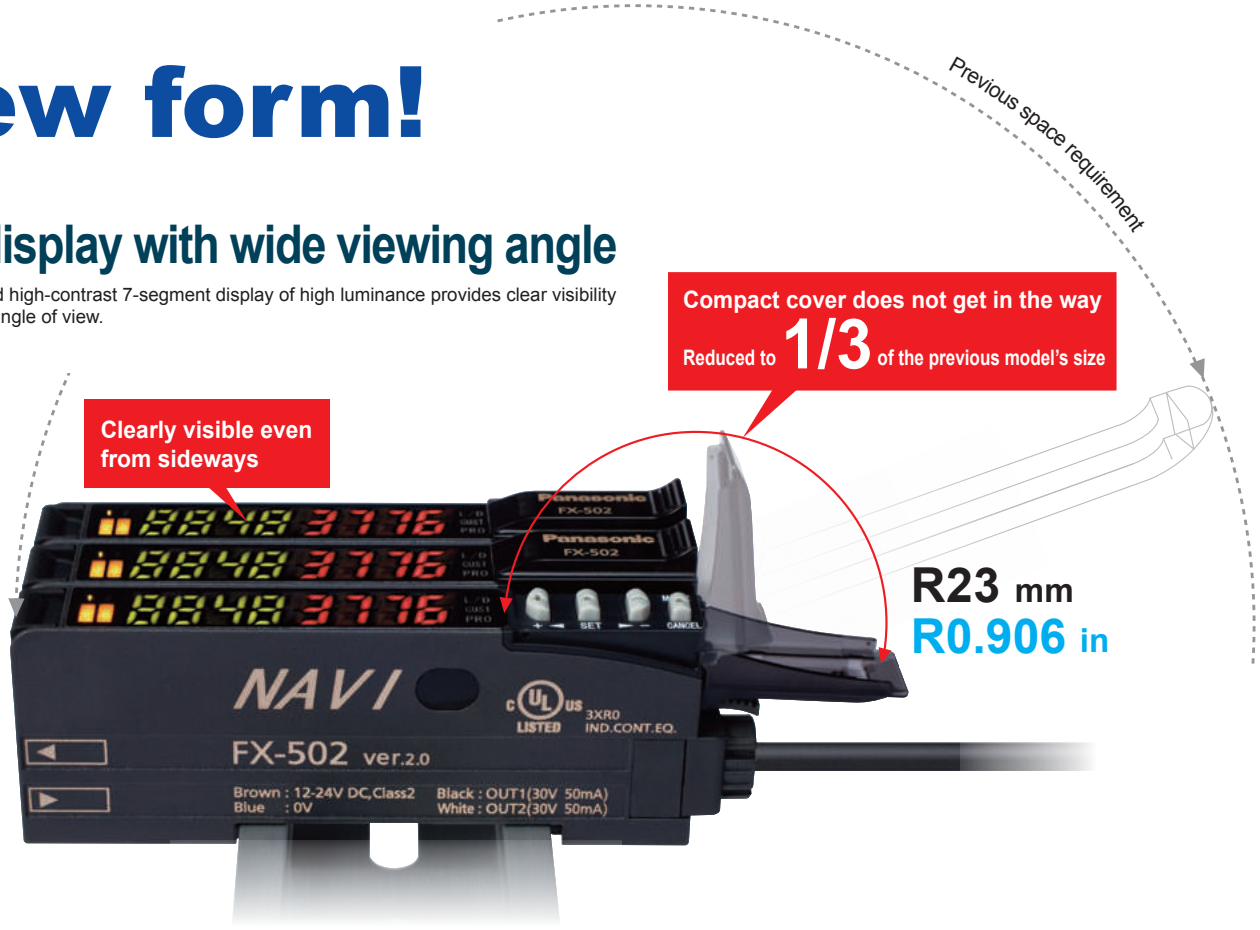


Class leading form and operability

New form!

Flat display with wide viewing angle

The large and high-contrast 7-segment display of high luminance provides clear visibility from a wide angle of view.



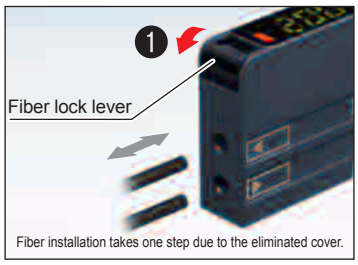
Streamlined fiber clamp

Conventionally clamp operation was performed after opening up the cover. The **FX-500** series adopts a guard structure eliminating the cover so that the clamp operation can be done in one step.

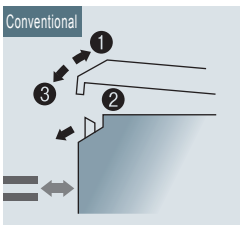
MODE NAVI + Direct setting

MODE NAVI uses three indicators and a dual display to show the amplifier's basic operations. The current operation mode can be confirmed at a glance, so even a first-time user can easily operate the amplifier.

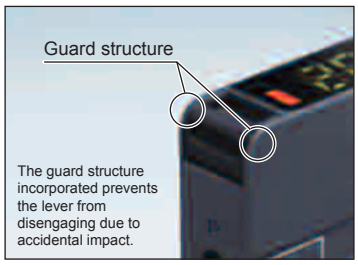
■Streamlined fiber clamp



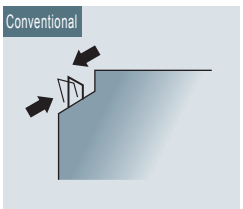
Fiber installation takes one step due to the eliminated cover.



Large cover model takes 3 steps.



The guard structure incorporated prevents the lever from disengaging due to accidental impact.



The lever is exposed and may be accidentally disengaged.

■NAVI display (lights off during RUN mode)

L/D

Switches output operation.
L: Light-ON D: Dark-ON

CUST

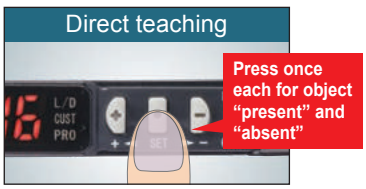
Allows direct setting change selectable from response time / hysteresis / emitting power / emission.
(Initial setting: response time)

PRO

Allows the selection of advanced functions such as timer, copy, and memory functions.

■Direct setting

Threshold value can be changed during RUN mode.



Teaching can be done during RUN mode.

A variety of functions at the industry's leading edge

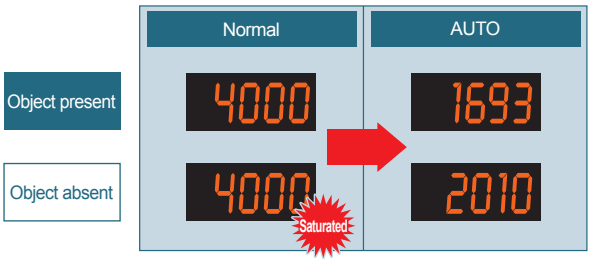
Stable detection while being eco-friendly

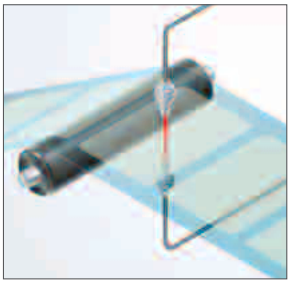
Emission power & gain setting

In cases when the incident light intensity is saturated, the light emitting amount can be adjusted to the optimal level by AUTO without changing the response time. This allows stable detection with an optimal S/N ratio and saves energy by controlling the emitting electric current.

Auto mode (AUTO) and 3-level manual mode (H / M / L [fine-adjustable]) are incorporated.

■Detecting a transparent sheet



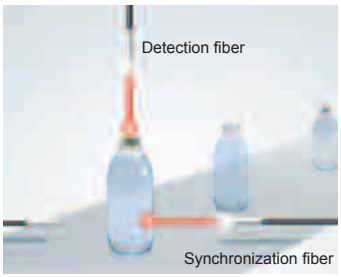


Built-in logic functions

No PLC necessary. Logical calculation with fiber sensor only

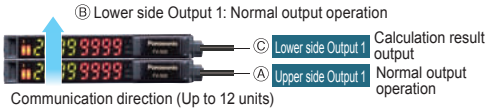
■Logical calculation functions

Three logical calculations (AND, OR, XOR) are available with fiber sensor only.
3 logical operation can be selected against Output 1. Additional controller is not required so both wire-saving and cost reduction can be achieved.



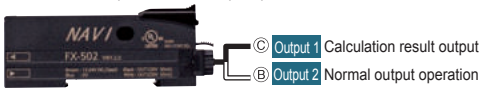
Calculation of two neighboring amplifiers

Ⓑ Lower side Output 1: Normal output operation



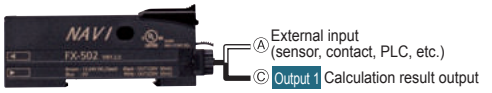
Calculation of two outputs in one amplifier FX-502(P) / FX-505(P)-C2

Ⓐ Output 1: Normal output operation



Calculation of one amplifier and external input FX-502(P) / FX-505(P)-C2

Ⓑ Output 1: Normal output operation



Truth table

A	B	Logical calculation output (C)		
		AND	OR	XOR
ON	ON	ON	ON	OFF
OFF	ON	OFF	ON	ON
ON	OFF	OFF	ON	ON
OFF	OFF	OFF	OFF	OFF

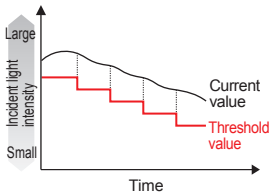
Saves maintenance time

Threshold tracking function

This function performs automatic setting of threshold value by checking the incident light intensity at desired intervals in order to follow the changes in the light amount resulting from changes in the environment over long periods (such as dust). This contributes to reduction in maintenance hours.

SHIFT
(Tracking by limit teaching)

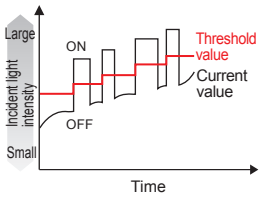
Effective for thru-beam type and retroreflective type! (Dark-ON)



Limit teaching is performed periodically.

AUTO
(Tracking by automatic teaching)

Effective for reflective type!

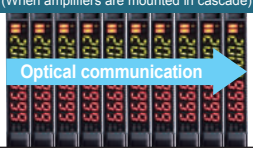


Automatic teaching which triggers output is performed.

Selectable interference prevention

In addition to the automatic interference prevention function which is enabled through the optical communication of amplifiers mounted in cascade, an alternate frequency interference prevention function is also incorporated. So even for layouts where optical communication cannot be carried out, switching of emission frequencies allows interference prevention.

Automatic interference prevention
(When amplifiers are mounted in cascade)



Alternate frequency interference prevention
(When amplifiers are not mounted in cascade)

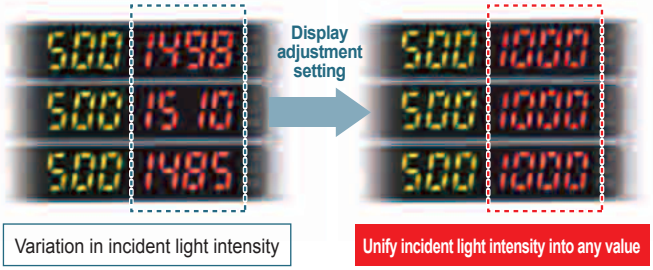
* Refer to specifications for details of number of sensors allowed in interference prevention.

A variety of functions at the industry's leading edge

Resolves variation in displayed incident light intensity

Display adjustment setting

The variation in display can be adjusted to random values. This helps to define proper instruction in a work order.

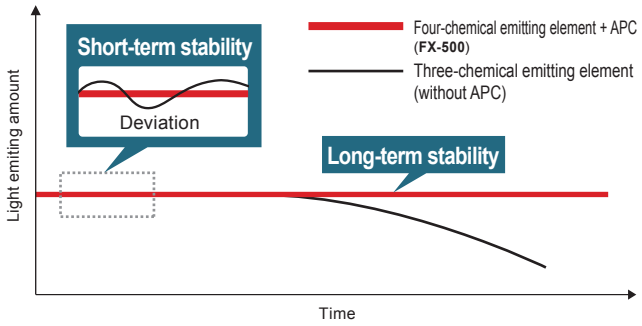


Stable detection over long and short periods

Stabilized emission amount

The "four-chemical emitting element", which we were the first to incorporate to maintain a stable level of light emission, has now become an industry standard.
FX-500 series continues to adopt the same emitting element as well as the "APC (Auto Power Control) circuit" which improves stability in short periods such as when the power is turned on.

■Stable sensing comparison



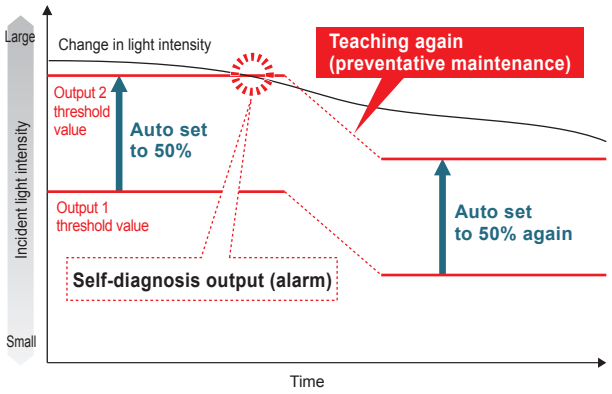
Suitable for preventative maintenance

Self-diagnosis output FX-502(P) / FX-505(P)-C2

FX-502(P) / FX-505(P)-C2 can set Output 2 as a self-diagnosis output. When the teaching of Output 1's threshold value is carried out, Output 2 is set concurrently with the setting randomly shifted by the amount of surplus of threshold value. Light intensity deterioration due to fiber breakage or dust accumulation can be notified as an alarm output.

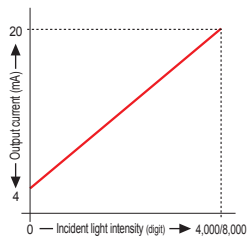
■Detect deterioration in light intensity (e.g. Useful in dusty environment)

Self-diagnosis can be used with the threshold tracking function for added effectiveness.

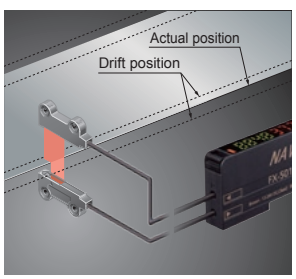


Analog output cable type FX-505(P)-C2

To monitor the sensing of objects, a 4 to 20 mA analog current is output in respond to the digital value of the incident light intensity.



■Edge tracking of film or sheet



The drifting path can be monitored as the light intensity changes.

8 data banks

Smooth setup changes

The number of data banks used for saving the setup conditions of the amplifier is increased to eight. Setup conditions can be saved and loaded to make setup changes easy at a worksite where multiple models are manufactured.

External input

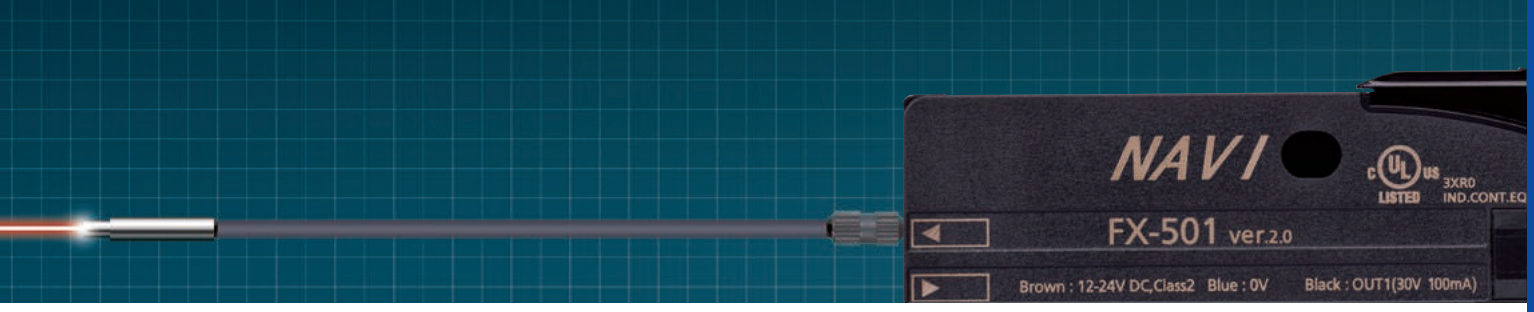
Remote control improves work efficiency FX-502(P) / FX-505(P)-C2

Work efficiency can be improved by operating via PLC output or other external signal.
(**FX-502(P)** can operate via external signal when switching from Output 2 to external input.)

■Functions operable by external input

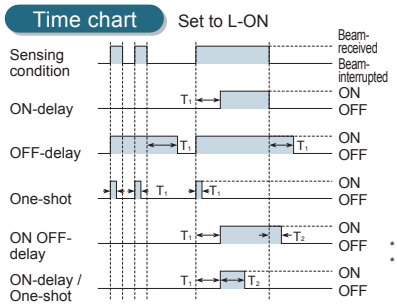
Full-auto* / Limit* / 2-point teaching*	Display adjustment setting*
Data bank load* / save*	Logical calculation (self-unit only)
Emission halt	Copying function lock (self-unit only)

* **FX-505(P)-C2** conducts the answer back output toward external input, when setting Sensing output 2 to the anser back output mode.



Equipped with 5 timer types

A wide variety of timer control operations can be carried out by fiber sensors only.



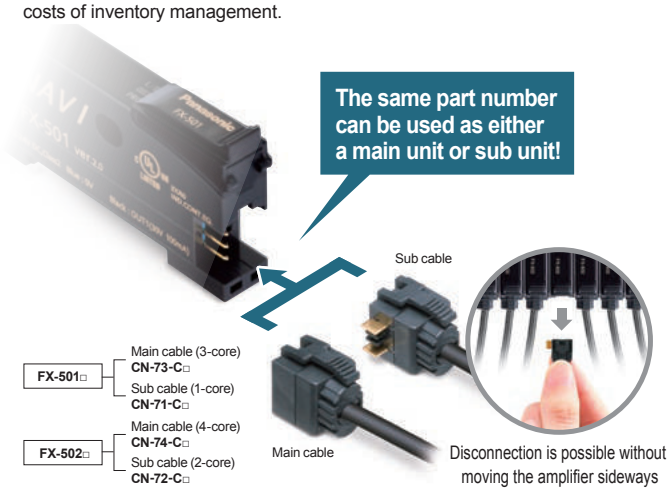
* Timer period: 0.05 ms to 32 s
* Output 1 has ON / OFF-delay and ON-delay / One-shot timers are available for Output 1 only.

An optical communication function allows sensors to be adjusted simultaneously

The data that is currently set can be copied and saved all at once for all amplifiers connected togther from the right side thanks to the optical communication function.
This greatly reduces troublesome setup tasks and makes setup much smoother.

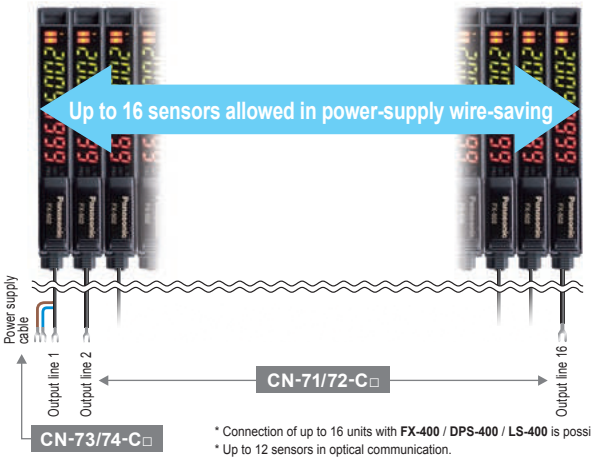
No need to specify a main unit or sub unit

All **FX-500** amplifiers can be used as either a main unit or a sub unit. Just use a main cable or a sub cable to distinguish the two. This reduces the costs of inventory management.



Wire-saving, space-saving

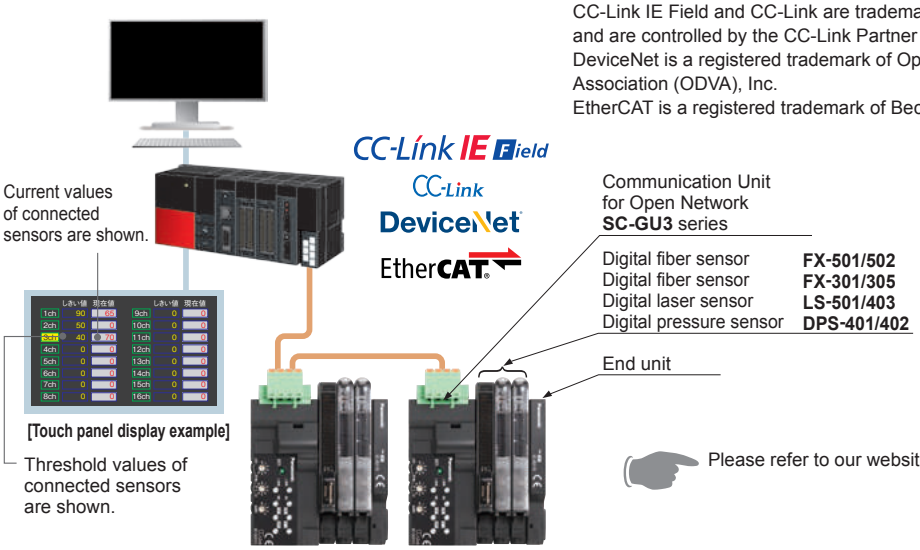
The quick-connection cables enable reduction in wiring. The connections and man-hours required for the relay terminal block setup can be reduced and valuable space is saved.



* Connection of up to 16 units with **FX-400** / **DPS-400** / **LS-400** is possible.
* Up to 12 sensors in optical communication.

Network communication

Connection to CC-Link IE Field / CC-Link / DeviceNet / EtherCAT open network is possible through the communication unit for open network, **SC-GU3** series. Monitoring or setting changes can be carried out via a PLC, PC, etc.



Please refer to our website for details of **SC-GU3** series.

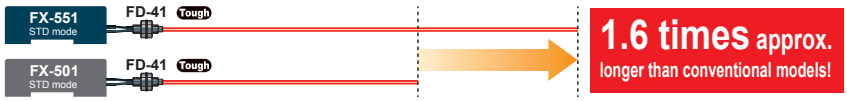
1.6 times longer sensing range than conventional models
Significantly improved stability and usability

Sensing range up to 1.6 times

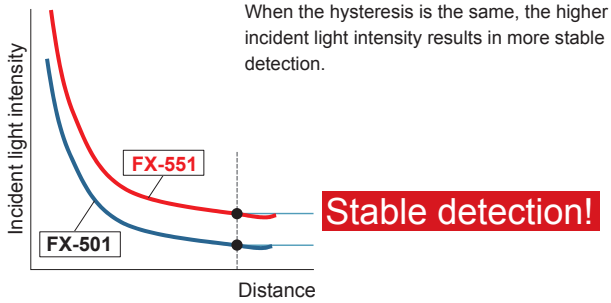
Ample sensing distance even with thin fiber

The sensing range of the thin reflective type fiber is about 1.6 times longer than that of a conventional product (the sensing range of the standard reflective type fiber is about 1.4 times longer). This adds extra flexibility to the sensor layout.

Fiber	Sensing range (STD mode)		Rate of increase in sensing range
	FX-551	FX-501	
FT-31	480 mm 18.898 in	315 mm 12.402 in	152 %
FT-42	1,470 mm 57.874 in	1,130 mm 44.488 in	130 %
FD-41	200 mm 7.874 in	125 mm 4.921 in	160 %
FD-61	620 mm 24.409 in	450 mm 17.717 in	138 %



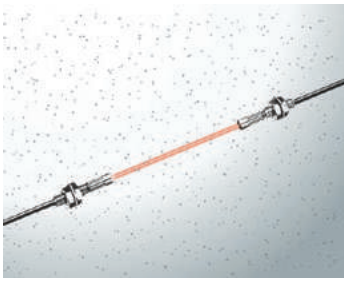
When the hysteresis is the same, the higher incident light intensity results in more stable detection.



When the hysteresis is the same, the higher incident light intensity results in more stable detection.

Easy adjustment of beam axis

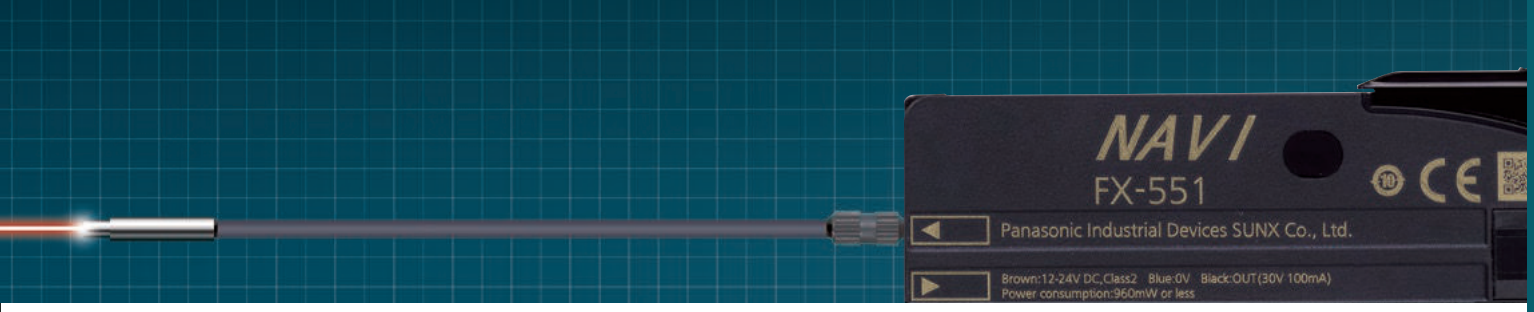
Thanks to the high emission power, a slight deviation of beam axis causes no problem.
It is ideal for use in dusty areas* or for detection through an extremely small slit.



* Need to confirm proper operation in installed condition.

Equipped with a mode to minimize the effect of ambient light

When setting to activate the environment resistance mode in the emission frequency setting, the ambient illuminance for LED lights becomes about 2.5 times higher than that in the normal mode. This reduces erroneous detections caused by LED lights.



Simplified functions for improved operation ease

The **FX-500** series and newer models are equipped with only basic functions for improved ease of use. No matter which model you select, they are all easy to use.

MODE NAVI + Direct setting

MODE NAVI uses three indicators and a dual display to show the amplifier's basic operations. The current operation mode can be confirmed at a glance, so even a first-time user can easily operate the amplifier.

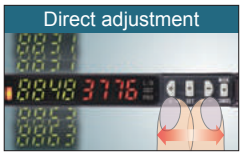
■ NAVI display (lights off during RUN mode)

L/D
Switches output operation.
L: Light-ON D: Dark-ON

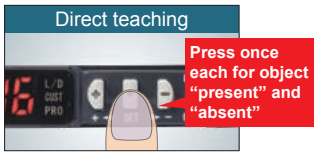
CUST
The sensitivity to received light can be changed directly.

PRO
Allows the selection of advanced functions such as timer, shift amount setting and threshold value tracking setting.

■ Direct setting



Threshold value can be changed during RUN mode.



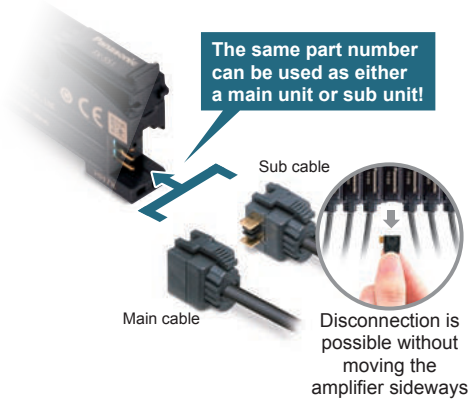
Teaching can be done during RUN mode.

▶ List of functions in PRO mode

PRO 1	Response time setting, timer setting, shift amount setting
PRO 2	Teaching lock setting, digital display item setting, digital display turning setting, Eco setting
PRO 3	Display adjustment setting, reset setting, emission frequency setting, threshold value tracking setting

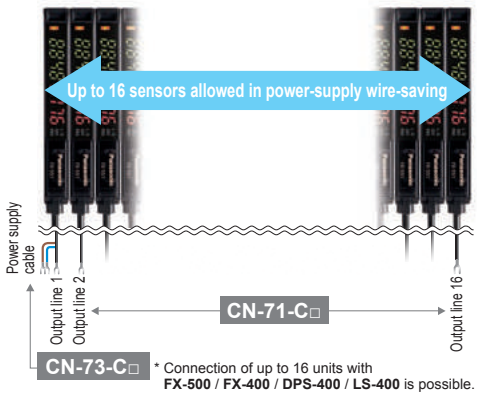
No need to specify a main unit or sub unit

All **FX-500** amplifiers can be used as either a main unit or a sub unit. Just use a main cable or a sub cable to distinguish the two. This reduces the costs of inventory management.



Wire-saving, space-saving

The quick-connection cables enable reduction in wiring. The connections and man-hours required for the relay terminal block setup can be reduced and valuable space is saved.



* Connection of up to 16 units with **FX-500** / **FX-400** / **DPS-400** / **LS-400** is possible.

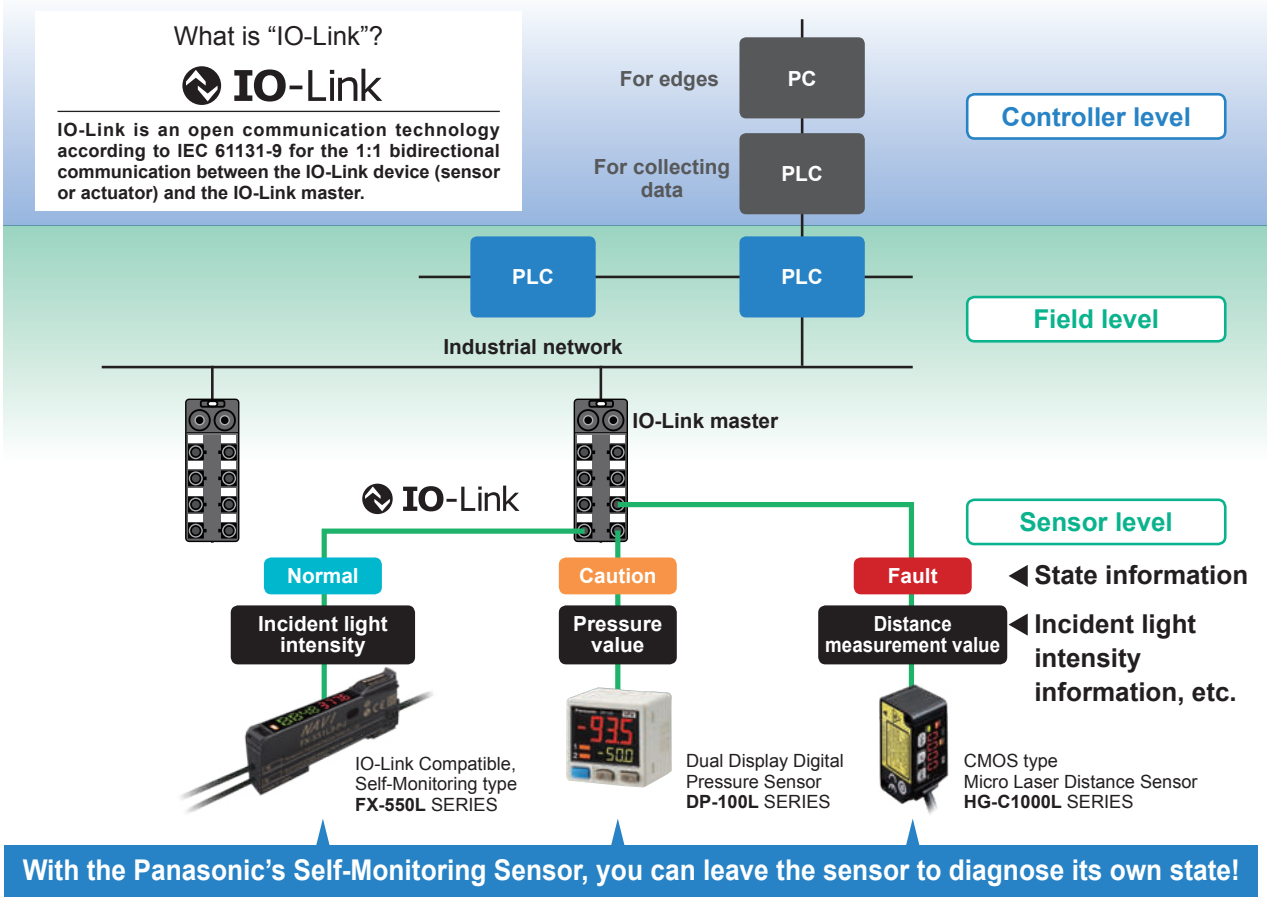
Note: **FX-550** series is not equipped with a communication function. When connecting to the host communication units **SC-GU3** series, **SC-GU2-C** and **SC-GU1-485**, please use **FX-500** series.

Reduction of the data analysis burden - one small step towards IoT.

IO-Link Compatible, Self-Monitoring Type Self-Monitoring Sensor

IO-Link compatible **Collecting sensor level data**

Field data collected and accumulated for “preventive maintenance” and “operation monitoring”.
An analysis of such field data requires high-level know-how and time, causing a burden to people responsible for the production site management.
The **Self-Monitoring Sensor** manufactured by Panasonic is capable of reporting sensor data and its own state to the host device through the I/O Link master.
With the Self-Monitoring Sensor, you can immediately judge the state of the sensor and easily identify the cause of failure.
Thus, this sensor contributes to the **reduction of the burden experienced by the client in collecting and analyzing data**.



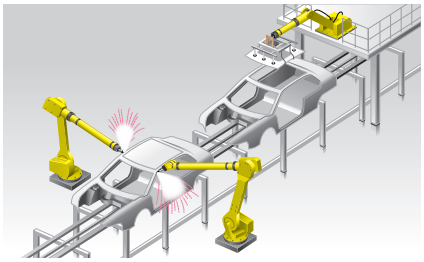
With the Panasonic’s Self-Monitoring Sensor, you can leave the sensor to diagnose its own state!

Examples of IoT in the industrial automation field

Before the introduction of Self-Monitoring Sensors

Preventive maintenance

- We want to avoid production line stoppage that might occur due to unexpected sensor failure.
  Line stoppage hours × (manufacturing unit cost / hour) = Loss
- We want to minimize the production line down time to almost zero.



Problems

◆The amount of data to be collected is large and this may lower the PLC processing capacity.
◆The burden of data analysis is large. ◆Resetting the replaced sensors is troublesome.

After the introduction of Self-Monitoring Sensors

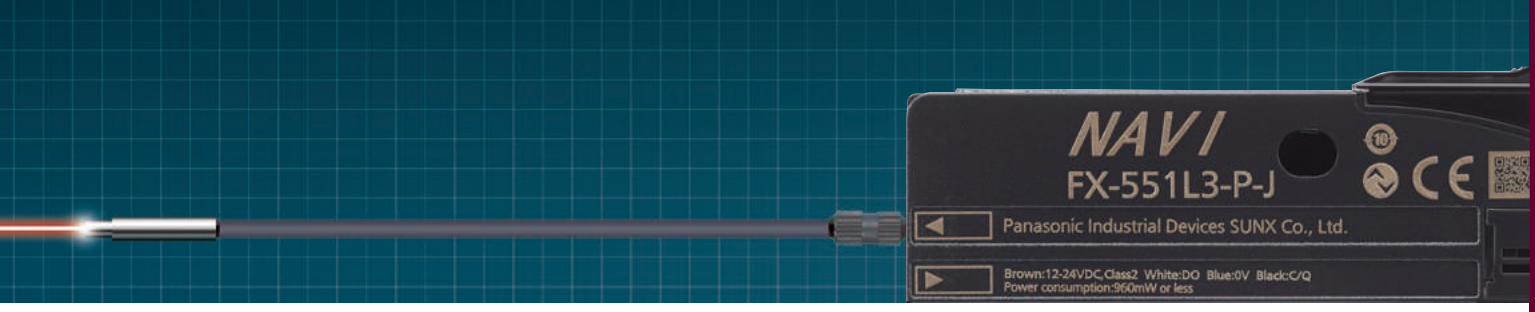
From preventive maintenance to predictive maintenance

Leave the sensor diagnosis to the sensor itself.

- All you need to do is to monitor the sensor state.
- PLC can be used exclusively for controlling devices.
- Possible to check detail information at a desired timing.

Leave the resetting for replaced sensors to the higher-level master

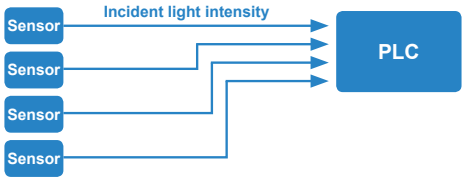
- Automatically written from the connected master.
- Possible not only to save time but also to prevent human errors.



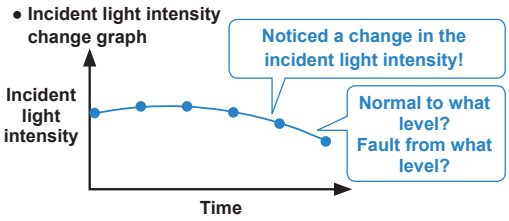
Self-monitoring function

With the Panasonic's Self-Monitoring Sensor, you can get high-level solutions!

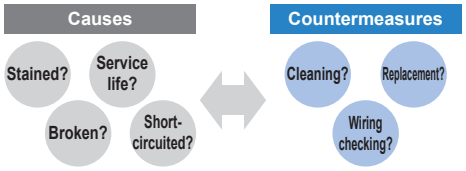
The introduction of IoT requires collection of the incident light intensity data and presents the following problems.



Previously only ON/OFF data was required. But, due to an addition of the incident light intensity data, the PLC processing burden has increased.



We noticed a change in the incident light intensity. However, because there is no judgment criteria, we cannot tell whether the incident light status is normal or not.



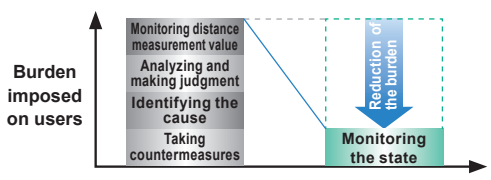
Unless we identify the cause of changes in the incident light intensity, we cannot optimize countermeasures targeting the sensors.

Problems are solved by the high-level self-diagnosis.

Status	Judgement of the state	
Normal	Operation is normal.	
Notification	Check the settings. Detected state is faulty.	* Recover to the normal state through checking installation and settings. Reduction in the incident light intensity
Caution	Getting close to the end of service life. Reached the state where the device should be replaced.	* Limitation in the writing frequency into the memory or in the operation hours, etc.
Fault	Short-circuited or broken. Reached the state where it is impossible to control as a device.	* Short-circuited output, damaged EEPROM, etc.

* By creating a program with a PLC, etc., the "State" of the self-monitoring sensor can be grasped.

Easy use of IoT



"Predictive maintenance" can be easily achieved through monitoring the state of the Self-Monitoring Sensor.

ORDER GUIDE

Amplifiers

Quick-connection cable is not supplied with the amplifier. Please order it separately.

Type		Appearance	Model No.	Emitting element	Output	External input
FX-500 series	Standard type		**FX-501**	Red LED	NPN open-collector transistor	———
			FX-501P		PNP open-collector transistor	
	2-output type		**FX-502**		NPN open-collector transistor 2 outputs	Incorporated (Switchable with Output 2)
			FX-502P		PNP open-collector transistor 2 outputs	
	Cable type		**FX-505-C2**		NPN open-collector transistor 2 outputs, analog output	Incorporated
			FX-505P-C2		PNP open-collector transistor 2 outputs, analog output	
FX-550 series	Connector type		**FX-551**	Red LED	NPN open-collector transistor	———
			FX-551P		PNP open-collector transistor	
	Cable type		**FX-551-C2**		NPN open-collector transistor	
			FX-551P-C2		PNP open-collector transistor	
FX-550L series (IO-Link compatible)	Discrete wire type		**FX-551L3-P-C2**	Red LED	PNP open-collector transistor	———
	M12 connector type	 Supports Smartclick (Note)	**FX-551L3-P-J**			

Note: Smartclick is a trademark of OMRON Corporation.

ORDER GUIDE

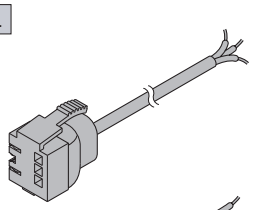
Quick-connection cables

For FX-501(P) / FX-551(P) 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	0.2 mm² 3-core cabtyre cable, with connector on one end Cable outer diameter: ø3.3 mm ø0.130 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	0.2 mm² 1-core cabtyre cable, with connector on one end Cable outer diameter: ø3.3 mm ø0.130 in Connectable to a main cable up to 15 cables.
	CN-71-C2	Length: 2 m 6.562 ft	
	CN-71-C5	Length: 5 m 16.404 ft	

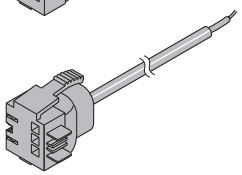
Main cable

• **CN-73-C□**



Sub cable

• **CN-71-C□**

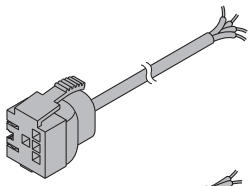


For FX-502(P) Quick-connection cable is not supplied with the amplifier. Please order it separately.

Type	Model No.	Description	
Main cable (4-core)	**CN-74-C1**	Length: 1 m 3.281 ft	0.2 mm² 4-core cabtyre cable, with connector on one end Cable outer diameter: ø3.3 mm ø0.130 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	0.2 mm² 2-core cabtyre cable, with connector on one end Cable outer diameter: ø3.3 mm ø0.130 in Connectable to a main cable up to 15 cables.
	CN-72-C2	Length: 2 m 6.562 ft	
	CN-72-C5	Length: 5 m 16.404 ft	

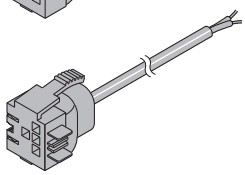
Main cable

• **CN-74-C□**



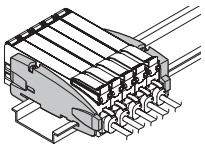
Sub cable

• **CN-72-C□**



End plates

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

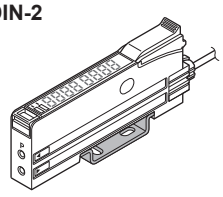
Appearance	Model No.	Description
	**MS-DIN-E**	When amplifiers are mounted in cascade, or when an amplifier moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when cascading multiple amplifiers together. Two pcs. per set

OPTIONS

Designation	Model No.	Description
Amplifier mounting bracket	**MS-DIN-2**	Mounting bracket for amplifier

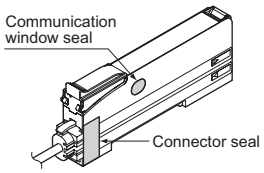
Amplifier mounting bracket

• **MS-DIN-2**



Amplifier protection seal

• **FX-MB1**
10 sets of 2 communication window seals and 1 connector seal



Recommended extension cables for M12 connector type

Manufactured by OMRON Corporation
Extension cable with connectors on both ends XS5W series Smartclick

* Smartclick is a trademark of OMRON Corporation. Contact the manufacturer for details of the recommended products.

OPTIONS

Communication unit for open network SC-GU3 series

For FX-501 / FX-502

Designation	Appearance	Model No.	Description
Communication unit for CC-Link IE Field		**SC-GU3-04**	This is a communication unit, which can convert the output signal of a sensor amplifier (NPN output type) into communication data for CC-Link IE Field.
Communication unit for CC-Link		**SC-GU3-01**	This is a communication unit, which can convert the output signal of a sensor amplifier (NPN output type) into communication data for CC-Link.
Communication unit for DeviceNet		**SC-GU3-02**	This is a communication unit, which can convert the output signal of a sensor amplifier (NPN output type) into communication data for DeviceNet.
Communication unit for EtherCAT		**SC-GU3-03**	This is a communication unit, which can convert the output signal of a sensor amplifier (NPN output type) into communication data for EtherCAT.
End unit		**SC-GU3-EU**	This end unit can change and check the settings of sensor amplifiers that allow optical communication and monitor operation status. * To obtain the output signal of the **FX-502** output 2, optical communication must be performed using the end unit **SC-GU3-EU**.
Cascading connector unit		**SC-71**	This one-touch connector is used to connect the following devices to **SC-GU3-0**□: The **FX-501/502/301/305** fiber sensor, the **LS-501/403** laser sensor, the **DPS-401/402** digital pressure sensor.

Note: Please refer to our website for details of communication unit for open network **SC-GU3** series.

SPECIFICATIONS

FX-500 series

Item \ Type		Standard type	2-output type	Cable type
Model No.	NPN output	**FX-501**	**FX-502**	**FX-505-C2**
	PNP output	**FX-501P**	**FX-502P**	**FX-505P-C2**
Regulatory compliance		EMC Directive, RoHS Directive, UL/c-UL Listing certification, Korean S mark certification		
Supply voltage		12 to 24 V DC $^{+10}_{-15}$ % Ripple P-P 10 % or less		
Power consumption		Normal operation: 960 mW or less (current consumption 40 mA or less at 24 V supply voltage, excluding analog output of cable type) ECO mode: 680 mW or less (current consumption 28 mA or less at 24 V supply voltage, excluding analog output of cable type)		
Output (2-output type and cable type: Output 1, Output 2)		<NPN output type> NPN open-collector transistor • Maximum sink current: 100 mA (2-output type and cable type are 50 mA) (Note 2) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 2 V or less (Note 3) (at maximum sink current)	<PNP output type> PNP open-collector transistor • Maximum source current: 100 mA (2-output type and cable type are 50 mA) (Note 2) • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 2 V or less (Note 3) (at maximum source current)	
	Output points	1 point	2 points	
	Output operation	Switchable either Light-ON or Dark-ON by L/D mode		
	Short-circuit protection	Incorporated		
Response time		H-SP: 25 µs or less, FAST: 60 µs or less, STD: 250 µs or less, LONG: 2 ms or less, U-LG: 4 ms or less, HYPR: 24 ms or less, selectable		
Analog output (Cable type only)		Output current: 4 to 20 mA approx. [H-SP, FAST STD: At 0 to 4,000 digits, LONG: At 0 to 8,000 digits (Note 4)], Response time: 2 ms or less, Zero point: Within 4 mA ±1 % F.S., Span: Within 16 mA ±5 % F.S., Linearity: Within ±3 % F.S., Load resistance: 0 to 250 Ω		
External input (2-output type only, switchable with Output 2)		———	<NPN output type> NPN non-contact input • Signal condition High: +8 V to +V DC or Open Low: 0 to +1.2 V DC (at 0.5 mA source current) • Input impedance: 10 kΩ approx.	<PNP output type> PNP non-contact input • Signal condition High: +4 V to +V DC (at 3 mA sink current) Low: 0 to +0.6 V DC or Open • Input impedance: 10 kΩ approx.
Possible external input function		———	Emission halt / Teaching (Full-auto, Limit, 2-point) / Logic operation setting / Copy lock / Display adjustment / Data bank load / Data bank save, selectable	
Sensitivity setting		2-point teaching / Limit teaching / Full-auto teaching / Manual adjustment		
Incident light intensity display range		H-SP / FAST / STD: 0 to 4,000, LONG: 0 to 8,000, U-LG / HYPR: 0 to 9,999		
Timer function		Incorporated with variable OFF-delay / ON-delay / One-shot / ON OFF-delay / ON-delay • One-shot timer, switchable either effective or ineffective	<Output 1> Incorporated with variable OFF-delay / ON-delay / One-shot / ON OFF-delay / ON-delay • One-shot timer, switchable either effective or ineffective	
			<Output 2> Incorporated with variable OFF-delay / ON-delay / One-shot timer, switchable either effective or ineffective	
	Timer period	Timer range “ms”: 0.5 ms approx., 1 to 9,999 ms approx., 1 ms approx., Timer range “sec.”: 0.5 s approx., 1 to 32 s approx., 1 s approx., Timer range “1/10 ms”: 0.05 ms approx., 0.1 to 999.9 ms approx., 0.1 ms approx., each output is set individually		
Light emitting amount selection function		Incorporated, 3 levels (each level 25 to 100 %) + Auto setting [1 level (25 to 100 %) when using H-SP mode]		
Interference prevention function		Incorporated (Note 5), selectable either automatic interference prevention or different frequency		
Various settings		Hysteresis setting / Shift amount setting / Emission power setting / Display turning setting / ECO setting / Data bank loading saving setting / Copying setting / Code setting / Reset setting / Logical calculation setting / Threshold tracking setting, etc.		
Protection		IP40 (IEC)		
Ambient temperature		-10 to +55 °C +14 to +131 °F [If 4 to 7 units are mounted in cascade: -10 to +50 °C +14 to +122 °F or if 8 to 16 units (cable type: 8 to 12 units) are mounted 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		
Vibration resistance		10 to 150 Hz frequency, 0.75 mm 0.030 in double amplitude (10 G max.) in X, Y and Z directions for two hours each		
Shock resistance		98 m/s² acceleration (10 G approx.) in X, Y and Z directions five times each		
Emitting element (modulated)		Red LED (Peak emission wavelength: 643 nm 0.025 mil)		
Material		Enclosure, Case cover: Polycarbonate, Switch: Polyacetal		
Cable		———		0.2 mm² 6-core cabtyre cable, 2 m 6.562 ft long
Cable extension		———		Extension up to total 100 m 328.084 ft is possible with 0.3 mm², or more, cable. (however, supply voltage 12 V DC)
Weight		Net weight: 15 g approx., Gross weight: 70 g approx.		Net weight: 60 g approx., Gross weight: 100 g approx.
Accessory		**FX-MB1** (Amplifier protection seal): 1 set		

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) 50 mA max. if 5 or more standard types are connected together. (25 mA in case of 2-output type and cable type)
3) In case of using the quick-connection cable (cable length 5 m 16.404 ft) (optional).
4) If display adjustment was conducted, it is not in this range.
5) Number of sensor heads which is possible to be mounted closely in auto interference prevention function depends on response time as shown in table below.
Number of sensor heads which is possible to be mounted closely in different frequency Interference prevention function is up to 3 units.

• Number of sensor heads mountable closely (Unit: set)

Response time	H-SP	FAST	STD	LONG	U-LG	HYPR
IP-1	0	2	4	8	8	12

SPECIFICATIONS

FX-550 series

Item \ Type		Connector type	Cable type
Model No.	NPN output	**FX-551**	**FX-551-C2**
	PNP output	**FX-551P**	**FX-551P-C2**
Regulatory compliance		EMC Directive, RoHS Directive	
Supply voltage		12 to 24 V DC $^{+10}_{-15}$ % Ripple P-P 10 % or less	
Power consumption		Normal operation: 960 mW or less (current consumption 40 mA or less at 24 V supply voltage) ECO mode: 680 mW or less (current consumption 28 mA or less at 24 V supply voltage)	
Output		<NPN output type> NPN open-collector transistor • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 2 V or less (Note 2) (at maximum sink current)	<PNP output type> PNP open-collector transistor • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 2 V or less (Note 2) (at maximum source current)
Output operation		Switchable either Light-ON or Dark-ON by L/D mode	
Short-circuit protection		Incorporated	
Response time		FAST: 60 µs or less, STD: 250 µs or less, LONG: 2 ms or less, U-LG: 4 ms or less, HYPR: 24 ms or less, selectable	
Sensitivity setting		2-point teaching / Limit teaching / Full-auto teaching / Manual adjustment	
Incident light sensitivity setting		Incorporated, 4 steps	
Incident light intensity display range		FAST / STD: 0 to 4,000, LONG: 0 to 8,000, U-LG / HYPR: 0 to 9,999	
Timer function		Incorporated with variable OFF-delay / ON-delay / One-shot / switchable either effective or ineffective	
Timer period		Timer range “ms”: 1 to 9,999 ms approx., 1 ms approx., Timer range “sec.”: 1 to 32 s approx., 1 s approx., Timer range “1/10 ms”: 0.1 to 999.9 ms approx., 0.1 ms approx. (Note 3)	
Different frequency interference prevention function (Note 4)		Incorporated (up to 4 units). Note that the response time varies depending on the setting. F-1: 0.8 ms or less, F-2: 0.9 ms or less, F-3: 1.0 ms or less, F-4: 1.7 ms or less	
Protection		IP40 (IEC)	
Ambient temperature		-10 to +55 °C +14 to +131 °F (If 4 to 7 units are mounted in cascade: -10 to +50 °C +14 to +122 °F or if 8 to 16 units are mounted 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	
Vibration resistance		10 to 150 Hz frequency, 0.75 mm 0.030 in double amplitude (10 G max.) in X, Y and Z directions for two hours each	
Shock resistance		98 m/s² acceleration (10 G approx.) in X, Y and Z directions five times each	
Emitting element (modulated)		Red LED (Peak emission wavelength: 660 nm 0.026 mil)	
Material		Enclosure, Case cover: Polycarbonate, Switch: Polyacetal	
Cable		——	0.2 mm² 3-core cabtyre cable, 2 m 6.562 ft long
Cable extension		——	Extension up to total 100 m 328.084 ft is possible with 0.3 mm², or more, cable. (however, supply voltage 12 V DC or more)
Weight		Net weight: 15 g approx., Gross weight: 55 g approx.	Net weight: 55 g approx., Gross weight: 90 g approx.

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) In case of using the quick-connection cable (cable length 5 m 16.404 ft) (optional).
3) When set to LONG, U-LG, HYPR, IP-F or IP-R, the time range cannot be set to 1/10 ms.
4) This function increases the hysteresis. Check the sensing condition when using the function.

SPECIFICATIONS

FX-550L series

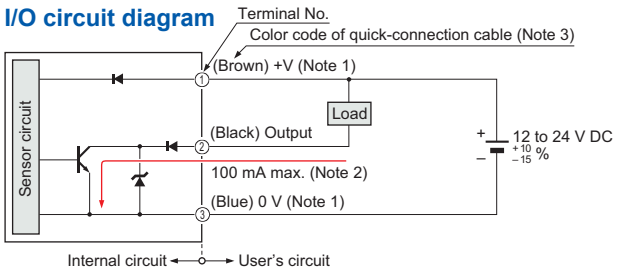
Item \ Type		Discrete wire type	M12 connector type
Model No.		**FX-551L3-P-C2**	**FX-551L3-P-J**
Regulatory compliance		EMC Directive, RoHS Directive	
Supply voltage		12 to 24 V DC $^{+10}_{-15}$ % Ripple P-P 10 % or less	
Power consumption		Normal operation: 960 mW or less (current consumption 40 mA or less at 24 V supply voltage) ECO mode: 720 mW or less (current consumption 30 mA or less at 24 V supply voltage)	
Communication output (C/Q) (Note 2)	IO-Link communication	IO-Link Specification V1.1	
	Baud rate	COM3 (230.4 kbps)	
	Process data	4 byte	
	Minimum cycle time	1.0 ms	
Control output (DO)		PNP open-collector transistor • Maximum source current: 50 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 2 V or less (Note 3) (at maximum source current)	
	Output operation	Switchable either Light-ON or Dark-ON by L/D mode	
	Short-circuit protection	Incorporated	
Response time		STD: 250 µs or less, LONG: 2 ms or less, U-LG: 4 ms or less, HYPR: 24 ms or less, selectable	
Sensitivity setting		2-point teaching / Limit teaching / Full-auto teaching / Manual adjustment	
Incident light sensitivity setting		Incorporated, 4 steps	
Incident light intensity display range		STD: 0 to 4,000, LONG: 0 to 8,000, U-LG / HYPR: 0 to 9,999	
Timer function		Incorporated with variable OFF-delay / ON-delay / One-shot, switchable either effective or ineffective	
	Timer period	0.1 to 999.9 ms approx., in units of 0.1 ms approx.	
Different frequency interference prevention function (Note 4)		Incorporated (up to 4 units). Note that the response time varies depending on the setting. F-1: 0.8 ms or less, F-2: 0.9 ms or less, F-3: 1.0 ms or less, F-4: 1.7 ms or less	
Protection		IP40 (IEC)	
Ambient temperature		-10 to +55 °C +14 to +131 °F (If 4 to 7 units are mounted in cascade: -10 to +50 °C +14 to +122 °F or if 8 to 16 units are mounted 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	
Vibration resistance		10 to 150 Hz frequency, 0.75 mm 0.030 in double amplitude (10 G max.) in X, Y and Z directions for two hours each	
Shock resistance		98 m/s² acceleration (10 G approx.) in X, Y and Z directions five times each	
Emitting element (modulated)		Red LED (Peak emission wavelength: 660 nm 0.026 mil)	
Material		Enclosure, Case cover: Polycarbonate, Switch: Polyacetal	
Cable		0.2 mm² 4-core cabtyre cable, 2 m 6.562 ft long	0.2 mm² cabtyre cable with M12 connector, 0.3 m 0.984 ft long
Cable extension		Extension up to total 20 m 65.617 ft is possible with 0.3 mm², or more, cable. (Condition of CE compliance: less tan 20 m 65.617 ft) (however, supply voltage 12 V DC or more)	
Weight		Net weight: 55 g approx., Gross weight: 80 g approx.	Net weight: 35 g approx., Gross weight: 60 g approx.

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) When the sensor is used as an ordinary sensor, the communication output (C/Q) provides the same output operation as the control output (DO).
3) In case of using the cable (cable length 2 m 6.562 ft).
4) This function increases the hysteresis. Check the sensing condition when using the function.

I/O CIRCUIT AND WIRING DIAGRAMS

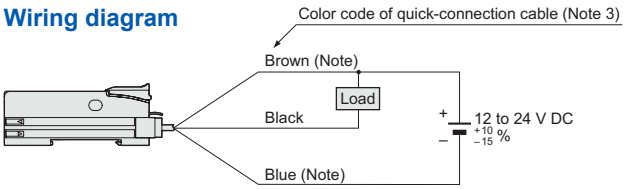
FX-501 FX-551 FX-551-C2 — NPN output type

I/O circuit diagram



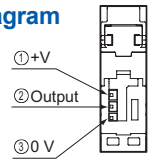
Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers or more, are connected together.
3) The color of the lead wire of the **FX-551**-C2 is the same.

Wiring diagram



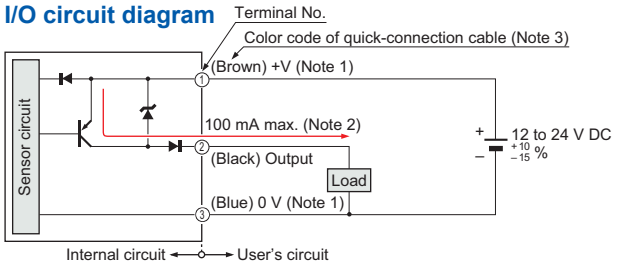
Note: The quick-connection sub cable does not have a brown and a blue lead wire.

Terminal arrangement diagram



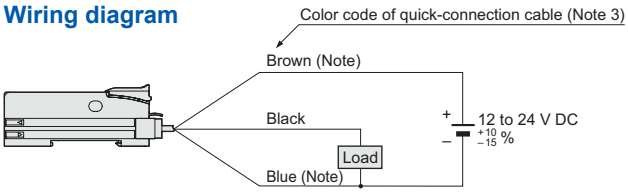
FX-501P FX-551P FX-551P-C2 — PNP output type

I/O circuit diagram



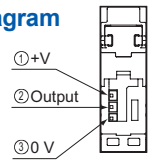
Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers or more, are connected together.
3) The color of the lead wire of the **FX-551P-C2** is the same.

Wiring diagram



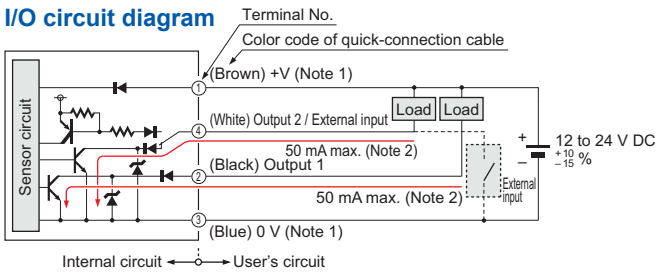
Note: The quick-connection sub cable does not have a brown and a blue lead wire.

Terminal arrangement diagram



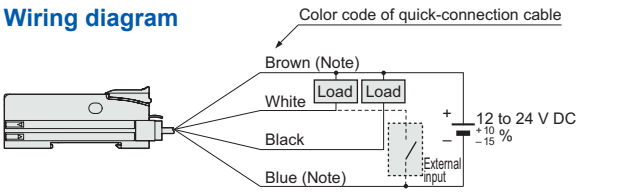
FX-502 — NPN output type

I/O circuit diagram



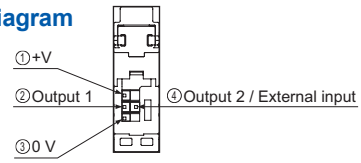
Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 25 mA max., if five amplifiers or more, are connected together.

Wiring diagram



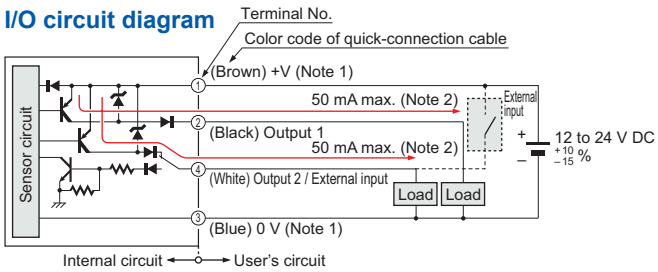
Note: The quick-connection sub cable does not have a brown and a blue lead wire.

Terminal arrangement diagram



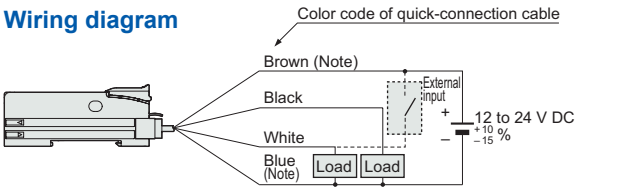
FX-502P — PNP output type

I/O circuit diagram



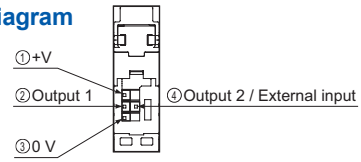
Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 25 mA max., if five amplifiers or more, are connected together.

Wiring diagram



Note: The quick-connection sub cable does not have a brown and a blue lead wire.

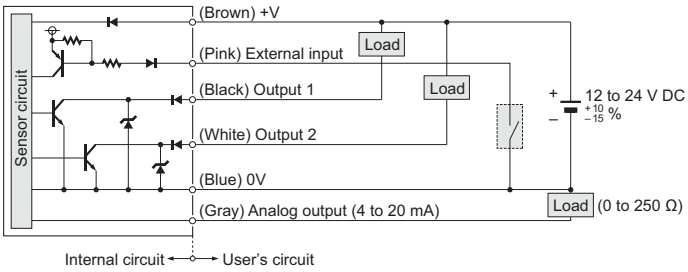
Terminal arrangement diagram



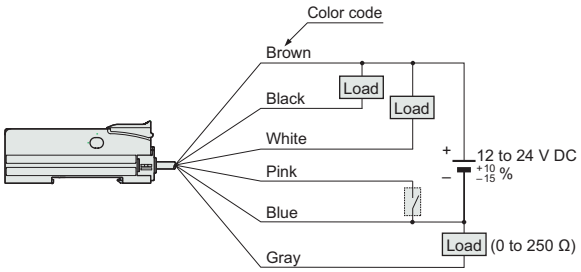
I/O CIRCUIT AND WIRING DIAGRAMS

FX-505-C2 — NPN output type

I/O circuit diagram

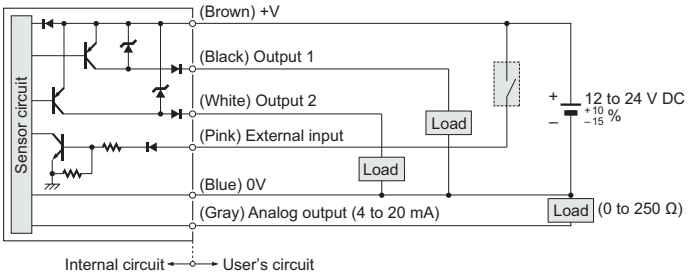


Wiring diagram

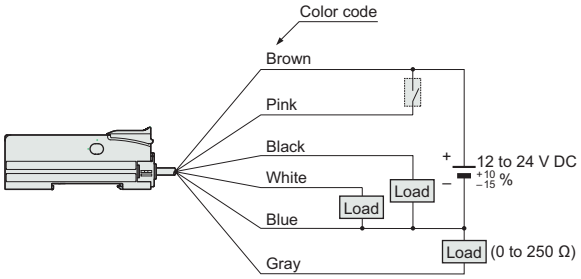


FX-505P-C2 — PNP output type

I/O circuit diagram



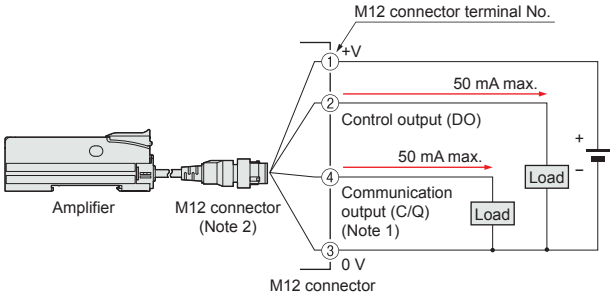
Wiring diagram



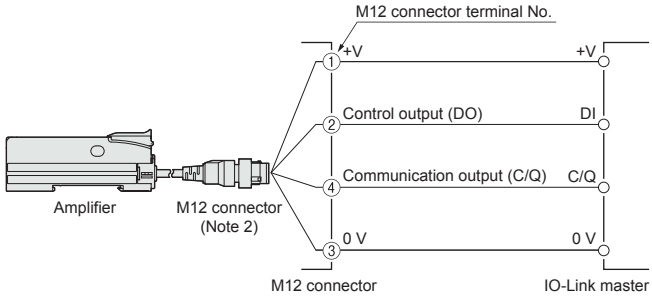
WIRING DIAGRAMS

FX-551L3-P-J — M12 connector type

<When using as an ordinary sensor>

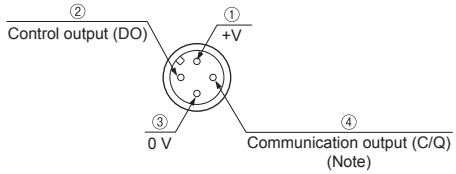


<When connecting to the IO-Link master>



Notes: 1) When the sensor is used as an ordinary sensor, the communication output (C/Q) provides the same output operation as the control output (DO).
2) When wiring with the discrete wire or extending the cable from the M12 connector, separately prepare commercially available M12 connector cable.

M12 connector terminal arrangement diagram



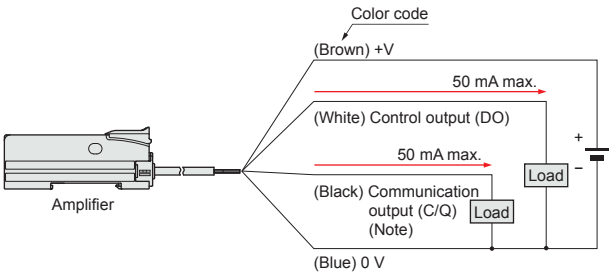
Terminal No.	Designation
①	+V
②	Control output (DO)
③	0 V
④	Communication output (C/Q) (Note)

Note: When the sensor is used as an ordinary sensor, the communication output (C/Q) provides the same output operation as the control output (DO).

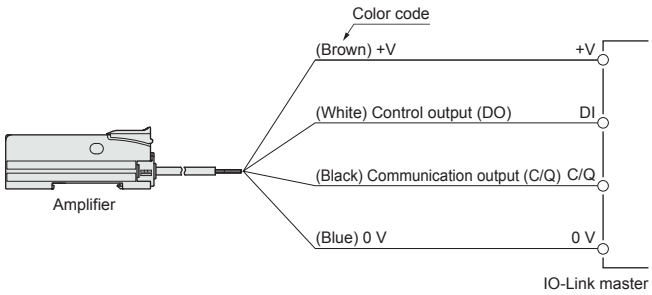
WIRING DIAGRAMS

FX-551L3-P-C2 Discrete wire type

<When using as an ordinary sensor>



<When connecting to the IO-Link master>



Note: When the sensor is used as an ordinary sensor, the communication output (C/Q) provides the same output operation as the control output (DO).

PRECAUTIONS FOR PROPER USE

Refer to the instruction manual for details.
The instruction manual data can be downloaded from our website.

- This catalog is a guide to select a suitable product. Be sure to read instruction manual attached to the product prior to its use.

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

Wiring

- Make sure that the power supply is OFF while adding or removing the amplifiers.
- Note that if a voltage exceeding the rated range is applied, or if an AC power supply is directly connected, the product may get burnt or damaged.
- Note that short-circuit of the load or wrong wiring may burn or damage the product.
- 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.
- Verify that the supply voltage variation is within the rating.
- 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.
- Make sure to use the quick-connection cable (optional) for **FX-500/550** series. Extension up to total 100 m 328.084 ft is possible with 0.3 mm^2 or more, cable. However, in order to reduce noise, make the wiring as short as possible.
- When extending the cable length of **FX-550L** series, use a cable with a conductor cross-sectional area of 0.3 mm^2 or more. Note that the maximum allowed cable length is 20 m 65.617 ft (CE Marking condition: less than 20 m 65.617 ft). However, in order to reduce noise, make the wiring as short as possible.
- Make sure that stress by forcible bending or pulling is not applied to the sensor cable joint and fiber cable.

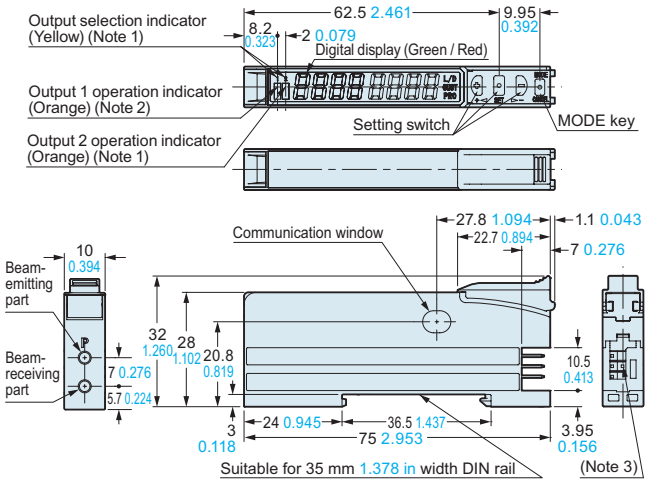
Others

- This product has been developed / produced for industrial use only.
- The specification may not be satisfied in a strong magnetic field.
- The ultra long distance (U-LG, HYPR) mode is more likely to be affected by extraneous noise since the sensitivity of that is higher than the other modes. Make sure to check the environment before use.
- Do not use during the initial transient time after the power supply is switched ON.
  FX-500 series
  H-SP, FAST, STD: 0.5 sec., LONG, U-LG, HYPR: 1 sec.
  FX-550 series
  FAST,STD: 0.5 sec., LONG, U-LG, HYPR: 1 sec.
  FX-550L series
  STD: 0.5 sec., LONG, U-LG, HYPR: 1 sec.
- These sensors are only for indoor use.
- Avoid dust, dirt, and steam.
- Make sure that the product does not come in contact with oil, grease, organic solvents such as thinner, etc., strong acid or alkaline.
- This product cannot be used in an environment containing inflammable or explosive gases.
- Never disassemble or modify this product.
- This product adopts EEPROM. Settings cannot be done a million times or more because of the EEPROM's lifetime.

DIMENSIONS (Unit: mm in)

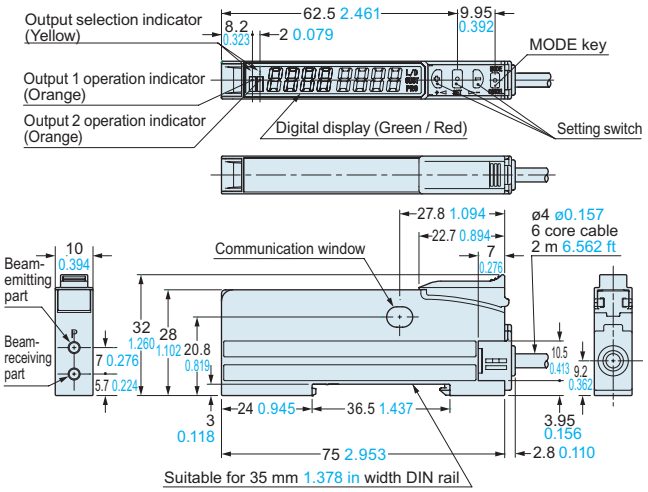
Refer to our website for fiber dimensions.
The CAD data can be downloaded from our website.

FX-501 FX-501P FX-502 FX-502P — Amplifier

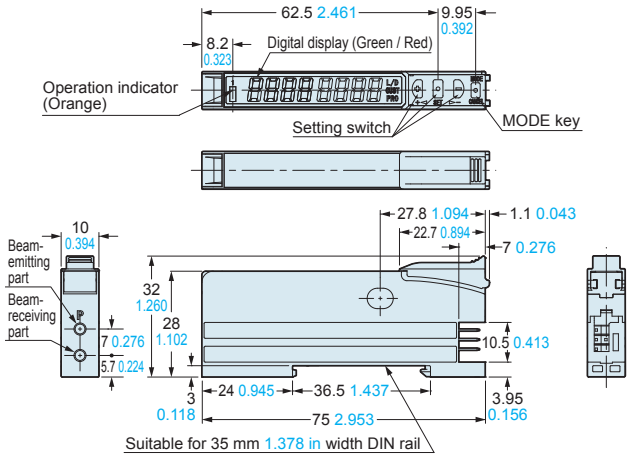


Notes: 1) **FX-502(P)** only
2) **FX-501(P)**: Operation indicator
3) **FX-501(P)**: 3-pin, **FX-502(P)**: 4-pin

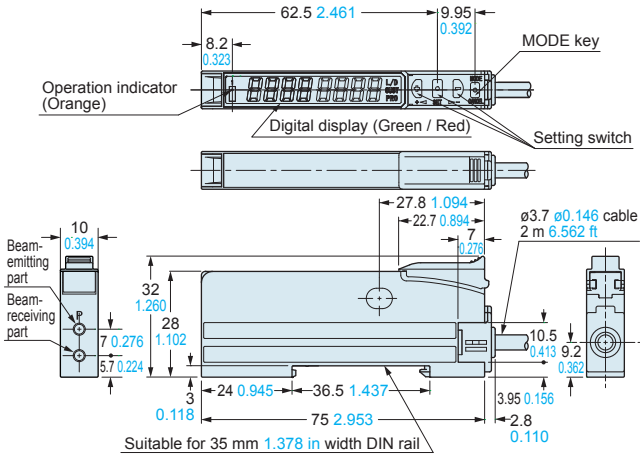
FX-505-C2 FX-505P-C2 — Amplifier



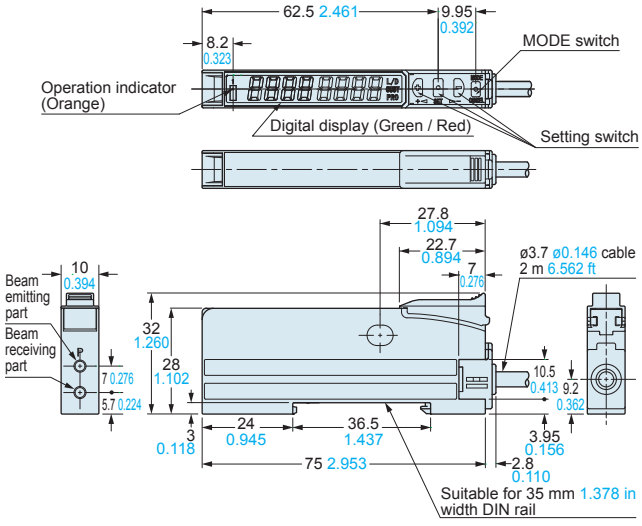
FX-551 FX-551P — Amplifier



FX-551-C2 FX-551P-C2 — Amplifier



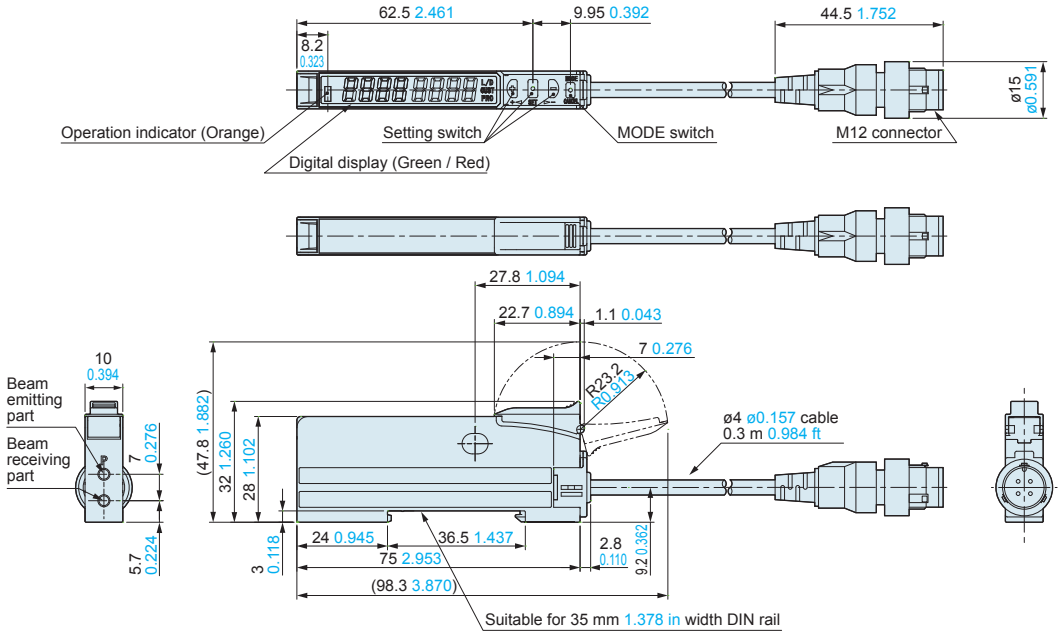
FX-551L3-P-C2 — Amplifier



DIMENSIONS (Unit: mm in)

Refer to our website for fiber dimensions.
The CAD data can be downloaded from our website.

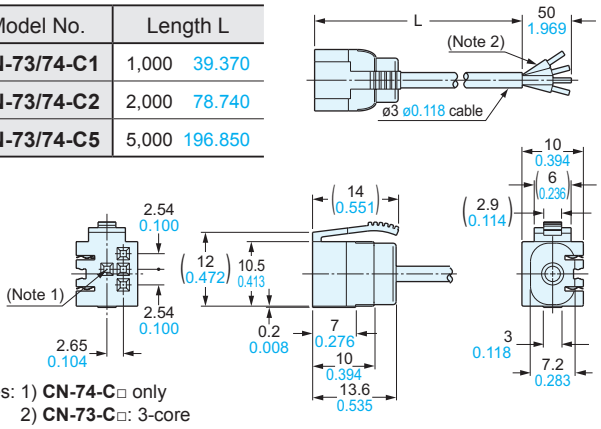
FX-551L3-P-J — Amplifier



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

• Length L

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

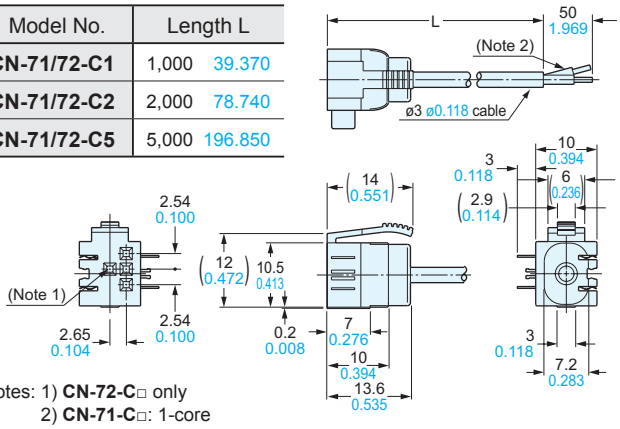


Notes: 1) **CN-74-C□** only
2) **CN-73-C□**: 3-core

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

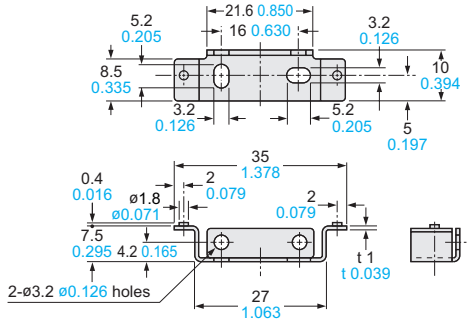
• Length L

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



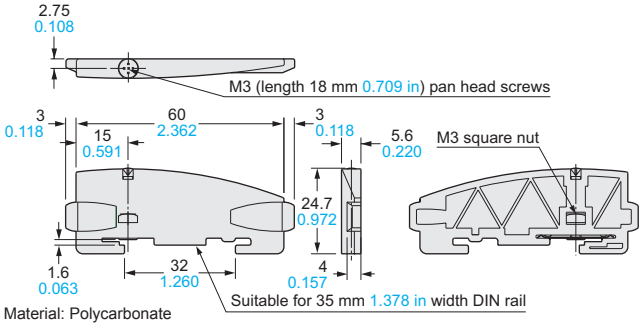
Notes: 1) **CN-72-C□** only
2) **CN-71-C□**: 1-core

MS-DIN-2 — Amplifier mounting bracket (Optional)



Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)

MS-DIN-E — End plate (Optional)



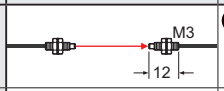
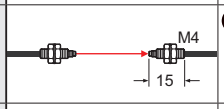
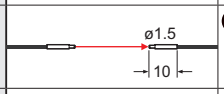
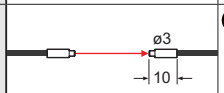
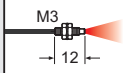
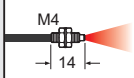
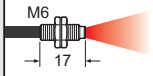
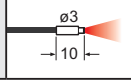
Material: Polycarbonate

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Super quality type

*Thru-beam type sensors are available as two pieces per set.

Type			Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in) (Note 2, 3) FX-500 series	Other modes	U-LG LONG FAST H-SP	FX-550 / FX-550L series	Other modes	U-LG LONG FAST	Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Optical transmission loss	Protection	Ambient temp.
Thru-beam	Threaded	M3		Tough Bending durability **FT-30**	R2	2 m (Note 4)	STD 400 15.748 HYPR 1,350 53.150	810 31.890 650 25.591 210 8.268 75 2.953	2,200 86.614 1,700 66.929 530 20.866 190 7.480	STD 570 22.441 HYPR 1,860 73.228	1,240 48.819 830 32.677 340 13.386	3,100 122.047 2,200 86.614 960 37.795	ø0.5	150 µm / ±2°	±10 %	IP67	−55 to +80 °C
		M4		Tough Bending durability **FT-40**	R4		STD 1,200 47.244 HYPR (Note 1) 3,600 141.732			STD 1,570 61.811 HYPR 3,600 141.732 (Note 1)			ø1				
	Cylindrical	ø1.5		Tough Bending durability **FT-S20**	R2		STD 400 15.748 HYPR 1,350 53.150	810 31.890 650 25.591 210 8.268 75 2.953	2,200 86.614 1,700 66.929 530 20.866 190 7.480	STD 550 21.654 HYPR 1,760 69.291	1,200 47.244 800 31.496 340 13.386	3,100 122.047 2,250 88.583 1,000 39.370	ø0.5				
		ø3		Tough Bending durability **FT-S30**	R4		STD 1,200 47.244 HYPR (Note 1) 3,600 141.732			STD 1,650 64.961 HYPR 3,600 141.732 (Note 1)			ø1				
Reflective	Threaded	M3		Tough Bending durability **FD-30**	R2	2 m (Note 4)	STD 160 6.299 HYPR 600 23.622	330 12.992 250 9.843 80 3.150 25 0.984		STD 210 8.268 HYPR 800 31.496	460 18.110 330 12.992 140 5.512		—	150 µm / ±3°	±10 %	IP67	−55 to +80 °C
		M4		Tough Bending durability **FD-40**													
		M6		Tough Bending durability **FD-60**	R4		STD 520 20.472 HYPR 1,550 61.024	900 35.433 740 29.134 260 10.236 90 3.543		STD 750 29.528 HYPR 1,750 68.898	1,300 51.151 970 38.189 420 16.535						
	Cylindrical	ø3		Tough Bending durability **FD-S30**			STD 160 6.299 HYPR 600 23.622	330 12.992 250 9.843 80 3.150 25 0.984		STD 220 8.661 HYPR 800 31.496	500 19.685 330 12.992 140 5.512						

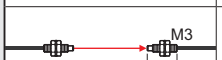
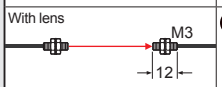
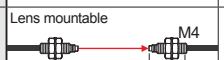
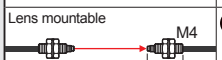
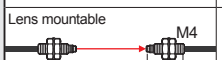
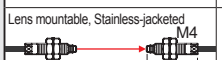
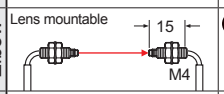
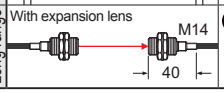
Notes: 1) The fiber cable length practically limits the sensing range.
2) The sensing range of reflective type is specified for white non-glossy paper.
3) The **FX-550L** series does not have FAST mode.
4) It is not a free-cut type.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Threaded type

*Thru-beam type sensors are available as two pieces per set.

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 3) FX-500 series	FX-500 series Other modes U-LG LONG FAST H-SP	FX-550 / FX-550L series	FX-550 / FX-550L series Other modes U-LG LONG FAST	Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Protection	Ambient temp.
Thru-beam Threaded M3		Tough Bending durability **FT-31**	R2	2 m	STD 315 12.402 HYPR 1,350 53.150	770 30.315 550 21.654 210 8.268 70 2.756	STD 480 18.898 HYPR 1,580 62.205	1,000 39.370 700 27.559 290 11.417	ø0.5	150 µm / ±2°	IP67	−55 to +80 °C
		**FT-31W**	R1		STD 260 10.236 HYPR 990 38.976	590 23.228 440 17.323 150 5.906 53 2.087	STD 420 16.535 HYPR 1,300 51.181	890 35.039 580 22.835 250 9.843		150 µm / ±3°		−40 to +60 °C
		Tough Bending durability **FT-32**	R2		STD 3,000 118.110 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,600 62.992 580 22.835	STD 3,600 141.732 (Note 2) HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,900 114.173	ø1.6	—	IP40	−40 to +70 °C
M4		Bending durability **FT-43**	R4		STD 1,400 55.118 HYPR (Note 2) 3,600 141.732	2,800 110.236 2,100 82.677 770 30.315 240 9.449	STD 2,200 86.614 HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,100 122.047 1,400 55.118	ø1.5	150 µm / ±2°	IP67	−55 to +80 °C
		Tough Bending durability **FT-42**			STD 1,130 44.488 HYPR (Note 2) 3,600 141.732	2,050 80.709 1,600 62.992 530 20.866 190 7.480	STD 1,470 57.874 HYPR 3,600 141.732 (Note 2)	2,900 114.173 2,100 82.677 890 35.039	ø1			
		**FT-42W**	R1		STD 800 31.496 HYPR 3,300 129.921	1,900 74.803 1,400 55.118 490 19.291 160 6.299	STD 1,200 47.244 HYPR 3,600 141.732 (Note 2)	2,600 102.362 1,780 70.079 710 27.953		150 µm / ±3°		−40 to +60 °C
		**FT-45X**	R4	1 m	STD 1,200 47.244 HYPR (Note 2) 1,600 62.992	1,600 62.992 (Note 2) 1,600 62.992 (Note 2) 630 24.803 200 7.874	STD 1,600 62.992 (Note 2) HYPR 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2) 1,070 42.126		150 µm / ±2°		−55 to +80 °C
Elbow		Tough Bending durability **FT-R40**	R4	2 m	STD 930 36.614 HYPR (Note 2) 3,600 141.732	1,750 68.898 1,500 59.055 500 19.685 160 6.299	STD 1,400 55.118 HYPR 3,600 141.732 (Note 2)	2,900 114.173 1,950 76.772 860 33.858				
M14 Long range		Tough Bending durability **FT-140**		10 m	STD (Note 2) 19,600 771.654 HYPR (Note 2) 19,600 771.654	19,600 771.654 (Note 2) 19,600 771.654 (Note 2) 16,000 629.921 6,300 248.031	STD 19,600 771.654 (Note 2) HYPR 19,600 771.654 (Note 2)	19,600 771.654 (Note 2) 19,600 771.654 (Note 2) 19,600 771.654 (Note 2)	ø10	—		−40 to +70 °C

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) The **FX-550L** series does not have FAST mode.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Threaded type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2, 3) FX-500 series	FX-500 series Other modes U-LG LONG FAST H-SP	FX-550 / FX-550L series	FX-550 / FX-550L series Other modes U-LG LONG FAST	Beam axis position / Inclination of beam axis	Protection	Ambient temp.
Reflective, Threaded, M3	M3, 12	Tough Bending durability **FD-31**	R2	2 m	STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	STD 200 7.874 HYPR 750 29.528	450 17.717 310 12.205 140 5.512	150 µm / ±3°	IP67	−55 to +80 °C
	M3, 12	**FD-31W**	R1	✂ 2 m	STD 80 3.150 HYPR 330 12.992	180 7.087 140 5.512 45 1.772 12 0.472	STD 130 5.118 HYPR 480 18.898	310 12.205 190 7.480 80 3.150	—		−40 to +60 °C
	Coaxial, Lens mountable, M3, 17	Tough Bending durability **FD-32G**	R2	2 m	STD 200 7.874 HYPR 650 25.591	380 14.961 270 10.630 95 3.740 27 1.063	STD 320 12.598 HYPR 1,150 45.278	730 28.740 420 16.535 170 6.693		IP40	−55 to +80 °C
	Coaxial, Lens mountable, Stainless-jacketed, M3, 18	**FD-32GX**	R2	✂ 1 m (Note 4)	STD 200 7.874 HYPR 630 24.803	410 16.142 360 14.173 100 3.937 30 1.181	STD 320 12.598 HYPR 1,350 53.150	730 28.740 490 19.291 180 7.087			
	Coaxial, With lens, M3, 15	Tough Bending durability **FD-34G**	R2	✂ 2 m	STD 90 3.543 HYPR 330 12.992	185 7.283 135 5.305 49 1.929 15 0.591	STD 130 5.118 HYPR 480 18.898	310 12.205 180 7.087 80 3.150		IP40	−40 to +70 °C
Ultra-small diameter	Coaxial, Lens mountable, M3, 16	**FD-EG30**	R4	500 mm	STD 48 1.890 HYPR 170 6.693	130 5.118 110 4.331 30 1.181 9 0.354	STD 90 3.543 HYPR 320 12.598	190 7.480 120 4.724 50 1.969			
	Coaxial, Lens mountable, M3, 16	**FD-EG31**			STD 20 0.787 HYPR 85 3.346	45 1.772 35 1.378 12 0.472 3.5 0.138	STD 35 1.378 HYPR 120 4.724	70 2.756 45 1.772 20 0.787			−20 to +60 °C
M4	M4, 14	Tough Bending durability **FD-41**	R2	2 m	STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	STD 200 7.874 HYPR 750 29.528	450 17.717 310 12.205 140 5.512	150 µm / ±3°	IP67	−55 to +80 °C
	M4, 14	**FD-41W**	R1		STD 270 10.630 HYPR 900 35.433	630 24.803 430 16.929 150 5.906 45 1.772	STD 480 18.898 HYPR 1,400 55.118	1,000 39.370 680 26.772 270 10.630	—		−40 to +60 °C
	Coaxial, Lens mountable, M4, 25	Tough Bending durability **FD-42G**	R2		STD 200 7.874 HYPR 650 25.591	380 14.961 270 10.630 95 3.740 27 1.063	STD 320 12.598 HYPR 1,150 45.278	730 28.740 420 16.535 170 6.693		IP40	−55 to +80 °C
	Coaxial, Lens mountable, M4, 25	**FD-42GW**	R1		STD 150 5.906 HYPR 670 26.378	340 13.386 280 11.024 90 3.543 25 0.984	STD 210 8.268 HYPR 950 37.402	540 21.260 330 12.992 130 5.118			−40 to +60 °C
M6	M6, 17	Bending durability **FD-62**	R4		STD 520 20.472 HYPR 1,500 59.055	1,000 39.370 940 37.008 340 13.386 110 4.331	STD 880 34.646 HYPR 1,950 76.772	1,450 57.087 1,140 44.882 550 21.654	150 µm / ±3°	IP67	−55 to +80 °C
	M6, 17	Tough Bending durability **FD-61**			STD 450 17.717 HYPR 1,400 55.118	840 33.071 670 26.378 200 7.874 70 2.756	STD 620 24.409 HYPR 1,630 64.173	1,180 46.457 870 34.252 380 14.961			
	M6, 17	**FD-61W**	R1		STD 270 10.630 HYPR 900 35.433	630 24.803 430 16.929 150 5.906 45 1.772	STD 480 18.898 HYPR 1,400 55.118	1,000 39.370 680 26.772 270 10.630	—		−40 to +60 °C
	Coaxial, M6, 17	Tough Bending durability **FD-61G**	R4		STD 420 16.535 HYPR 1,100 43.307	800 31.496 650 25.591 200 7.874 60 2.362	STD 600 23.622 HYPR 1,350 53.150	1,200 47.244 850 33.465 350 13.780		IP40	−55 to +80 °C
	Stainless-jacketed, M6, 22	**FD-64X**	R4	1 m	STD 280 11.024 HYPR 670 26.378	500 19.685 410 16.142 160 6.299 50 1.969	STD 410 16.142 HYPR 1,200 47.244	700 27.559 590 23.228 230 9.055			
Elbow	15, M6	Tough Bending durability **FD-R60**	R4	✂ 2 m	STD 290 11.417 HYPR 1,100 43.307	600 23.622 550 21.654 190 7.480 65 2.559	STD 500 19.685 HYPR 1,450 57.087	1,150 45.276 800 31.496 350 13.780	150 µm / ±3°	IP67	

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The sensing range is specified for white non-glossy paper.
3) The **FX-550L** series does not have FAST mode.
4) The allowable cutting range is 700 mm 27.559 in from the end that the amplifier inserted.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Square head type

*Thru-beam type sensors are available as two pieces per set.

Type			Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 3, 4) FX-500 series	Other modes / U-LG LONG FAST H-SP	FX-550 / FX-550L series	Other modes / U-LG LONG FAST	Beam axis dia. (Fiber Core) (mm)	Protection	Ambient temp.
Thru-beam	Square head	M3	M3 W5.5 × H8 × D16	Tough Bending durability FT-R31	R2	2 m	STD 270 10.630 HYPR 1,000 39.370	580 22.835 / 440 17.323 / 160 6.299 / 55 2.165	STD 510 20.079 HYPR 1,670 65.748	1,120 44.094 / 700 27.559 / 310 12.205	ø0.5	IP67	−55 to +80 °C
		M4	Lens mountable M4 W7 × H9 × D13.5	Tough Bending durability FT-R43	R4		STD 720 28.346 HYPR 3,000 118.110	1,600 62.992 / 1,100 43.307 / 430 16.929 / 130 5.118	STD 1,250 49.213 HYPR 3,600 141.732 (Note 2)	2,650 104.331 / 1,750 68.898 / 750 29.528	ø1		
			Lens mountable (FX-LE2) M4 W7 × H9 × D13.9	FT-R41W	R1		STD 800 31.496 HYPR 3,200 125.984	1,800 70.866 / 1,400 55.118 / 460 18.110 / 150 5.906	STD 1,300 51.181 HYPR 3,600 141.732 (Note 2)	2,900 114.173 / 1,850 72.835 / 800 31.496		IP40	−40 to +60 °C
			With expansion lens M4 W7 × H9 × D14.4	FT-R42W			STD 2,200 86.614 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) / 3,500 137.795 / 1,300 51.181 / 460 18.110	STD 3,600 141.732 (Note 2) HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) / 3,600 141.732 (Note 2) / 2,800 110.236	ø2.2		
		M4 Oil-resistant	Cable-protection type Lens mountable M4 W7 × H9.5 × D15.5	Tough Bending durability FT-R44Y	R4		STD 720 28.346 HYPR 3,000 118.110	1,600 62.992 / 1,100 43.307 / 430 16.929 / 130 5.118	STD 1,300 51.181 HYPR 3,600 141.732 (Note 2)	2,900 114.173 / 1,800 70.866 / 800 31.496	ø1	IP67 (Note 5)	−55 to +80 °C
		M6 Oil-resistant	Full-protection type M6 W10 × H11 × D21.2	Tough Bending durability FT-R60Y			STD 2,100 82.677 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) / 3,600 141.732 (Note 2) / 1,260 49.606 / 400 15.748	STD 3,600 141.732 (Note 2) HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) / 3,600 141.732 (Note 2) / 1,900 74.803	ø3.5	IP68G	
Reflective	Square head	M3	Coaxial, Lens mountable M3 W5.5 × H8 × D16	Tough Bending durability FD-R31G	R2	2 m	STD 170 6.693 HYPR 530 20.866	310 12.205 / 260 10.236 / 85 3.346 / 27 1.063	STD 290 11.417 HYPR 900 35.433	600 23.622 / 400 15.748 / 160 6.299	Emitter ø0.5	IP40	−55 to +80 °C
			Coaxial, Lens mountable M3 W5.5 × H8 × D16	FD-R32EG	R4	500mm	STD 45 1.772 HYPR 170 6.693	110 4.331 / 92 3.622 / 30 1.181 / 9 0.354	STD 80 3.150 HYPR 290 11.417	180 7.087 / 110 4.331 / 45 1.772	Emitter ø0.25		−40 to +70 °C
			Coaxial, Lens mountable M3 W5.5 × H8 × D16	FD-R34EG			STD 38 1.496 HYPR 130 5.118	90 3.543 / 70 2.756 / 23 0.906 / 7 0.276	STD 70 2.756 HYPR 250 9.843	140 5.512 / 90 3.543 / 40 1.575	Emitter ø0.175		−20 to +60 °C
			Coaxial, Lens mountable M3 W5.5 × H8 × D16	FD-R33EG			STD 19 0.748 HYPR 84 3.307	44 1.732 / 33 1.299 / 11 0.433 / 3 0.118	STD 30 1.181 HYPR 110 4.331	65 2.559 / 40 1.575 / 18 0.709	Emitter ø0.125		
		M4	M4 W7 × H9 × D13.5	Tough Bending durability FD-R41	R2	2 m	STD 210 8.268 HYPR 710 27.953	430 16.929 / 320 12.598 / 100 3.937 / 34 1.339	STD 340 13.386 HYPR 1,150 45.276	750 29.528 / 450 17.716 / 190 7.480	ø0.75	IP67	−55 to +80 °C
		M6 Oil-resistant	Cable-protection type M6 W10 × H11 × D15.5	Tough Bending durability FD-R61Y	R4		STD 280 11.024 HYPR 990 38.976	610 24.016 / 435 17.126 / 160 6.299 / 50 1.969	STD 450 17.717 HYPR 1,350 53.150	1,000 39.370 / 650 25.591 / 250 9.843	—	IP67 (Note 5)	

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) The **FX-550L** series does not have FAST mode.
4) The sensing range of reflective type is specified for white non-glossy paper.
5) The fiber part is oil-resistant.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Cylindrical type

*Thru-beam type sensors are available as two pieces per set.

Type			Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1 ,3, 4) FX-500 series	FX-500 series Other modes	FX-500 series U-LG LONG FAST H-SP	FX-550 / FX-550L series	FX-550 / FX-550L series Other modes	FX-550 / FX-550L series U-LG LONG FAST	Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Protection	Ambient temp.
Thru-beam	Cylindrical	ø1	ø1 6	Tough Bending durability FT-S11	R2	500 mm	STD 90 3.543 HYPR 350 13.780	210 8.268 160 6.299 60 2.362 19 0.748		STD 130 5.118 HYPR 400 15.748		280 11.024 180 7.867 80 3.145	ø0.25	—	IP67	−55 to +80 °C
		ø1·5	ø1.5 10	Tough Bending durability FT-S21	R2	✂ 2 m	STD 315 12.402 HYPR 1,350 53.150	770 30.315 550 21.654 210 8.268 70 2.756		STD 450 17.717 HYPR 1,600 62.992		1,000 39.370 670 26.378 280 11.024	ø0.5	150 µm / ±2°		
			ø1.5 10	FT-S21W	R1		STD 260 10.236 HYPR 990 38.976	590 23.228 440 17.323 150 5.906 53 2.087		STD 400 15.748 HYPR 1,650 64.961		850 33.465 580 22.835 240 9.449		150 µm / ±3°		−40 to +60 °C
			With lens ø1.5 8	Tough Bending durability FT-S22			STD 450 17.717 HYPR 1,500 59.055	920 36.220 730 28.740 250 9.843 90 3.543		STD 870 34.252 HYPR 2,900 114.173		1,900 74.803 1,200 47.244 530 20.866	ø0.7	—	IP40	−40 to +70 °C
		ø2·5	With lens, Long sensing range ø2.5 8	Bending durability FT-S32	R10		STD 3,100 122.047 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,800 70.866 600 23.622		STD 3,600 141.732 (Note 2) HYPR 3,600 141.732 (Note 2)		3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,000 118.110	ø2			
		ø3	ø3 10	FT-S31W	R1		STD 800 31.496 HYPR 3,300 129.921	1,900 74.803 1,400 55.118 490 19.291 160 6.299		STD 1,100 43.307 HYPR 3,600 141.732 (Note 2)		2,450 96.457 1,600 62.992 650 25.591	ø1	150 µm / ±3°		−40 to +60 °C
	Ultra-small diameter	ø3	Narrow beam ø0.125mm ø0.25 ø3 Sleeve part cannot be bent. 5 15	Tough Bending durability FT-E13	R2	✂ 1 m	STD 15 0.591 HYPR 52 2.047	30 1.181 24 0.945 8 0.315 2 0.079		STD 21 0.827 HYPR 68 2.677		45 1.772 30 1.181 12 0.472	ø0.125	—	IP67	−40 to +70 °C
			Narrow beam ø0.25mm ø0.4 ø3 Sleeve part cannot be bent. 5 15	Tough Bending durability FT-E23			STD 75 2.953 HYPR 270 10.630	160 6.299 125 4.921 42 1.654 13 0.512		STD 120 4.724 HYPR 355 13.976		250 9.843 165 6.496 70 2.756	ø0.25			
	Side-view	ø4	ø4 3 25	Tough Bending durability FT-V40	R4	✂ 2 m	STD 3,500 137.795 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,400 94.488 850 33.465		STD 3,600 141.732 (Note 2) HYPR 3,600 141.732 (Note 2)		3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	ø2.5		IP50	−40 to +60 °C
Reflective	Cylindrical	ø1·5	ø1.5 10	Tough Bending durability FD-S21	R2	1 m	STD 80 3.150 HYPR 190 7.480	130 5.118 110 4.331 37 1.457 11 0.433		STD 85 3.346 HYPR 175 6.890		130 5.118 110 4.331 50 1.969	—	—	IP40	−55 to +80 °C
		ø3	ø3 15	Tough Bending durability FD-S32	R4	✂ 2 m	STD 420 16.535 HYPR 1,200 47.244	790 31.102 660 25.984 220 8.661 75 2.953		STD 600 23.622 HYPR 1,600 62.992		1,200 42.244 900 35.433 350 13.780	—	150 µm / ±3°	IP67	−55 to +80 °C
			ø3 15	FD-S32W	R1		STD 270 10.630 HYPR 900 35.433	630 24.803 430 16.929 150 5.906 45 1.772		STD 450 17.717 HYPR 1,400 55.118		1,000 39.370 650 25.591 250 9.843		—		−40 to +60 °C
			ø3 10	Tough Bending durability FD-S31	R2		STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984		STD 200 7.874 HYPR 700 27.559		450 17.717 300 11.811 130 5.118		150 µm / ±3°		−55 to +80 °C
			Coaxial ø3 15	FD-S33GW	R1		STD 150 5.906 HYPR 670 26.378	340 13.386 280 11.024 90 3.543 25 0.984		STD 240 9.449 HYPR 880 34.646		550 21.654 370 14.567 150 5.906		—	IP40	−40 to +60 °C
			Coaxial, With lens ø3 15	Tough Bending durability FD-S34G	R2		STD 90 3.543 HYPR 330 12.992	185 7.283 135 5.305 49 1.929 15 0.591		STD 130 5.118 HYPR 480 18.898		310 12.205 180 7.187 80 3.150				−40 to +60 °C
	Ultra-small diameter	ø1·5	ø1.5 ø0.48 15 3 Sleeve part cannot be bent.	FD-E13	R4	1 m	STD 12 0.472 HYPR 50 1.969	29 1.142 25 0.984 7 0.276 2 0.079		STD 23 0.906 HYPR 75 2.953		50 1.969 30 1.181 12 0.472				−40 to +60 °C
		ø3	Coaxial ø3 ø0.63 15 5 Sleeve part cannot be bent.	FD-E23			STD 55 2.165 HYPR 170 6.693	120 4.724 80 3.150 30 1.181 9 0.354		STD 80 3.150 HYPR 290 11.417		170 6.693 105 4.134 45 1.772				−40 to +70 °C

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) The **FX-550L** series does not have FAST mode.
4) The sensing range of reflective type is specified for white non-glossy paper.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Sleeve type

*Thru-beam type sensors are available as two pieces per set.

Type			Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 4 ,5) FX-500 series	Other modes	U-LG LONG FAST H-SP	FX-550 / FX-550L series	Other modes	U-LG LONG FAST	Beam axis dia. (mm)	Protection	Ambient temp.
Thru-beam	Threaded	M3	Sleeve 40mm M3 ø0.88 10	Tough Bending durability FT-31S	R2 (Note 2)	✂ 2 m	STD 315 12.402 HYPR 1,220 48.031		740 29.134 550 21.654 195 7.677 63 2.480	STD 480 18.898 HYPR 1,580 62.205		1,000 39.370 700 27.559 290 11.417	ø0.5	IP67	−55 to +80 °C
		M4	Sleeve 40mm M4 ø1.48 12	Tough Bending durability FT-42S	R4 (Note 2)		STD 1,130 44.488 HYPR (Note 3) 3,600 141.732		2,050 80.709 1,600 62.992 530 20.866 190 7.480	STD 1,470 57.874 HYPR 3,600 141.732 (Note 3)		2,900 114.173 2,100 82.677 890 35.039	ø1		
	Ultra-small diameter	ø3	Narrow beam ø0.125mm ø0.25 ø3 Sleeve part cannot be bent. 5 15	Tough Bending durability FT-E13	R2	✂ 1 m	STD 15 0.591 HYPR 52 2.047		30 1.181 24 0.945 8 0.315 2 0.079	STD 21 0.827 HYPR 68 2.677		45 1.772 30 1.181 12 0.472	ø0.125		−40 to +70 °C
			Narrow beam ø0.25mm ø0.4 ø3 Sleeve part cannot be bent. 5 15	Tough Bending durability FT-E23			STD 75 2.953 HYPR 270 10.630		160 6.299 125 4.921 42 1.654 13 0.512	STD 120 4.724 HYPR 355 13.976		250 9.843 165 6.496 70 2.756	ø0.25		
	Side-view	ø2	ø1 ø2 Sleeve part cannot be bent. 20 15	Tough Bending durability FT-V23	R4	✂ 2 m	STD 450 17.717 HYPR 1,800 70.866		1,000 39.370 880 34.646 280 11.024 90 3.543	STD 750 29.528 HYPR 2,400 94.488		1,600 62.992 1,050 41.339 450 17.717	ø0.75	IP30	−55 to +80 °C
			ø1 ø2 Sleeve part cannot be bent. 15 15	Tough Bending durability FT-V25	R2		STD 240 9.449 HYPR 900 35.433		550 21.654 480 18.898 140 5.512 45 1.772	STD 450 17.717 HYPR 1,400 55.118		950 37.402 630 24.803 280 11.024	ø0.5		
			ø1 ø2 Sleeve part cannot be bent. 15 15	FT-V24W	R1		STD 110 4.331 HYPR 380 14.961		230 9.055 200 7.874 60 2.362 20 0.787	STD 160 6.299 HYPR 500 19.685		350 13.780 220 8.661 95 3.740			−40 to +60 °C
		ø2.5	ø1.5 ø2.5 Sleeve part cannot be bent. 20 15	Tough Bending durability FT-V30	R4		STD 680 26.772 HYPR 2,200 86.614		1,200 47.244 1,000 39.370 340 13.386 100 3.937	STD 950 37.402 HYPR 3,600 141.732 (Note 3)		1,950 76.772 1,300 51.181 550 21.654	ø1.0		−55 to +80 °C
Reflective	Threaded	Ultra-small diameter M3	Sleeve 15 mm M3 ø0.8 15 Sleeve part cannot be bent.	FD-EG30S	R4	1 m	STD 50 1.969 HYPR 170 6.693		110 4.331 80 3.150 30 1.181 9 0.354	STD 90 3.543 HYPR 320 12.598		190 7.480 120 4.724 50 1.969	—	IP40	−40 to +70 °C
		M4	Sleeve 40 mm M4 ø1.48 12	Tough Bending durability FD-41S	R2 (Note 2)	✂ 2 m	STD 125 4.921 HYPR 515 20.276		290 11.417 220 8.661 80 3.150 25 0.984	STD 200 7.874 HYPR 750 29.528		450 17.717 310 12.205 140 5.512		IP67	−55 to +80 °C
			Sleeve 40 mm M4 ø1.48 12	FD-41SW	R1 (Note 2)		STD 80 3.150 HYPR 330 12.992		180 7.087 140 5.512 45 1.772 12 0.472	STD 130 5.118 HYPR 480 18.898		310 12.205 190 7.480 80 3.150			−40 to +60 °C
		M6	Sleeve 40 mm M6 ø2.5 15	Tough Bending durability FD-61S	R4 (Note 2)		STD 420 16.535 HYPR 1,200 47.244		790 31.102 660 25.984 220 8.661 75 2.953	STD 650 25.591 HYPR 1,900 74.803		1,300 51.181 900 35.433 400 15.748			−55 to +80 °C
	Cylindrical	Ultra-small diameter	ø1.5 ø0.48 15 3 Sleeve part cannot be bent.	FD-E13	R4	1 m	STD 12 0.472 HYPR 50 1.969		29 1.142 25 0.984 7 0.276 2 0.079	STD 23 0.906 HYPR 75 2.953		50 1.969 30 1.181 12 0.472		IP40	−40 to +60 °C
		ø3	Coaxial ø3 ø0.63 15 15 Sleeve part cannot be bent.	FD-E23			STD 55 2.165 HYPR 170 6.693		120 4.724 80 3.150 30 1.181 9 0.354	STD 80 3.150 HYPR 290 11.417		170 6.693 105 4.134 45 1.772			−40 to +70 °C
		Side-view ø3	Small diameter 15 15 ø3 ø1.5 Sleeve part cannot be bent.	Tough Bending durability FD-V30	R2	✂ 2 m	STD 65 2.559 HYPR 240 9.449		130 5.118 120 4.724 35 1.378 14 0.551	STD 90 3.243 HYPR 430 16.929		210 8.268 145 5.709 65 2.559		IP30	−55 to +80 °C
			15 15 ø3 ø1.5 Sleeve part cannot be bent.	FD-V30W	R1		STD 20 0.787 HYPR 80 3.150		40 1.575 30 1.181 10 0.394 2 0.079	STD 30 1.181 HYPR 120 4.724		65 2.559 37 1.457 16 0.630			−40 to +60 °C
		ø5	15 20 ø2 ø5 Sleeve part cannot be bent.	Tough Bending durability FD-V50	R4		STD 120 4.724 HYPR 370 14.567		220 8.661 210 8.268 75 2.953 25 0.984	STD 180 7.087 HYPR 530 20.866		400 15.748 240 9.449 110 4.331			−55 to +80 °C

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) Bending radius of sleeve part is R10 mm R0.394 in or more.
3) The fiber cable length practically limits the sensing range.
4) The **FX-550L** series does not have FAST mode.
5) The sensing range of reflective type is specified for white non-glossy paper.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Flat type

*Thru-beam type sensors are available as two pieces per set.

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 3, 4) FX-500 series	FX-500 series Other modes	FX-500 series U-LG LONG FAST H-SP	FX-550 / FX-550L series	FX-550 / FX-550L series Other modes	FX-550 / FX-550L series U-LG LONG FAST	Beam axis dia. (mm)	Protection	Ambient temp.
Thru-beam, Flat	Top sensing W3 × H8 × D12	Tough Bending durability FT-Z30H	R2	✂ 2 m	STD 3,500 137.795 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,600 102.362 810 31.890	STD 3,600 141.732 (Note 2) HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	2 × 3	IP40	−40 to +60 °C
	Top sensing W3 × H8 × D12	FT-Z30HW	R1										
	Side sensing W3 × H12 × D8	Tough Bending durability FT-Z30E	R2		STD 3,500 137.795 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,400 94.488 740 29.134	STD 3,600 141.732 (Note 2) HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2)					
	Side sensing W3 × H12 × D8	FT-Z30EW	R1		STD 3,400 133.858 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,000 78.740 630 24.803	STD 3,600 141.732 (Note 2) HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2)					
	Front sensing W8.5 × H12 × D3	Tough Bending durability FT-Z30	R2		STD 2,100 82.677 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,200 47.244 410 16.142	STD 3,600 141.732 (Note 2) HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,200 86.614	ø2				
	Front sensing W8.5 × H12 × D3	FT-Z30W	R1		STD 1,500 59.055 HYPR (Note 2) 3,600 141.732	3,300 129.921 3,200 125.984 1,000 39.370 280 11.024	STD 2,800 110.236 HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,700 66.929					
	With boss: Front sensing W10 × H7 × D2	FT-Z20W		✂ 1 m	STD 620 24.409 HYPR (Note 2) 1,600 62.992	1,500 59.055 1,100 43.307 420 16.535 130 5.118	STD 1,100 43.307 HYPR 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2) 650 25.591	ø1.5				
	With boss: Fiber guide type W2 × H10 × D10	FT-Z20HBW	R1		STD 260 10.236 HYPR 1,100 43.307	670 26.378 570 22.441 180 7.087 55 2.165	STD 450 17.717 HYPR 1,600 62.992 (Note 2)	1,000 39.370 650 25.591 280 11.024	ø0.5	IP67			
	With boss: Front sensing W14 × H7 × D3.5	FT-Z40W			STD 1,500 59.055 HYPR (Note 2) 3,600 141.732	3,300 129.921 2,300 90.551 900 35.433 290 11.417	STD 2,000 78.740 HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 2,800 110.236 1,200 47.244	ø1.5	IP40			
	With boss: Fiber guide type W3.5 × H14 × D11	FT-Z40HBW		✂ 2 m	STD 800 31.496 HYPR 3,300 129.921	1,900 74.803 1,400 55.118 490 19.291 160 6.299	STD 1,300 51.181 HYPR 3,600 141.732 (Note 2)	2,700 106.299 1,850 72.835 750 29.528	ø1	IP67			
	Chemical-resistant: Easy mounting, Rectangular head SEMI S2 compliant (Note 5) Metal-free W7 × H15 × D13	Tough Bending durability FT-Z802Y	R4		STD 3,100 122.047 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,900 74.803 470 18.504	STD 3,600 141.732 (Note 2) HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	ø3.7	IP68G	0 to +60 °C
Reflective, Flat, With boss	Front sensing W10 × H7 × D2	FD-Z20W		✂ 1 m	STD 1 to 65 0.039 to 2.559 HYPR 260 10.236	150 5.906 130 5.118 2 to 45 0.079 to 1.772 5 to 13 0.197 to 0.512	STD 130 5.118 HYPR 450 17.717	290 11.417 190 7.480 80 3.150	—	IP40	−40 to +60 °C		
	Fiber guide type W2 × H10 × D10	FD-Z20HBW	R1		STD 2 to 85 0.079 to 3.346 HYPR 1 to 340 0.039 to 13.386	1 to 210 0.039 to 8.268 1 to 180 0.039 to 7.087 2 to 55 0.079 to 2.165 3 to 15 0.118 to 0.591	STD 170 6.693 HYPR 550 21.254	370 14.567 240 9.449 100 3.937		IP67			
	Front sensing W14 × H7 × D3.5	FD-Z40W		✂ 2 m	STD 190 7.480 HYPR 790 31.102	440 17.323 390 15.354 1 to 120 0.039 to 4.724 2 to 35 0.079 to 1.378	STD 390 15.254 HYPR 1,500 59.155	950 37.402 510 20.079 230 9.055		IP40			
	Fiber guide type W3.5 × H14 × D11	FD-Z40HBW			STD 260 10.236 HYPR 760 29.921	540 21.260 470 18.504 1 to 160 0.039 to 6.299 2 to 50 0.079 to 1.969	STD 480 18.898 HYPR 1,350 53.150	1,000 39.370 680 26.772 270 10.630		IP67			

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) The **FX-550L** series does not have FAST mode.
4) The sensing range of reflective type is specified for white non-glossy paper.
5) The design takes into account the environmental testing required by SEMI S2. To ensure that the final system complies with the standards, you must design and use it in accordance with relevant standards, regulations, and regulations.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Convergent reflective type

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2, 3) FX-500 series	FX-500 series Other modes U-LG LONG FAST H-SP	FX-550 / FX-550L series	FX-550 / FX-550L series Other modes U-LG LONG FAST	Protection	Ambient temp.
Convergent reflective	Glass substrate detection	Mapping W25 × H7.3 × D30	Bending durability **FD-L32H**	R4	4 m	STD 0 to 56 0 to 2.205 HYPR 0 to 110 0 to 4.331	0 to 87 0 to 3.425 0 to 74 0 to 2.913 1 to 38 0.039 to 1.496 Cannot use	STD 0 to 65 0 to 2.559 HYPR 0 to 100 0 to 3.397	0 to 90 0 to 3.543 0 to 75 0 to 2.953 0 to 50 0 to 1.969	IP40	−40 to +60 °C
		Alignment W20 × H29 × D3.8	Tough Bending durability **FD-L30A**	R2	3 m	STD 0 to 43 0 to 1.693 HYPR 0 to 43 0 to 1.693	0 to 43 0 to 1.693 0 to 43 0 to 1.693 0 to 42 0 to 1.654 0 to 29 0 to 1.142	STD 0 to 52 0 to 2.047 HYPR 0 to 72 0 to 2.835	0 to 68 0 to 2.677 0 to 62 0 to 2.441 0 to 46 0 to 1.811		0 to +70 °C
		Alignment W23.5 × H29 × D4.5	Tough Bending durability **FD-L31A**	R4		STD 4 to 33 0.157 to 1.299 HYPR 3 to 35 0.118 to 1.378	4 to 33 0.157 to 1.299 4 to 33 0.157 to 1.299 4 to 32 0.157 to 1.260 5 to 25 0.197 to 0.984	STD 3 to 42 0.118 to 1.654 HYPR 0 to 50 0 to 1.967	2 to 43 0.079 to 1.693 3 to 42 0.118 to 1.654 3 to 40 0.118 to 1.575		
		Alignment W17 × H29 × D3.8	Tough Bending durability **FD-L22A**	R2	2 m	STD 0 to 24 0 to 0.945 HYPR 0 to 31 0 to 1.220	0 to 28 0 to 1.102 0 to 27 0 to 1.063 0 to 24 0 to 0.945 0 to 18 0 to 0.709	STD 0 to 34 0 to1.339 HYPR 0 to 35 0 to 1.378	0 to 35 0 to 1.378 0 to 35 0 to 1.378 0 to 32 0 to 1.260		
		Seating confirmation W18 × H29 × D3.8	Tough Bending durability **FD-L23**		3 m	STD 0 to 29 0 to 1.142 HYPR 0 to 30 0 to 1.181	0 to 30 0 to 1.181 0 to 30 0 to 1.181 0 to 28 0 to 1.102 1.5 to 24 0.059 to 0.945	STD 0 to 34 0 to1.339 HYPR 0 to 34 0 to1.339	0 to 34 0 to 1.339 0 to 34 0 to 1.339 0 to 32 0 to 1.260		−20 to +70 °C
		Seating confirmation W12 × H19 × D3	Tough Bending durability **FD-L11**	R4	2 m	STD 0 to 9.5 0 to 0.374 HYPR 0 to 11.5 0 to 0.453	0 to 10.5 0 to 0.413 0 to 10 0 to 0.394 0 to 9 0 to 0.354 0 to 8 0 to 0.315	STD 0 to 13 0 to 0.512 HYPR 0 to 14 0 to 0.551	0 to 13 0 to 0.512 0 to 13 0 to 0.512 0 to 12 0 to 0.472		−40 to +60 °C
		Seating confirmation W12 × H19 × D3	Tough Bending durability **FD-L10**			STD 0 to 5 0 to 0.197 HYPR 0 to 6 0 to 0.236	0 to 5.5 0 to 0.217 0 to 5.5 0 to 0.217 0 to 4.5 0 to 0.177 0 to 4 0 to 0.157	STD 0 to 5 0 to 0.197 HYPR 0 to 6 0 to 0.236	0 to 5.5 0 to 0.217 0 to 5.5 0 to 0.217 0 to 5 0 to 0.197		
		W24 × H21 × D4	Tough Bending durability **FD-L21**	R2		STD 1.5 to 16 0.059 to 0.630 HYPR 1 to 19 0.039 to 0.748	1 to 18 0.039 to 0.709 1 to 18 0.039 to 0.709 2 to 15 0.079 to 0.591 3 to 12 0.118 to 0.472	STD 1 to 19 0.039 to 0.748 HYPR 1 to 20 0.039 to 0.787	1 to 20 0.039 to 0.787 1 to 19 0.039 to 0.748 2 to 18 0.079 to 0.709		
		W24 × H21 × D4	**FD-L21W**	R1		STD 3 to 14 0.118 to 0.551 HYPR 1.5 to 15 0.059 to 0.591	2 to 15 0.079 to 0.591 2 to 15 0.079 to 0.591 4 to 14 0.157 to 0.551 6.5 to 10 0.256 to 0.394	STD 2 to 18 0.079 to 0.709 HYPR 1 to 19 0.039 to 0.748	1 to 19 0.039 to 0.748 2 to 18 0.079 to 0.709 3 to 17 0.118 to 0.669		
	General purpose	W6 × H18 × D14	Tough Bending durability **FD-L20H**	R2		STD 0 to 23 0 to 0.906 HYPR 0 to 45 0 to 1.772	0 to 35 0 to 1.378 0 to 32 0 to 1.260 2 to 15 0.079 to 0.591 5 to 9 0.197 to 0.354	STD 0 to 33 0 to 1.229 HYPR 0 to 65 0 to 2.559	0 to 50 0 to 1.969 0 to 40 0 to 1.575 0 to 25 0 to 0.984		−40 to +70 °C
	Ultra-small	W7.2 × H7.5 × D2	**FD-L12W**	R1	1 m	STD 0 to 8 0 to 0.315 HYPR 0 to 14 0 to 0.551	0 to 12.5 0 to 0.492 0 to 12 0 to 0.472 0.5 to 7 0.020 to 0.276 0.5 to 4 0.020 to 0.157	STD 0 to 12 0 to 0.472 HYPR 0 to 17 0 to 0.669	0 to 16 0 to 0.630 0 to 15 0 to 0.591 0 to 10 0 to 0.394	IP30	−40 to +60 °C

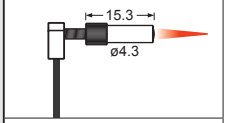
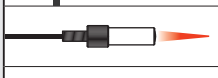
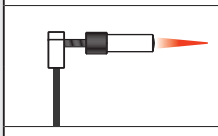
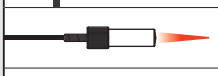
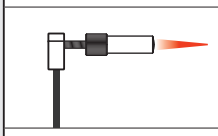
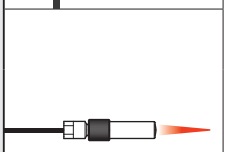
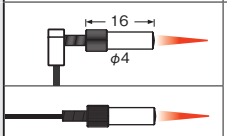
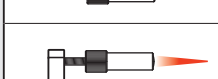
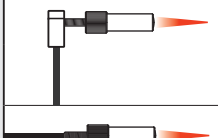
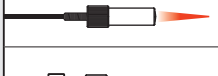
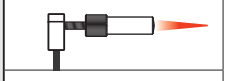
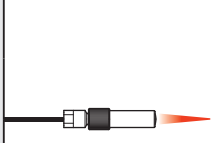
Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The sensing range is specified for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in (**FD-L32H**: R edge, **FD-L21** and **FD-L21W**: t2 mm t0.079 in) (**FD-L20H**: white non-glossy paper, **FD-L10**: silicon wafers 100 × 100 mm 3.937 × 3.937 in).
3) The **FX-550L** series does not have FAST mode.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Small spot

Reflective type fiber & spot lens

Designation	Shape of head (mm)	Spot diameter (mm in) (Note 1)	Sensing range (mm in) (Note 1)	Lens		Applicable fibers				
				Model No.	Ambient temp.	Model No.	Fiber cable length ✂: Free-cut (Note 2)	Bending radius (mm)	Protection	Ambient temp.
Finest spot lens		ø0.1 ø0.004 approx.	Distance to focal point 7 ±0.5 0.276 ±0.020	FX-MR7	−55 to +70 °C	FD-R33EG	500 mm	R4	IP40	−20 to +60 °C
						FD-EG31				
		ø0.15 ø0.006 approx.				FD-R34EG				
		ø0.2 ø0.008 approx.				FD-R32EG				−40 to +70 °C
						FD-EG30				
		ø0.4 ø0.016 approx.				Tough Bending durability FD-R31G		R2		−55 to +80 °C
						Tough Bending durability FD-42G	✂ 2 m			
						FD-42GW		R1		−40 to +60 °C
						Tough Bending durability FD-32G		R2		−55 to +80 °C
						FD-32GX	✂ 1 m (Note 3)			
		ø0.1 ø0.004 approx.	Distance to focal point 7 ±0.5 0.276 ±0.020	FX-MR6	−20 to +60°C	FD-R33EG	500mm	R4		−20 to +60°C
						FD-EG31				
		ø0.15 ø0.006 approx.				FD-R34EG				
		ø0.2 ø0.008 approx.				FD-R32EG				−40 to +70°C
						FD-EG30				
		ø0.4 ø0.016 approx.				Tough Bending durability FD-R31G		R2		−55 to +80°C
						Tough Bending durability FD-42G	✂ 2m			
						FD-42GW		R1		−40 to +60°C
						Tough Bending durability FD-32G		R2		−55 to +80°C
						FD-32GX	✂ 1m (Note 3)			

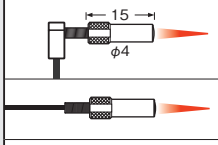
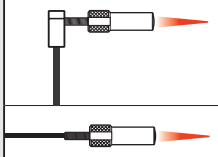
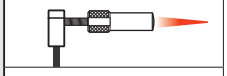
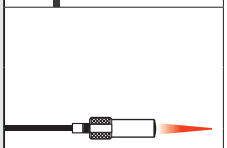
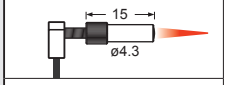
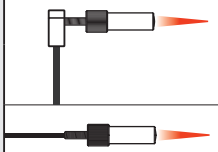
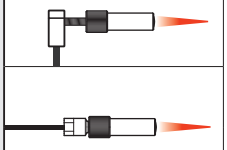
Notes: 1) Spot diameter, sensing range and distance to focal point are specified for **FX-500** / **FX-550** / **FX-550L** series.
2) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
3) The allowable cutting range is 700 mm 27.559 in from the end that the amplifier inserted.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Small spot

Reflective type fiber & spot lens

Designation	Shape of head (mm)	Spot diameter (mm in) (Note 1)	Sensing range (mm in) (Note 1)	Lens		Applicable fibers				
				Model No.	Ambient temp.	Model No.	Fiber cable length ✂: Free-cut (Note 2)	Bending radius (mm)	Protection	Ambient temp.
Finest spot lens		ø0.15 ø0.006 approx.	Distance to focal point 7.5 ±0.5 0.295 ±0.020	FX-MR3	−40 to +70 °C	FD-R33EG	500mm	R4	IP40	−20 to +60 °C
						FD-EG31				
		ø0.2 ø0.008 approx.				FD-R34EG				
		ø0.3 ø0.012 approx.				FD-R32EG				−40 to +70 °C
						FD-EG30				
		ø0.5 ø0.020 approx.				Tough Bending durability FD-R31G	2m	R2		−55 to +80 °C
						Tough Bending durability FD-42G				
						FD-42GW		R1		−40 to +60 °C
						Tough Bending durability FD-32G		R2		−55 to +80 °C
						FD-32GX	✂1m (Note 3)			
Zoom lens		ø0.4 to ø2.0 ø0.016 to ø0.079 approx.	10 to 30 0.394 to 1.181	FX-MR8	−55 to +70 °C	FD-R33EG	500 mm	R4		−20 to +60 °C
						FD-EG31				
		ø0.4 to ø2.2 ø0.016 to ø0.087 approx.				FD-R34EG				
		ø0.5 to ø2.5 ø0.020 to ø0.098 approx.				FD-R32EG				−40 to +70 °C
						FD-EG30				
		ø0.8 to ø3.5 ø0.031 to ø0.138 approx.				Tough Bending durability FD-R31G	✂ 2 m	R2		−55 to +80 °C
						Tough Bending durability FD-32G				
						FD-32GX	✂1 m (Note 3)			

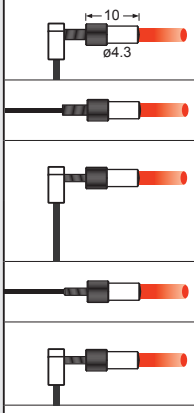
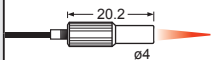
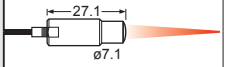
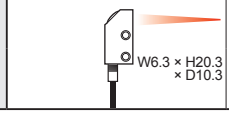
Notes: 1) Spot diameter, sensing range and distance to focal point are specified for **FX-500** / **FX-550** / **FX-550L** series.
2) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
3) The allowable cutting range is 700 mm 27.559 in from the end that the amplifier inserted.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Small spot

Reflective type fiber & spot lens

Designation	Shape of head (mm)	Spot diameter (mm in) (Note 1)	Sensing range (mm in) (Note 1)	Lens		Applicable fibers				
				Model No.	Ambient temp.	Model No.	Fiber cable length ✂: Free-cut (Note 2)	Bending radius (mm)	Protection	Ambient temp.
Parallel light lens		ø4 ø0.157 approx.	0 to 30 0 to 1.181	FX-MR9	−55 to +70 °C	FD-R33EG	500 mm	R4	IP40	−20 to +60 °C
						FD-EG31				
						FD-R34EG				
						FD-R32EG				−40 to +70 °C
						FD-EG30				
						Tough Bending durability FD-R31G		R2		−55 to +80 °C
						Tough Bending durability FD-42G	✂ 2 m			
						FD-42GW		R1		−40 to +60 °C
						Tough Bending durability FD-32G		R2		−55 to +80 °C
						FD-32GX	✂ 1 m (Note 3)			
Pinpoint spot lens		ø0.5 ø0.020	Distance to focal point 6 ±1 0.236 ±0.039	FX-MR1	−40 to +70 °C	Tough Bending durability FD-42G		R2		−55 to +80 °C
						FD-42GW		R1		−40 to +60 °C
Zoom lens		ø0.7 to ø2.0 ø0.028 to ø0.079 approx.	Distance to focal point 18.5 to 43 0.728 to 1.693 approx.	FX-MR2	−40 to +70 °C	Tough Bending durability FD-42G	✂ 2 m	R2		−55 to +80 °C
						FD-42GW		R1		−40 to +60 °C
Zoom lens (Side-view type)		ø0.5 to ø3.0 ø0.020 to ø0.118 approx.	Distance to focal point 13 to 30 0.512 to 1.181 approx.	FX-MR5	−40 to +60 °C	Tough Bending durability FD-42G		R2		−55 to +80 °C
						FD-42GW		R1		−40 to +60 °C

Notes: 1) Spot diameter, sensing range and distance to focal point are specified for **FX-500** / **FX-550** / **FX-550L** series.
2) Note 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 allowable cutting range is 700 mm 27.559 in from the end that the amplifier inserted.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Narrow beam

*Thru-beam type sensors are available as two pieces per set.

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 3, 4, 5) FX-500 series	FX-500 series Other modes	FX-500 series U-LG LONG FAST H-SP	FX-550 / FX-550L series	FX-550 / FX-550L series Other modes	FX-550 / FX-550L series U-LG LONG FAST	Beam axis dia. (mm)	Inclination of beam axis	Protection	Ambient temp.
Thru-beam Narrow beam Side-view	Aperture angle 2° ø3.5 ø3.7 20	Tough Bending durability FT-KS40	R2	2 m	STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,200 47.244	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	STD 3,600 141.732 (Note 2) HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	ø2.2	—	IP40	−40 to +80 °C
	Aperture angle 2° ø4 25	Tough Bending durability FT-KV40			STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,200 47.244		STD 3,600 141.732 (Note 2) HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2)		ø2.5	±0.8°	IP30	
	Aperture angle 2° ø4 25	FT-KV40W	R1		STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,100 122.047 940 37.008		STD 3,600 141.732 (Note 2) HYPR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2)					−40 to +60 °C
	Aperture angle 3° 1.5 × 2 20	Tough Bending durability FT-KV26	R2		STD 710 27.953 HYPR 2,500 98.425	1,600 62.992 1,200 47.244 440 17.323 160 6.299		STD 1,100 43.307 HYPR 3,600 141.732 (Note 2)	2,300 90.551 1,600 62.992 650 25.591		ø1	X ±1° Z ±0.5°		−40 to +80 °C
	Aperture angle 3° 1.5 × 2 20	FT-KV26H1	R10		STD 630 24.803 HYPR 2,200 86.614	1,430 56.299 1,070 42.126 390 15.354 135 5.315		STD 1,000 39.370 HYPR 3,600 141.732 (Note 2)	1,900 74.803 1,400 55.118 650 25.591					−40 to +105 °C
Retroreflective With polarizing filter	W5.2 × H9.5 × D16 W30 × H30 × D0.5	FR-Z50HW	R1	2 m	STD 100 to 990 3.937 to 38.976 HYPR 100 to 1,900 3.937 to 74.803	100 to 1,400 3.937 to 55.118 100 to 1,200 3.937 to 47.244 100 to 780 3.937 to 30.709 100 to 490 3.937 to 19.291		STD 100 to 1,150 3.937 to 45.278 HYPR 100 to 2,250 3.937 to 88.583	100 to 1,800 3.937 to 70.866 100 to 1,400 3.937 to 55.118 100 to 950 3.937 to 37.402		—	—	IP40	−25 to +55 °C
Retroreflective Ultra-narrow beam	W7.5 × H2.2 × D11.2 Aperture angle 3° (emitter) W4 × H2 × D21.5	Tough Bending durability FR-KZ22E			STD 15 to 310 0.591 to 12.205 HYPR 15 to 570 0.591 to 22.441	15 to 460 0.591 to 18.110 15 to 410 0.591 to 16.142 15 to 220 0.591 to 8.661 15 to 100 0.591 to 3.937		STD 15 to 540 0.591 to 21.260 HYPR 15 to 800 0.591 to 31.496	15 to 700 0.591 to 27.559 15 to 600 0.591 to 23.622 15 to 400 0.591 to 15.748				IP30	−40 to +60 °C
Retroreflective Narrow beam Top sensing	W5.2 × H9.5 × D21 W10.6 × H28 × D10.1	Tough Bending durability FR-KZ50H	R2		STD 20 to 300 0.787 to 11.811 HYPR 20 to 1,000 0.787 to 39.370	20 to 800 0.787 to 31.496 20 to 400 0.787 to 15.748 20 to 200 0.787 to 7.874 20 to 200 0.787 to 7.874		STD 20 to 400 0.787 to 15.748 HYPR 20 to 1,600 0.787 to 62.992	20 to 1,300 0.787 to 51.181 20 to 500 0.787 to 19.685 20 to 350 0.787 to 13.780					
Retroreflective Narrow beam Side sensing	W9.5 × H25 × D5.2 W28 × H10.6 × D10.1	Tough Bending durability FR-KZ50E												
Reflective Long range	W5.2 × H9.5 × D16	FD-Z50HW	R1	2 m	STD 10 to 650 0.394 to 25.591 HYPR 10 to 2,500 0.394 to 98.425	10 to 1,100 0.394 to 43.307 10 to 1,000 0.394 to 39.370 10 to 410 0.394 to 16.142 15 to 130 0.591 to 5.118		STD 10 to 950 0.394 to 37.402 HYPR 10 to 3,700 0.394 to 154.669	10 to 2,100 0.394 to 82.677 10 to 1,300 0.394 to 51.181 10 to 590 0.394 to 23.228		—	—	IP40	−40 to +60 °C

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) The **FX-550L** series does not have FAST mode.
4) The sensing range of retroreflective type is the possible setting range for the attached reflector. The fiber can detect an object less than setting range for the reflector. Refer to the next page for the sensing range when **FR-Z50HW** is used in combination with a reflector (optional).
5) The sensing range of reflective type is specified for white non-glossy paper.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Wide beam

*Thru-beam type sensors are available as two pieces per set.

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 4, 5) FX-500 series	Other modes	U-LG LONG FAST H-SP	FX-550 / FX-550L series	Other modes	U-LG LONG FAST	Beam axis dia. (mm)	Protection	Ambient temp.
Thru-beam	Wide beam	Sensing width 32mm W5 × H69 × D20	Tough Bending durability **FT-A32** (Note 2)	R2	2 m	STD (Note 3) 3,600 141.732 HYPR (Note 3) 3,600 141.732	3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 2,100 82.677		STD 3,600 141.732 (Note 3) HYPR 3,600 141.732 (Note 3)	3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 3,600 141.732 (Note 3)		3.2 × 32	IP40	−40 to +60 °C
		Allows flexible wiring Sensing width 32mm W5 × H69 × D20	**FT-A32W** (Note 2)	R1		STD (Note 3) 3,600 141.732 HYPR (Note 3) 3,600 141.732	3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 3,000 118.110		STD 3,600 141.732 (Note 3) HYPR 3,600 141.732 (Note 3)	3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 3,600 141.732 (Note 3)				−40 to +55 °C
		Sensing width 11mm W4.2 × H31 × D13.5	Tough Bending durability **FT-A11** (Note 2)	R2		STD (Note 3) 3,600 141.732 HYPR (Note 3) 3,600 141.732	3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 1,100 43.307		STD 3,600 141.732 (Note 3) HYPR 3,600 141.732 (Note 3)	3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 3,600 141.732 (Note 3)		2.2 × 11		−40 to +70 °C
		Allows flexible wiring Sensing width 11mm W4.2 × H31 × D13.5	**FT-A11W** (Note 2)	R1		STD (Note 3) 3,600 141.732 HYPR (Note 3) 3,600 141.732	3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 1,300 51.181		STD 3,600 141.732 (Note 3) HYPR 3,600 141.732 (Note 3)	3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 3,600 141.732 (Note 3)				−40 to +55 °C
	Array	Sensing width 5.5mm W5 × H15 × D15	Tough Bending durability **FT-AL05**	R2		STD 860 33.858 HYPR 2,300 90.551	1,550 61.024 1,500 59.055 500 19.685 170 6.693		STD 1,150 45.276 HYPR 3,600 141.732 (Note 3)	2,350 92.520 1,600 62.992 660 25.984		0.25 × 5.5		−55 to +80 °C
Reflective	Wide beam	W7 × H15 × D30	Tough Bending durability **FD-A16**	R4		STD 200 7.874 HYPR Cannot use	200 7.874 200 7.874 140 5.512 75 2.953		STD 350 13.780 HYPR —	— 350 13.780 250 9.843		—	IP40	−40 to +60 °C
	Array	W5 × H20 × D20	Tough Bending durability **FD-AL11**	R2	2 m	STD 320 12.598 HYPR 670 26.378	530 20.866 510 20.079 180 7.087 50 1.969		STD 450 17.717 HYPR 1,300 51.181	1,000 39.370 700 27.559 320 12.598				−55 to +80 °C

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The slit mask (accessory) is sold separately. Refer to the last page for more details.
3) The fiber cable length practically limits the sensing range.
4) The **FX-550L** series does not have FAST mode.
5) The sensing range of reflective type is specified for white non-glossy paper.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Retroreflective type

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2, 3) FX-500 series	FX-500 series Other modes: U-LG LONG FAST H-SP	FX-550 / FX-550L series	FX-550 / FX-550L series Other modes: U-LG LONG FAST	Protection	Ambient temp.
Retroreflective	With polarizing filters	W5.2 × H9.5 × D16 W30 × H30 × D0.5	FR-Z50HW	R1	2 m	STD 100 to 990 3.937 to 38.976 HYPR 100 to 1,900 3.937 to 74.803	100 to 1,400 3.937 to 55.118 100 to 1,200 3.937 to 47.244 100 to 780 3.937 to 30.709 100 to 490 3.937 to 19.291	STD 100 to 1,150 3.937 to 45.278 HYPR 100 to 2,250 3.937 to 88.583	100 to 1,800 3.937 to 70.866 100 to 1,400 3.937 to 55.118 100 to 950 3.937 to 37.402	IP40	−25 to +55 °C
	Ultra-narrow beam	W7.5 × H2.2 × D11.2 Aperture angle 3° (emitter) W4 × H2 × D21.5	Tough Bending durability FR-KZ22E			STD 15 to 310 0.591 to 12.205 HYPR 15 to 570 0.591 to 22.441	15 to 460 0.591 to 18.110 15 to 410 0.591 to 16.142 15 to 220 0.591 to 8.661 15 to 100 0.591 to 3.937	STD 15 to 540 0.591 to 21.260 HYPR 15 to 800 0.591 to 31.496	15 to 700 0.591 to 27.559 15 to 600 0.591 to 23.622 15 to 400 0.591 to 15.748	IP30	−40 to +60 °C
	Narrow beam Top sensing	W5.2 × H9.5 × D21 W10.6 × H28 × D10.1	Tough Bending durability FR-KZ50H	R2		STD 20 to 300 0.787 to 11.811 HYPR 20 to 1,000 0.787 to 39.370	20 to 800 0.787 to 31.496 20 to 400 0.787 to 15.748 20 to 200 0.787 to 7.874 20 to 200 0.787 to 7.874	STD 20 to 400 0.787 to 15.748 HYPR 20 to 1,600 0.787 to 62.992	20 to 1,300 0.787 to 51.181 20 to 500 0.787 to 19.685 20 to 350 0.787 to 13.780		
	Side sensing	W9.5 × H25 × D5.2 W28 × H10.6 × D10.1	Tough Bending durability FR-KZ50E								

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The sensing range is the possible setting range for the attached reflector. The fiber can detect an object less than setting range for the reflector.
3) The **FX-550L** series does not have FAST mode.

<Sensing range when FR-Z50HW is used in combination with a reflector (optional)>

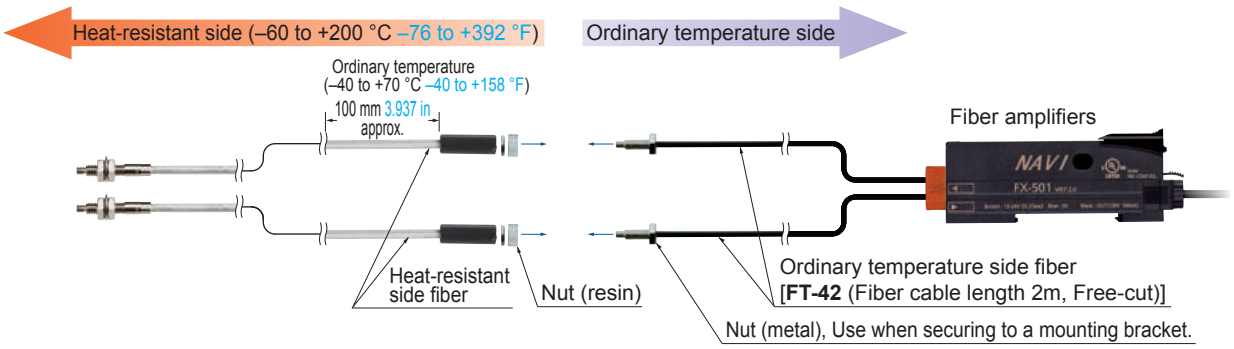
Reflector model No.	Sensing range (mm in) FX-500 series HYPR	U-LG	LONG	STD	FAST	H-SP	FX-550 / FX-550L series HYPR	U-LG	LONG	STD	FAST
RF-230	100 to 19,000 3.937 to 748.030	100 to 8,000 3.937 to 314.960	100 to 5,000 3.937 to 196.850	100 to 3,600 3.937 to 141.732	100 to 2,900 3.937 to 114.173	100 to 1,400 3.937 to 55.118	100 to 20,000 3.937 to 78.402	100 to 11,000 3.937 to 433.071	100 to 7,000 3.937 to 275.591	100 to 5,000 3.937 to 196.850	100 to 3,500 3.937 to 137.795
RF-220	100 to 8,000 3.937 to 314.960	100 to 4,700 3.937 to 185.039	100 to 3,500 3.937 to 137.795	100 to 3,000 3.937 to 118.110	100 to 1,800 3.937 to 70.866	100 to 830 3.937 to 32.677	100 to 10,000 3.937 to 393.701	100 to 6,500 3.937 to 255.906	100 to 4,500 3.937 to 177.165	100 to 3,500 3.937 to 137.795	100 to 2,500 3.937 to 98.425
RF-210	100 to 5,500 3.937 to 216.535	100 to 2,700 3.937 to 106.299	100 to 2,400 3.937 to 94.488	100 to 1,500 3.937 to 59.055	100 to 1,200 3.937 to 47.244	100 to 530 3.937 to 20.866	100 to 7,000 3.937 to 275.591	100 to 4,000 3.937 to 157.480	100 to 3,600 3.937 to 141.732	100 to 2,800 3.937 to 110.236	100 to 2,100 3.937 to 82.677

Note: 1) The sensing range is the possible setting range for the reflector. The fiber can detect an object less than 100 mm 3.937 in. 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.
2) The **FX-550L** series does not have FAST mode.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

<Heat-resistant joint fiber set contents>



Heat-resistant

*Thru-beam type sensors are available as two pieces per set.

Type		Heat-resistant temp.	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 3) FX-500 series	FX-500 series: Other modes	FX-500 series: U-LG LONG FAST H-SP	FX-550 / FX-550L series	FX-550 / FX-550L series: Other modes	FX-550 / FX-550L series: U-LG LONG FAST	Beam axis dia. (mm)	Ambient temp.
Thru-beam	Heat-resistant	350 °C	Lens mountable (FX-LE1/LE2/SV1) M4 ←30→	FT-H35-M2	R25	2 m	STD 430 16.929 HYPR 1,200 47.244		880 34.646 670 26.378 250 9.843 80 3.150	STD 1,050 41.339 HYPR 3,600 141.732 (Note 2)		2,300 90.551 1,500 59.055 650 25.591	ø1.2	−60 to +350 °C
			Sleeve 60 mm M4 ø2.1 ←27→	FT-H35-M2S6	Fiber R25 Sleeve R10									
		200 °C	Allows flexible wiring Lens mountable (FX-LE1/LE2/SV1) M4 ←23→	FT-H20W-M1	R10	1 m	STD 470 18.504 HYPR (Note 2) 1,600 62.992		1,000 39.370 840 33.071 300 11.811 90 3.543	STD 730 28.740 HYPR 1,600 62.992 (Note 2)		1,600 62.992 (Note 2) 1,050 41.339 440 17.323	ø0.8	−60 to +200 °C
			Lens mountable (FX-LE1/LE2/SV1) M4 ←23→	FT-H20-M1	R25		STD 540 21.260 HYPR (Note 2) 1,600 62.992		1,300 51.181 960 37.795 330 12.992 110 4.331	STD 1,000 39.370 HYPR 1,600 62.992 (Note 2)		1,600 62.992 (Note 2) 1,600 62.992 (Note 2) 600 23.622	ø1.2	
		130 °C	Lens mountable (FX-LE2 only) M4 ←16→	FT-H13-FM2		✂ 2 m	STD 700 27.559 HYPR 3,300 129.921		1,900 74.803 1,300 51.181 410 16.142 140 5.512	STD 1,150 45.276 HYPR 3,600 141.732 (Note 2)		2,700 106.299 1,690 66.535 750 29.528	ø1.5	−60 to +130 °C
	Heat-resistant (joint)	200 °C	Lens mountable (FX-LE1/LE2/SV1) M4 ← 23 →	FT-H20-J20-S (Note 6)	Heat-resistant side R18 (Note 5)	✂ 200 mm (Note 4)	STD 470 18.504 HYPR 1,600 62.992		1,000 39.370 790 31.102 300 11.811 90 3.543	STD 860 33.858 HYPR 2,600 102.362		1,800 70.866 1,200 47.244 530 20.866	ø1.2	−60 to +200 °C
				FT-H20-J30-S (Note 6)		✂ 300 mm (Note 4)								
				FT-H20-J50-S (Note 6)		✂ 500 mm (Note 4)								
			Side-view 24 ø3.8 ø4	FT-H20-VJ50-S (Note 6)		✂ 500 mm (Note 4)	STD 600 23.622 HYPR 2,100 82.677		1,300 51.181 980 38.583 390 15.354 120 4.724	STD 1,000 39.370 HYPR 3,600 141.732 (Note 2)		2,200 86.614 1,400 55.118 620 24.409		
				FT-H20-VJ80-S (Note 6)		✂ 800 mm (Note 4)								

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) The **FX-550L** series does not have FAST mode.
4) Fiber length (fixed-length) for heat-resistant fiber side. Fiber length for ordinary temperature side is 2 m 6.562 ft (free-cut).
5) Bending-resistant fiber R4 mm R0.157 in or more for ordinary temperature side.
6) Heat-resistant joint fibers and ordinary-temperature fibers (**FT-42**) are sold as a set.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Heat-resistant

Type	Heat-resistant temp.	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2, 3) FX-500 series	FX-500 series Other modes: U-LG LONG FAST H-SP	FX-550 / FX-550L series	FX-550 / FX-550L series Other modes: U-LG LONG FAST	Ambient temp.
Reflective, Heat-resistant, Threaded	350 °C	Coaxial M6, 25	FD-H35-M2	R25	2 m	STD 260 10.236 / HYPR 720 28.346	540 21.260 / 460 18.110 / 150 5.906 / 45 1.772	STD 400 15.748 / HYPR 750 29.528	600 23.662 / 500 19.685 / 220 8.661	−60 to +350 °C
		Sleeve 60 mm, M6, ø2.8, 22	FD-H35-M2S6	Fiber R25 Sleeve R10						
		Sleeve 90 mm, M4, ø2.1, 27	FD-H35-20S		1 m	STD 260 10.236 / HYPR 840 33.071	550 21.654 / 440 17.323 / 140 5.512 / 45 1.772	STD 410 16.142 / HYPR 850 33.465	750 29.528 / 550 21.654 / 230 9.055	
	200 °C	Coaxial M6, 28	FD-H20-M1	R25		STD 330 12.992 / HYPR 840 33.071	550 21.654 / 500 19.685 / 200 7.874 / 55 2.165	STD 450 17.717 / HYPR 1,350 53.150	1,000 39.370 / 650 25.591 / 300 11.811	−60 to +200 °C
		Coaxial M4, 27	FD-H20-21			STD 230 9.055 / HYPR 770 30.315	500 19.685 / 380 14.961 / 130 5.118 / 45 1.772	STD 450 17.717 / HYPR 1,250 49.213	850 33.465 / 650 25.591 / 250 9.843	
	130 °C	M6, 21	FD-H13-FM2		✂ 2 m	STD 350 13.780 / HYPR 880 34.646	640 25.197 / 600 23.622 / 200 7.874 / 65 2.559	STD 670 26.378 / HYPR 1,650 64.961	1,300 51.181 / 940 37.008 / 390 15.354	−60 to +130 °C
Glass substrate detection convergent reflective	300 °C	W19 × H27 × D5	FD-H30-L32		2 m	STD 0 to 17 0 to 0.669 / HYPR 0 to 40 0 to 1.575	0 to 30 0 to 1.181 / 0 to 25 0 to 0.984 / 0 to 12 0 to 0.472 / 1.5 to 6 0.059 to 0.236	STD 0 to 21 0 to 0.827 / HYPR 0 to 60 0 to 2.362	0 to 42 0 to 1.654 / 0 to 25 0 to 0.984 / 0 to 16 0 to 0.630	−60 to +300 °C
	250 °C	W21 × H33.2 × D5	FD-H25-L43		3 m	STD 1.5 to 26 0.059 to 1.024 / HYPR 1 to 31 0.039 to 1.220	1 to 30 0.039 to 1.181 / 1 to 28 0.039 to 1.102 / 1.5 to 24 0.059 to 0.945 / 2 to 18 0.079 to 0.709	STD 1 to 28 0.039 to 1.102 / HYPR 1 to 31 0.039 to 1.220	1 to 30 0.039 to1.181 / 1 to 29 0.039 to1.142 / 1 to 26 0.039 to1.024	−20 to +250 °C (Ordinary temp. side: −20 to +70 °C)
		W21 × H34.5 × D5	FD-H25-L45			STD 5 to 42 0.197 to 1.654 / HYPR 4 to 43.5 0.157 to 1.713	4 to 43 0.157 to 1.693 / 4.5 to 43 0.177 to 1.693 / 5 to 40 0.197 to 1.575 / 6.5 to 34 0.256 to 1.339	STD 4 to 48 0.157 to 1.890 / HYPR 4 to 51 0.157 to 2.008	4 to 50 0.157 to 1.969 / 4 to 49 0.157 to 1.929 / 4 to 44 0.157 to 1.732	
	180 °C	W19 × H27 × D5	FD-H18-L31		✂ 2 m	STD 0 to 16 0 to 0.630 / HYPR 0 to 60 0 to 2.362	0 to 32 0 to 1.260 / 0 to 24 0 to 0.945 / 0 to 13 0 to 0.512 / 2 to 6.5 0.079 to 0.256	STD 0 to 45 0 to 1.772 / HYPR 0 to 130 0 to 5.118	0 to 85 0 to 3.346 / 0 to 60 0 to 2.362 / 0 to 30 0 to 1.181	−60 to +180 °C

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The sensing range of reflective type is the value for white non-glossy paper (50 × 50 mm 1.969 × 1.969 in glass substrate for **FD-H30-L32** and **FD-H18-L31**, transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in for **FD-H25-L43** and **FD-H25-L45**).
3) The **FX-550L** series does not have FAST mode.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

Oil-resistant

*Thru-beam type sensors are available as two pieces per set.

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2, 3) FX-500 series	FX-500 series Other modes / U-LG LONG FAST H-SP	FX-550 / FX-550L series	FX-550 / FX-550L series Other modes / U-LG LONG FAST	Beam axis dia. (mm)	Protection	Ambient temp.
Thru-beam, Oil-resistant, Square head type, M6	Full-protection type W10 × H11 × D21.2	Tough Bending durability **FT-R60Y**	R4	2 m	STD 2,100 82.677 HYPR (Note 4) 3,600 141.732	3,600 141.732 (Note 4) 3,600 141.732 (Note 4) 1,260 49.606 400 15.748	STD 3,600 141.732 (Note 4) HYPR 3,600 141.732 (Note 4)	3,600 141.732 (Note 4) 3,600 141.732 (Note 4) 1,900 74.803	ø3.5	IP68G	−55 to +80 °C
Thru-beam, Oil-resistant, Square head type, M4	Cable-protection type Lens mountable W7 × H9.5 × D15.5	Tough Bending durability **FT-R44Y**			STD 720 28.346 HYPR 3,000 118.110	1,600 62.992 1,100 43.307 430 16.929 130 5.118	STD 1,300 51.181 HYPR 3,600 141.732 (Note 4)	2,900 114.173 1,800 70.866 800 31.496	ø1	IP67 (Note 5)	
Reflective, Oil-resistant, Square head type, M6	Cable-protection type W10 × H11 × D15.5	Tough Bending durability **FD-R61Y**	R4	2 m	STD 280 11.024 HYPR 990 38.976	610 24.016 435 17.126 160 6.299 50 1.969	STD 450 17.717 HYPR 1,350 53.150	1,000 39.370 650 25.591 250 9.843	—	IP67 (Note 5)	−55 to +80 °C

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The **FX-550L** series does not have FAST mode.
3) The sensing range of reflective type is specified for white non-glossy paper.
4) The fiber cable length practically limits the sensing range.
5) The fiber part is oil-resistant.

Chemical-resistant

*Thru-beam type sensors are available as two pieces per set.

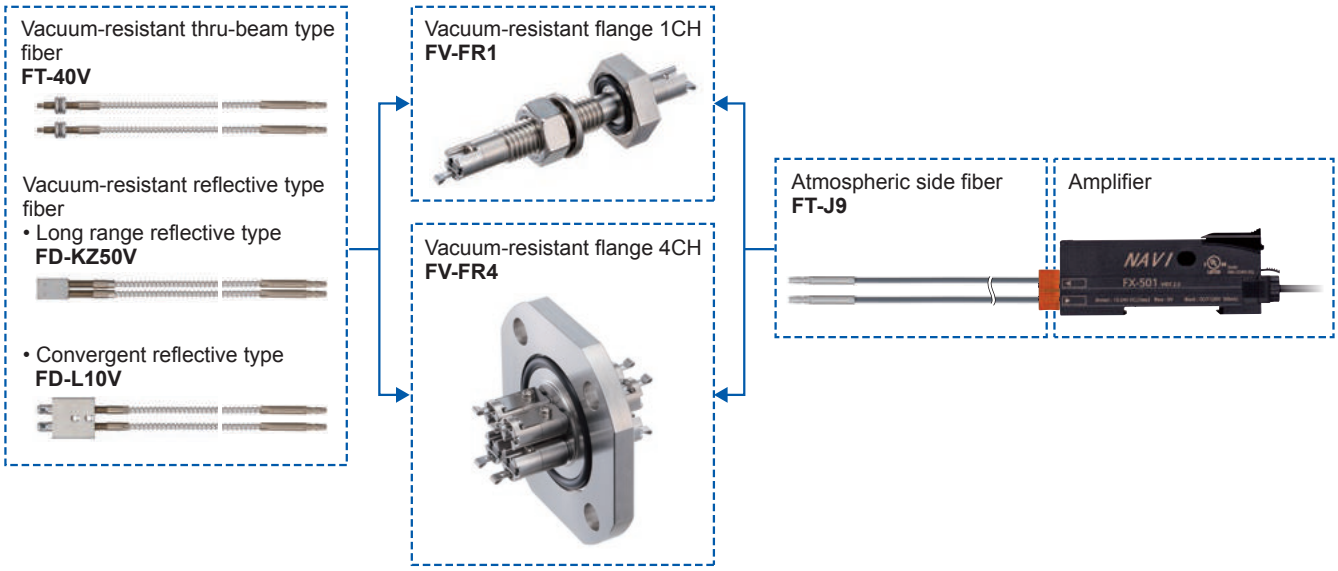
Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2, 3) FX-500 series	FX-500 series Other modes / U-LG LONG FAST H-SP	FX-550 / FX-550L series	FX-550 / FX-550L series Other modes / U-LG LONG FAST	Beam axis dia. (mm)	Protection	Ambient temp.
Thru-beam, Chemical-resistant, Flat type	Easy mounting • Rectangular head SEMI S2 compliant (Note 6) Metal-free W7 × H15 × D13	Tough Bending durability **FT-Z802Y**	R4	2 m	STD 3,100 122.047 HYPR (Note 4) 3,600 141.732	3,600 141.732 (Note 4) 3,600 141.732 (Note 4) 1,900 74.803 470 18.504	STD 3,600 141.732 (Note 4) HYPR 3,600 141.732 (Note 4)	3,600 141.732 (Note 4) 3,600 141.732 (Note 4) 3,600 141.732 (Note 4)	ø3.7	IP68G	0 to +60 °C
Thru-beam, Chemical-resistant, Cylindrical type	Heat-resistant 115 °C Metal-free ø5.5 (25)	**FT-HL80Y**	R30	2 m (Note 5)	STD (Note 4) 3,600 141.732 HYPR (Note 4) 3,600 141.732	3,600 141.732 (Note 4) 3,600 141.732 (Note 4) 2,300 90.551 740 29.134	STD 3,600 141.732 (Note 4) HYPR 3,600 141.732 (Note 4)	3,600 141.732 (Note 4) 3,600 141.732 (Note 4) 3,600 141.732 (Note 4)			−40 to +115 °C
	Metal-free ø5.5 (25)	**FT-L80Y**			STD (Note 4) 3,600 141.732 HYPR (Note 4) 3,600 141.732	3,600 141.732 (Note 4) 3,600 141.732 (Note 4) 2,800 110.236 920 36.220	STD 3,600 141.732 (Note 4) HYPR 3,600 141.732 (Note 4)	3,600 141.732 (Note 4) 3,600 141.732 (Note 4) 3,600 141.732 (Note 4)			−40 to +70 °C
	Side-view Metal-free ø5.5 (25)	**FT-V80Y**			STD 1,300 51.181 HYPR (Note 4) 3,600 141.732	2,800 110.236 2,200 86.614 800 31.496 240 9.449	STD 2,200 86.614 HYPR 3,600 141.732 (Note 4)	3,600 141.732 (Note 4) 3,600 141.732 (Note 4) 1,400 55.118	ø2.8		
Reflective, Chemical-resistant, Cylindrical type	Metal-free ø5.5 (16)	Tough Bending durability **FD-S60Y**	Protective tube R30 mm Fiber R4	2 m (Note 5)	STD 320 12.598 HYPR 600 23.622	590 23.228 420 16.535 200 7.874 75 2.953	STD 450 17.717 HYPR —	700 27.559 550 21.654 380 14.961	—	IP68G	−40 to +70 °C

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The **FX-550L** series does not have FAST mode.
3) The sensing range of reflective type is specified for white non-glossy paper.
4) The fiber cable length practically limits the sensing range.
5) The allowable cutting range is 500 mm 19.685 in from the end that the amplifier inserted.
6) The design takes into account the environmental testing required by SEMI S2. To ensure that the final system complies with the standards, you must design and use it in accordance with relevant standards, regulations, and regulations.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

<One-touch connection system compatible with 4CH / 1CH flange Vacuum-resistant fiber set contents>



Vacuum-resistant (One-touch connection system compatible with 4CH / 1CH flange)

*Thru-beam type sensors are available as two pieces per set.

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in) (Note 3, 4) FX-500 series	Other modes	FX-500 series	FX-550 / FX-550L series	Other modes	FX-550 / FX-550L series	Beam axis dia. (mm)	Ambient temp.
Thru-beam	Vacuum-resistant	300 °C, Lens mountable (FV-LE1/SV1/SV2) M4, 30	FT-40V	R25	1 m (Note 2)	STD 270 10.630 HYPR 1,000 39.370	590 23.228 470 18.504 160 6.299 55 2.165	U-LG LONG FAST H-SP	STD 400 15.748 HYPR 1,400 55.118	950 37.402 620 24.409 250 9.843	U-LG LONG FAST	ø1.3	-30 to +300 °C
Long range reflective	Vacuum-resistant	300 °C, Rectangular head W9.5 × H5.2 × D15	FD-KZ50V	R25	1 m (Note 2)	STD 20 to 200 0.787 to 7.874 HYPR 5 to 500 0.197 to 19.685	10 to 340 0.394 to 13.386 15 to 270 0.591 to 10.630 20 to 120 0.787 to 4.724 20 to 45 0.787 to 1.772	U-LG LONG FAST H-SP	STD 20 to 450 0.787 to 17.717 HYPR 5 to 1,500 0.197 to 59.055	10 to 1,000 0.394 to 39.370 15 to 650 0.591 to 25.591 20 to 300 0.787 to 11.811	U-LG LONG FAST	—	-30 to +300 °C
Convergent reflective	Vacuum-resistant	300 °C, Glass substrate detection W19 × H5 × D27	FD-L10V	R25	3 m (Note 2)	STD 0 to 8 0 to 0.315 HYPR 0 to 18 0 to 0.709	0 to 12 0 to 0.472 0 to 10 0 to 0.394 0 to 5.5 0 to 0.217 1.5 to 3 0.059 to 0.118	U-LG LONG FAST H-SP	STD 0 to 11 0 to 0.433 HYPR 0 to 27 0 to 1.063	0 to 19 0 to 0.748 0 to 13 0 to 0.512 0 to 7.5 0 to 0.295	U-LG LONG FAST		

Notes: 1) Atmospheric side fiber is optional and sold separately.
2) This is not a “free-cut” type. We offer only semi-custom products in which the fiber length can be specified in 100 mm 3.937 in increments. For details, please contact our sales office.
3) The sensing range is the value for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in.
4) **FX-550L** series does not have FAST mode.

Atmospheric side (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Ambient temp.
Atmospheric side	ø3.7 × 30	Tough Bending durability FT-J9	R4	✂ 2 m (Note 1, 2)	-30 to +80 °C

Notes: 1) We offer only semi-custom products in which the fiber length can be specified in 1 m 3.280 ft increments. For details, please contact our sales office.
2) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

LIST OF FIBERS

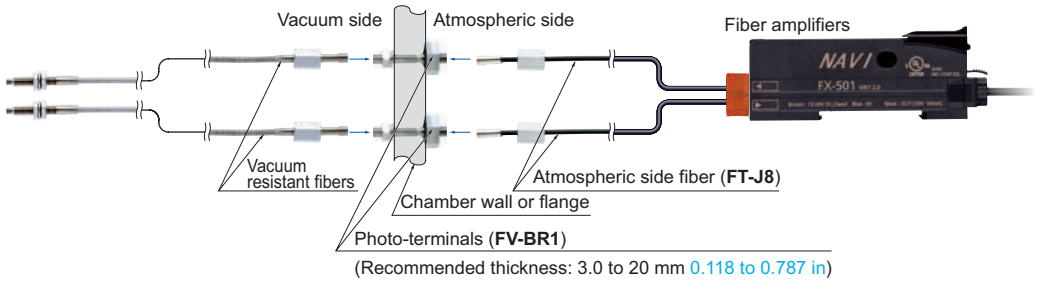
Vacuum-resistant flange

Designation	Model No.		Description
Vacuum-resistant flange 1CH	**FV-FR1**		Atmospheric side and vacuum side are isolated. Main specifications
Vacuum-resistant flange 4CH	**FV-FR4**		Recommended thickness of vacuum chamber wall • For **FV-FR1**: 3.0 to 40.0 mm 0.118 to 1.575 in (Note 1) • For **FV-FR4**: 3.0 mm 0.118 in or more (Note 2)

Model No.	FV-FR1	FV-FR4
Applicable fibers	FT-40V, FD-KZ50V, FD-L10V, FT-J9	
Leakage	1.0×10^{-10} Pa·m³/s [He] or less (* Measured with a He detector)	
Ambient temperature	-30 to +120°C -22 to +248°F (Same for storage. Up to +40 °C +104°F when humidity is high. However, no dew condensation or icing allowed.	
Ambient humidity	35 to 85% RH (Same for storage)	
Tightening torque	Nut: 14.7 N·m or less (M14 nut)	9.8 N·m or less (M8 screw)
Tensile strength	20 N or less (Atmospheric / vacuum side fiber joint)	
O-ring size	V15	V40
Weight	100 g approx.	410 g approx.
Material	Main unit: Stainless steel (SUS303), Holding bracket: Stainless steel (SUS301), Fiber: Quartz glass, O-ring: Fluororubber	

Notes: 1) Confirm the wall thickness in advance since the **FV-FR1** cannot be installed to a vacuum chamber with a wall thickness outside the recommended thickness range.
2) If the vacuum chamber wall is too thick, the **FV-FR4** may not be able to connect to the vacuum side fiber. In that case, connect the **FV-FR4** to the vacuum side fiber before the installation.

<Vacuum-resistant fiber set contents>



Vacuum-resistant

*Thru-beam type sensors are available as two pieces per set.

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in) (Note 3, 4) FX-500 series	Other modes U-LG LONG FAST H-SP	FX-550 / FX-550L series	Other modes U-LG LONG FAST	Beam axis dia. (mm)	Ambient temp.
Thru-beam	Vacuum-resistant	300 °C Lens mountable (**FV-LE1/SV2**) M4 30	**FT-H30-M1V-S** (Note 1)	R18	1 m (Note 2)	STD 270 10.630 HYPR 1,000 39.370	590 23.228 470 18.504 160 6.299 55 2.165	STD 400 15.748 HYPR 1,400 55.118	950 37.402 620 24.409 250 9.843	ø1.2	−30 to +300 °C
Reflective		300 °C, Rectangular head W9.5 × H5.2 × D15	**FD-H30-KZ1V-S** (Note 1)	R18	1 m (Note 2)	STD 20 to 200 0.787 to 7.874 HYPR 5 to 500 0.197 to 19.685	10 to 340 0.394 to 13.386 15 to 270 0.591 to 10.630 20 to 120 0.787 to 4.724 20 to 45 0.787 to 1.772	STD 20 to 450 0.787 to 17.717 HYPR 5 to 1,500 0.197 to 59.055	10 to 1,000 0.394 to 39.370 15 to 650 0.591 to 25.591 20 to 300 0.787 to 11.811	—	−30 to +300 °C
Convergent reflective		300 °C, Glass substrate detection W19 × H5 × D27	**FD-H30-L32V-S** (Note 1)	R18	3 m (Note 2)	STD 0 to 8 0 to 0.315 HYPR 0 to 18 0 to 0.709	0 to 12 0 to 0.472 0 to 10 0 to 0.394 0 to 5.5 0 to 0.217 1.5 to 3 0.059 to 0.118	STD 0 to 11 0 to 0.433 HYPR 0 to 27 0 to 1.063	0 to 19 0 to 0.748 0 to 13 0 to 0.512 0 to 7.5 0 to 0.295		

Notes: 1) Sold as a set comprising vacuum type fiber + photo-terminal (**FV-BR1**) + fiber at atmospheric side (**FT-J8**).
2) This is not a “free-cut” type.
3) **FX-550L** series does not have FAST mode.
4) The sensing range is the value for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in.

LIST OF FIBERS

Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm R0.394 in, reciprocating bending: 180°).

Liquid leak / Liquid detection

Type			Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Description: FX-500 series (STD mode)	Description: FX-550 / FX-550L series (STD mode)	Protection	Ambient temp.
Reflective type	Contact type	Liquid level sensing	Heat resistant 125 °C Fluorine resin coating ø6	**FD-F8Y**	Protective tube R40 Fiber R15	✂ 2 m (Note 1)	ø6 mm ø0.236 in Protective tube: Fluorine resin, length 1,000 mm 39.370 in (not cuttable) Liquid surface not contacted: Beam received, Liquid surface contacted: Beam not received		IP68	−40 to +125 °C
			Heat resistant 105 °C Fluorine resin coating Metal-free ø4	**FD-HF40Y** (Note 2)	Protective tube R20 Fiber R10	✂ 2 m	ø4 mm ø0.157 in Protective tube: Fluorine resin, length 500 mm 19.685 in (cuttable) Liquid surface not contacted: Beam received, Liquid surface contacted: Beam not received		IP68G	−40 to +105 °C
			Heat resistant 70 °C Fluorine resin coating throughout the fiber Metal-free ø4	**FD-F41Y** (Note 2)			ø4 mm ø0.157 in Protective tube: Fluorine resin, length 500 mm 19.685 in (cuttable) Liquid surface not contacted: Beam received, Liquid surface contacted: Beam not received			−40 to +70 °C
		Liquid leak detection	SEMI S2 compliant (Note 3) W20 × H30 × D10	Tough Bending durability **FD-F71**	R4	✂ 5 m	Liquid leak detection Leak absent: Beam received, Leak present: Beam not received Compatible amplifier: **FX-500** / **FX-550** / **FX-550L** series only		IP67	−20 to +60 °C
Reflective type	Pipe-mountable type	Liquid level sensing	Standard W25 × H13 × D20	**FD-F41**	R10	✂ 2 m	Applicable pipe diameter: Outer dia. ø6 to ø26 mm ø0.236 to ø1.024 in transparent pipe [PVC (vinyl chloride), fluorine resin, polycarbonate, acrylic, glass, wall thickness 1 to 3 mm 0.039 to 0.118 in] Liquid absent: Beam received, Liquid present: Beam not received		—	−40 to +100 °C
			For 1 mm thick PFA pipe W25 × H13 × D20	**FD-F4**			Applicable pipe diameter: Outer dia. ø6 to ø26 mm ø0.236 to ø1.024 in transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1 mm 0.039 in] Liquid absent: Beam received, Liquid present: Beam not received			
		Liquid sensing	Array fiber W6.5 × H28.3 × D17	Tough Bending durability **FD-FA93**	R4		Applicable pipe diameter: Outer dia. ø8 mm ø0.315 in or more transparent pipe (When used with the tying bands: ø8 to ø80 mm ø0.315 to ø3.150 in) [PFA (fluorine resin), including translucent] Liquid absent: Beam received, Liquid present: Beam not received		IP40	−40 to +70 °C
Thru-beam type			SEMI S2 compliant (Note 3) W23 × H20 × D17	Tough Bending durability **FT-F93**	Protective tube R20 Fiber R2		Applicable pipe diameter: Outer dia. ø3 to ø10 mm ø0.118 to ø0.394 in transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 0.3 to 1 mm 0.012 to 0.039 in] Liquid absent: Beam not received, Liquid present: Beam received Compatible amplifire: **FX-500** / **FX-550** / **FX-550L** series only			−40 to +60 °C

Notes: 1) The allowable cutting range is 1,000 mm 39.370 in from the end that the amplifier inserted.
2) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint is available.
3) The design takes into account the environmental testing required by SEMI S2. To ensure that the final system complies with the standards, you must design and use it in accordance with relevant standards, regulations, and regulations.

FIBER OPTIONS

Lens (For thru-beam type fiber)

FX-LE1

Expansion lens (Note 1)

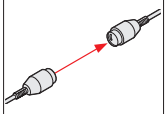
For thru-beam type fiber

Increases the sensing range by 5 times or more.
• Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 4) • Beam dia: ø3.6 mm ø0.142 in

Sensing range (mm in) [Lens on both sides] (Note 3)

Fiber \ Amplifier / Mode	HYPR	U-LG	LONG	STD	FAST	H-SP
FT-43	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	1,600 62.992 —
FT-42 **FT-42W**	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	2,200 86.614 —
FT-45X	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,500 59.055 —
FT-R40	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	1,900 74.803 —
FT-R43 **FT-R44Y**	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	1,900 74.803 3,600 141.732 (Note 2)	670 26.378 —
FT-H35-M2	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,300 129.921 3,600 141.732 (Note 2)	1,400 55.118 —
FT-H20W-M1	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	850 33.465 —
FT-H20-M1	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,200 47.244 —
FT-H20-J50-S **FT-H20-J30-S** **FT-H20-J20-S**	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,500 137.795 3,600 141.732 (Note 2)	2,000 78.740 3,600 141.732 (Note 2)	1,600 62.992 3,600 141.732 (Note 2)	500 19.685 —

FX-LE2



Super-expansion lens (Note 1)

Tremendously increases the sensing range with large diameter lenses.
• Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 4) • Beam dia: ø9.8 mm ø0.386 in

Sensing range (mm in) [Lens on both sides] (Note 3)

Fiber \ Amplifier / Mode	HYPR	U-LG	LONG	STD	FAST	H-SP
FT-43 **FT-42** **FT-42W**	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) —
FT-45X	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) —
FT-R40	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) —
FT-R41W **FT-R43** **FT-R44Y**	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) —
FT-H35-M2	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) —
FT-H20W-M1 **FT-H20-M1**	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) —
FT-H13-FM2	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) —
FT-H20-J50-S **FT-H20-J30-S** **FT-H20-J20-S**	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) —

Notes: 1) Be careful sure to use it only after you have adjusted it sufficiently when installing the thru-beam type fiber equipped with the expansion lens, as the beam envelope becomes narrow and alignment is difficult.
2) The fiber cable length practically limits the sensing range.
3) **FX-550L** series does not have FAST mode.
4) Refer to LIST OF FIBERS (p.25~) for the ambient temperature of fibers to be used in combination.

FIBER OPTIONS

Lens (For thru-beam type fiber)

Designation		Model No.	Description
For thru-beam type fiber	Side-view lens	**FX-SV1**	

Beam axis is bent by 90°.
• Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 1) • Beam dia: ø2.8 mm ø0.110 in
Sensing range (mm in) [Lens on both sides] (Note 3)

Fiber \ Amplifier / Mode	**FX-500** series (Upper value) **FX-550 / FX-550L** series (Lower value)					
	HYPR	U-LG	LONG	STD	FAST	H-SP
FT-43	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,400 133.858 3,600 141.732 (Note 2)	2,600 102.362 3,600 141.732 (Note 2)	1,700 66.929 2,300 90.551	970 38.189 1,400 55.118	310 12.205 — —
FT-42	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	2,100 82.677 2,800 110.236	1,150 45.276 1,700 66.929	370 14.567 — —
FT-42W	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3,500 137.795 3,600 141.732 (Note 2)	2,700 106.299 3,600 141.732 (Note 2)	1,800 70.866 2,300 90.551	990 38.976 1,400 55.118	320 12.598 — —
FT-45X	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,400 55.118 1,600 62.992 (Note 2)	800 31.496 1,600 62.992 (Note 2)	210 8.268 — —
FT-R43	3,200 125.984 3,600 141.732 (Note 2)	1,800 70.866 3,600 141.732 (Note 2)	1,300 51.181 2,700 106.299	950 37.402 1,900 74.803	510 20.079 1,200 47.244	160 6.299 — —
FT-R44Y	3,200 125.984 3,600 141.732 (Note 2)	1,800 70.866 3,600 141.732 (Note 2)	1,300 51.181 3,200 125.984	950 37.402 2,200 86.614	510 20.079 1,400 55.118	160 6.299 — —
FT-H35-M2	3,500 137.795 3,600 141.732 (Note 2)	1,600 62.992 2,800 110.236	1,200 47.244 1,800 70.866	780 30.709 1,300 51.181	500 19.685 750 29.528	150 5.906 — —
FT-H20W-M1	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,500 59.055 1,600 62.992 (Note 2)	950 37.402 1,250 49.213	560 22.047 690 27.165	190 7.480 — —
FT-H20-M1	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,600 62.992 (Note 2) 1,600 62.992 (Note 2)	1,300 51.181 1,600 62.992 (Note 2)	780 30.709 1,600 62.992 (Note 2)	500 19.685 800 31.496	150 5.906 — —
FT-H20-J50-S **FT-H20-J30-S** **FT-H20-J20-S**	1,600 62.992 (Note 2) 3,600 141.732 (Note 2)	960 37.795 2,400 94.488	740 29.134 1,500 59.055	450 17.717 1,100 43.307	290 11.417 680 26.771	80 3.150 — —

Notes: 1) Refer to LIST OF FIBERS (p.25~) for the ambient temperature of fibers to be used in combination.
2) The fiber cable length practically limits the sensing range.
3) **FX-550L** series does not have FAST mode.

FIBER OPTIONS

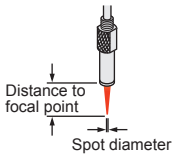
Vacuum-resistant lens (For thru-beam type fiber)

<table>
<tr><th colspan="2">Designation</th><th>Model No.</th><th></th><th>Description</th></tr>
<tr><td rowspan="3">For thru-beam type fiber</td><td>Vacuum-resistant expansion lens (Note 1)</td><td>FV-LE1</td><td>  </td><td>Increases the sensing range 4 times or more.
• Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 6)
• Beam axis dia: ø3.6 mm ø0.142 in
Sensing range (mm in) [Lens on both sides] (Note 3, 4, 5)
<table>
<tr><th rowspan="2">Fiber \ Amplifier / Mode</th><th colspan="6">FX-500 series (Upper value)
FX-550 / FX-550L series (Lower value)</th></tr>
<tr><th>HYPR</th><th>U-LG</th><th>LONG</th><th>STD</th><th>FAST</th><th>H-SP</th></tr>
<tr><td>FT-40V</td><td>1,800 (Note 2)
70.866
1,800 (Note 2)
70.866</td><td>1,800 (Note 2)
70.866
1,800 (Note 2)
70.866</td><td>1,800 (Note 2)
70.866
1,800 (Note 2)
70.866</td><td>1,500
59.055
1,800 (Note 2)
70.866</td><td>900
35.433
1,650
64.961</td><td>370
14.567
—</td></tr>
<tr><td>FT-H30-M1V-S</td><td>3,600
141.732 (Note 2)
3,600
141.732 (Note 2)</td><td>3,600
141.732 (Note 2)
3,600
141.732 (Note 2)</td><td>3,400
133.858
3,600
141.732 (Note 2)</td><td>1,500
59.055
2,500
98.425</td><td>900
35.433
1,650
64.961</td><td>370
14.567
—</td></tr>
</table></td></tr>
<tr><td>Vacuum-resistant compact side-view lens (Note 1)</td><td>FV-SV1</td><td>  </td><td>Beam axis is bent by 90°.
• Ambient temperature: -30 to +300 °C -22 to +572 °F (Note 6)
• Beam axis dia: ø3 mm ø0.118 in
Sensing range (mm in) [Lens on both sides] (Note 3, 4)
<table>
<tr><th rowspan="2">Fiber \ Amplifier / Mode</th><th colspan="6">FX-500 series (Upper value)
FX-550 / FX-550L series (Lower value)</th></tr>
<tr><th>HYPR</th><th>U-LG</th><th>LONG</th><th>STD</th><th>FAST</th><th>H-SP</th></tr>
<tr><td>FT-40V</td><td>1,800 (Note 2)
70.866
1,800 (Note 2)
70.866</td><td>900
35.433
1,800 (Note 2)
70.866</td><td>700
27.559
1,050
41.339</td><td>450
17.717
720
28.346</td><td>290
11.417
430
16.929</td><td>90
3.543
—</td></tr>
</table></td></tr>
<tr><td>Vacuum-resistant side-view lens (Note 1)</td><td>FV-SV2</td><td>  </td><td>Beam axis is bent by 90°.
• Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 6)
• Beam axis dia: ø3.7 mm ø0.146 in
Sensing range (mm in) [Lens on both sides] (Note 3, 4, 5)
<table>
<tr><th rowspan="2">Fiber \ Amplifier / Mode</th><th colspan="6">FX-500 series (Upper value)
FX-550 / FX-550L series (Lower value)</th></tr>
<tr><th>HYPR</th><th>U-LG</th><th>LONG</th><th>STD</th><th>FAST</th><th>H-SP</th></tr>
<tr><td>FT-40V</td><td>1,800 (Note 2)
70.866
1,800 (Note 2)
70.866</td><td>1,800 (Note 2)
70.866
1,800 (Note 2)
70.866</td><td>1,800 (Note 2)
70.866
1,800 (Note 2)
70.866</td><td>1,500
59.055
1,800 (Note 2)
70.866</td><td>900
35.433
1,100
43.307</td><td>370
14.567
—</td></tr>
<tr><td>FT-H30-M1V-S</td><td>3,600
141.732 (Note 2)
3,600
141.732 (Note 2)</td><td>3,600
141.732 (Note 2)
3,600
141.732 (Note 2)</td><td>3,400
133.858
3,600
141.732 (Note 2)</td><td>1,500
59.055
1,800
70.866</td><td>900
35.433
1,100
43.307</td><td>370
14.567
—</td></tr>
</table></td></tr>
</table>

Notes: 1) Be careful when installing the thru-beam type fiber equipped with the lens, as the beam envelope becomes narrow and alignment is difficult.
2) The fiber cable length practically limits the sensing range.
3) **FX-550L** series does not have FAST mode.
4)The fiber cable length for the **FT-40V** is 1 m 3.281 ft. The sensing ranges take into account the length of the **FT-J9** atmospheric side fiber.
5) The fiber cable length for the **FT-H30-M1V-S** is 1 m 3.281 ft. The sensing ranges in HYPR, U-LG and LONG of **FX-500** / **FX-550** / **FX-550L** series are specified considering the length of the **FT-J8** atmospheric side fiber.
6) Refer to LIST OF FIBERS (p.25~) for the ambient temperature of fibers to be used in combination.

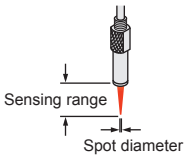
FIBER OPTIONS

Lens (For reflective type fiber)

<table>
<tr><th colspan="2">Designation</th><th>Model No.</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">For reflective type fiber</td><td rowspan="3">Finest spot lens</td><td>FX-MR7</td><td rowspan="3">  </td><td>Extremely fine spot of ø0.1 mm ø0.004 in approx. achieved.
• Applicable fibers:
FD-R33EG, FD-EG31,
FD-R34EG, FD-R32EG,
FD-EG30, FD-R31G, FD-42G,
FD-42GW, FD-32G, FD-32GX
• Ambient temperature: -55 to +70 °C
+67 to +158 °F
(Note)

Sensing range for FX-500 / FX-550 / FX-550L series<table><tr><th>Fiber model No.</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-R33EG
FD-EG31</td><td rowspan="4">7 ±0.5 mm
0.276 ±0.020 in</td><td>ø0.1 mm approx.
ø0.004 in approx.</td></tr><tr><td>FD-R34EG</td><td>ø0.15 mm approx.
ø0.006 in approx.</td></tr><tr><td>FD-R32EG
FD-EG30</td><td>ø0.2 mm approx.
ø0.008 in approx.</td></tr><tr><td>FD-R31G
FD-42G/42GW
FD-32G/32GX</td><td>ø0.4 mm approx.
ø0.016 in approx.</td></tr></table></td></tr>
<tr><td>FX-MR6</td><td>Extremely fine spot of ø0.1 mm ø0.004 in approx. achieved.
• Applicable fibers:
FD-R33EG, FD-EG31,
FD-R34EG, FD-R32EG,
FD-EG30, FD-R31G, FD-42G,
FD-42GW, FD-32G, FD-32GX
• Ambient temperature: -20 to +60 °C
-4 to +140 °F
(Note)

Sensing range for FX-500 / FX-550 / FX-550L series<table><tr><th>Fiber model No.</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-R33EG
FD-EG31</td><td rowspan="4">7 ±0.5 mm
0.276 ±0.020 in</td><td>ø0.1 mm approx.
ø0.004 in approx.</td></tr><tr><td>FD-R34EG</td><td>ø0.15 mm approx.
ø0.006 in approx.</td></tr><tr><td>FD-R32EG
FD-EG30</td><td>ø0.2 mm approx.
ø0.008 in approx.</td></tr><tr><td>FD-R31G
FD-42G/42GW
FD-32G/32GX</td><td>ø0.4 mm approx.
ø0.016 in approx.</td></tr></table></td></tr>
<tr><td>FX-MR3</td><td>Extremely fine spot of ø0.15 mm ø0.006 in approx. achieved.
• Applicable fibers:
FD-R33EG, FD-EG31,
FD-R34EG, FD-R32EG,
FD-EG30, FD-R31G, FD-42G,
FD-42GW, FD-32G, FD-32GX
• Ambient temperature: -40 to +70 °C
-40 to +158 °F
(Note)

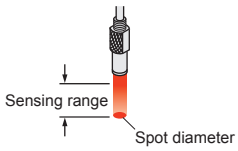
Sensing range for FX-500 / FX-550 / FX-550L series<table><tr><th>Fiber model No.</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-R33EG
FD-EG31</td><td rowspan="4">7.5 ±0.5 mm
0.295 ±0.020 in</td><td>ø0.15 mm approx.
ø0.006 in approx.</td></tr><tr><td>FD-R34EG</td><td>ø0.2 mm approx.
ø0.008 in approx.</td></tr><tr><td>FD-R32EG
FD-EG30</td><td>ø0.3 mm approx.
ø0.012 in approx.</td></tr><tr><td>FD-R31G
FD-42G/42GW
FD-32G/32GX</td><td>ø0.5 mm approx.
ø0.020 in approx.</td></tr></table></td></tr>
<tr><td></td><td>Zoom lens</td><td>FX-MR8</td><td>  </td><td>The spot diameter is adjustable according to how much the fiber is screwed in.
• Applicable fibers:
FD-R33EG, FD-EG31,
FD-R34EG, FD-R32EG,
FD-EG30, FD-R31G,
FD-32G, FD-32GX
• Ambient temperature: -55 to +70 °C
+67 to +158 °F
(Note)

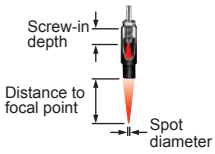
Sensing range for FX-500 / FX-550 / FX-550L series<table><tr><th>Fiber model No.</th><th>Sensing range</th><th>Spot diameter</th></tr><tr><td>FD-R33EG
FD-EG31</td><td rowspan="4">10 to 30 mm
0.394 to 1.181 in</td><td>ø0.4 to ø2.0 mm approx.
ø0.016 to ø0.079 in approx.</td></tr><tr><td>FD-R34EG</td><td>ø0.4 to ø2.2 mm approx.
ø0.016 to ø0.087 in approx.</td></tr><tr><td>FD-R32EG
FD-EG30</td><td>ø0.5 to ø2.5 mm approx.
ø0.020 to ø0.098 in approx.</td></tr><tr><td>FD-R31G
FD-32G/32GX</td><td>ø0.8 to ø3.5 mm approx.
ø0.031 to ø0.138 in approx.</td></tr></table></td></tr>
</table>

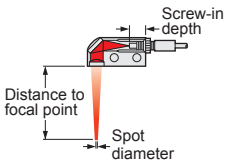
Note: Refer to LIST OF FIBERS (p.25~) for the ambient temperature of fibers to be used in combination.

FIBER OPTIONS

Lens (For reflective type fiber)

<table>
<tr><th colspan="2">Designation</th><th>Model No.</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">For reflective type fiber</td><td>Parallel light lens</td><td>FX-MR9</td><td> 
</td><td>Long-range parallel light
• Applicable fibers:
FD-R33EG, FD-EG31,
FD-R34EG, FD-R32EG,
FD-EG30, FD-R31G, FD-42G, FD-42GW,
FD-32G, FD-32GX
• Ambient temperature: -55 to +70 °C
+67 to +158 °F
(Note)

Sensing range for FX-500 / FX-550 / FX-550L series
<table>
<tr><th>Fiber model No.</th><th>Sensing range</th><th>Spot diameter</th></tr>
<tr><td>FD-R33EG
FD-EG31</td><td rowspan="4">0 to 30 mm
0.394 to 1.181 in</td><td rowspan="4">ø4.0 mm approx.
ø0.157 in approx.</td></tr>
<tr><td>FD-R34EG</td></tr>
<tr><td>FD-R32EG
FD-EG30</td></tr>
<tr><td>FD-R31G
FD-42G/42GW
FD-32G/32GX</td></tr>
</table></td></tr>
<tr><td>Pinpoint spot lens</td><td>FX-MR1</td><td>  </td><td colspan="2">Pinpoint spot of ø0.5 mm ø0.020 in. Enables detection of minute objects or small marks.
• Distance to focal point: 6 ± 1 mm 0.236 ± 0.039 in
• Applicable fibers: FD-42G, FD-42GW
• Ambient temperature: -40 to +70 °C -40 to +158 °F (Note)</td></tr>
<tr><td>Zoom lens</td><td>FX-MR2</td><td> 
</td><td>The spot diameter is adjustable from ø0.7 to ø2 mm ø0.028 to ø0.079 in according to how much the fiber is screwed in.
• Applicable fibers: FD-42G, FD-42GW
• Ambient temperature:-40 to +70 °C
-40 to +158 °F
(Note)
• Accessory: MS-EX3 (mounting bracket)

Sensing range for FX-500 / FX-550 / FX-550L series
<table>
<tr><th>Screw-in depth</th><th>Distance to focal point</th><th>Spot diameter</th></tr>
<tr><td>7 mm 0.276 in</td><td>18.5 mm approx.
0.728 in approx.</td><td>ø0.7 mm approx.
ø0.028 in approx.</td></tr>
<tr><td>12 mm 0.472 in</td><td>27 mm approx.
1.063 in approx.</td><td>ø1.2 mm approx.
ø0.047 in approx.</td></tr>
<tr><td>14 mm 0.551 in</td><td>43 mm approx.
1.693 in approx.</td><td>ø2.0 mm approx.
ø0.079 in approx.</td></tr>
</table></td></tr>
<tr><td>Zoom lens (side-view type)</td><td>FX-MR5</td><td> 
</td><td>FX-MR2 is converted into a side-view type and can be mounted in a very small space.
• Applicable fibers: FD-42G, FD-42GW
• Ambient temperature: -40 to +60 °C
-40 to +140 °F
(Note)

Sensing range for FX-500 / FX-550 / FX-550L series
<table>
<tr><th>Screw-in depth</th><th>Distance to focal point</th><th>Spot diameter</th></tr>
<tr><td>8 mm 0.315 in</td><td>13 mm approx.
0.512 in approx.</td><td>ø0.5 mm approx.
ø0.020 in approx.</td></tr>
<tr><td>10 mm 0.394 in</td><td>15 mm approx.
0.591 in approx.</td><td>ø0.8 mm approx.
ø0.031 in approx.</td></tr>
<tr><td>14 mm 0.551 in</td><td>30 mm approx.
1.181 in approx</td><td>ø3.0 mm approx.
ø0.118 in approx.</td></tr>
</table></td></tr>
</table>

Note: Refer to LIST OF FIBERS (p.25~) for the ambient temperature of fibers to be used in combination.

FIBER OPTIONS

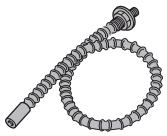
Others

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-42** **FT-42S** **FT-42W**	**FT-43** **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-31** **FT-31S** **FT-31W**	**FD-31** **FD-31W**	
	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-61** **FD-61G** **FD-61S** **FD-61W**	**FD-62** **FD-H13-FM2**	
	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-41** **FD-41W**	**FD-41S** **FD-41SW**	
	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 1)				
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				
Liquid inflow prevention joint (Note 2)	**MS-FX-01Y**	Applicable fibers	**FD-HF40Y** **FD-F41Y**	This joint suppresses false operations due to liquid slip-in from the top of the protective tube.		
Protective tube extension joint (Note 2)	**MS-FX-02Y**			The protective tube can be extended.		
Fiber mounting joint (Note 2)	**MS-FX-03Y**			The joint is used for mounting fibers on a tank.		
Single core holder	**FX-AT15A**	The incident light intensity may vary when using a multi-core fiber or a thin type sharp bending fiber. This holder suppresses the variation in the incident light intensity. (Brown)				
Reflector	**RF-210**	Used with **FR-Z50HW**. Refer to p.38 for the sensing range of **FR-Z50HW** to be used in combination.				
	RF-220					
	RF-230					

Notes: 1) Do not bend the sleeve part of any side-view type fiber or ultra-small diameter head type fiber.
2) The joint internal ferrule (**MS-FX-YF**) is available as a spare part. A distorted ferrule may result in leakage.

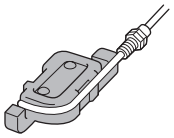
Protective tube

- **FTP-□**
- **FDP-□**



Fiber bender

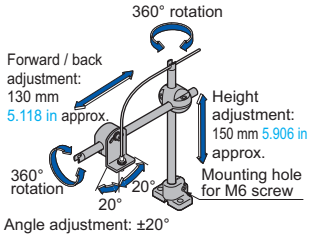
- **FB-1**



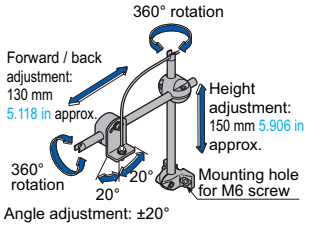
Universal sensor mounting stand

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**

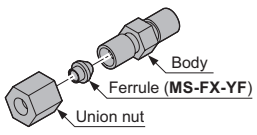


Single core holder

- **FX-AT15A**

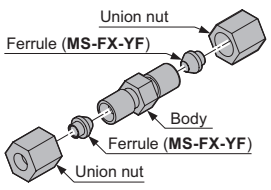
Liquid inflow prevention joint

- **MS-FX-01Y**



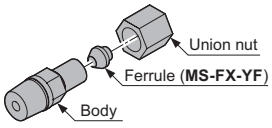
Protective tube extension joint

- **MS-FX-02Y**



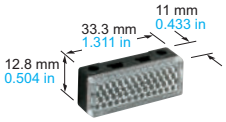
Fiber mounting joint

- **MS-FX-03Y**



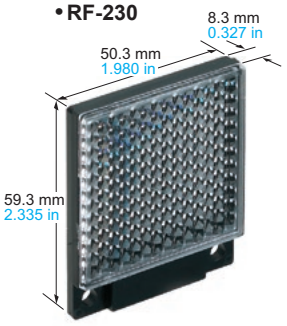
Reflector

- **RF-210**



- **RF-220**

- **RF-230**



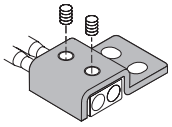
FIBER OPTIONS

Model No. when ordering heat-resistant fibers individually as spare parts

- Heat-resistant side fiber
  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)
- Ordinary temperature side fiber
  FT-42 (one pair set)

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

- Vacuum-resistant fiber
  FT-H30-M1V (one pair set)
  FD-H30-KZ1V
  FD-H30-L32V
- Photo-terminal
  FV-BR1 (one pair set)
- Fiber at atmospheric side
  FT-J8 (one pair set)
- Mouting bracket for **FD-KZ50V / FD-H30-KZ1V**(**-S**)
  MS-FD-2



Model No. when ordering accessories additionally

- **RF-003** (Reflector for **FR-KZ50E/KZ50H**)
- **RF-13** (Reflective tape for **FR-Z50HW**)
- **FX-CT2** (Fiber cutter)
- **FX-CT3** (Fiber cutter for ø1mm ø0.039 in / ø1.3mm ø0.051 in fiber cable / ø4mm ø0.157 in protective tube)
- **FX-CT4** (Fiber cutter for ø2mm ø0.079 in fiber cable / ø4mm ø0.157 in protective tube)
- **FX-AT2** (Attachment for fixed-length fiber, Orange)
- **FX-AT3** (Attachment for ø2.2 mm ø0.087 in fiber, Clear orange)
- **FX-AT4** (Attachment for ø1 mm ø0.039 in fiber, Black)
- **FX-AT5** (Attachment for ø1.3 mm ø0.051 in fiber, Gray)
- **FX-AT6** (Attachment for ø1 mm ø0.039 in / ø1.3 mm ø0.051 in mixed fiber, Black / Gray)
- **FX-AT4G1** (Gland single for ø1 mm ø0.039 in fiber, Black)
- **FX-AT5G1** (Gland single for ø1.3 mm ø0.051 in fiber, Gray)
- **FX-AT6G1** (Gland single for ø1 mm ø0.039 in / ø1.3 mm ø0.051 in mixed fiber, Black / Gray)
- **FX-SL1** (Slit mask for **FT-A11** / **FT-A11W** (one pair set), slit size: 0.5 × 12 mm 0.020 × 0.472 in)
- **FX-SL2** (Slit mask for **FT-A11** / **FT-A11W** (one pair set), slit size: 1 × 12 mm 0.039 × 0.472 in)
- **FX-SL3** (Slit mask for **FT-A32** / **FT-A32W** (one pair set), slit size: 0.5 × 33 mm 0.020 × 1.299 in)
- **MS-FD-2** (Fiber mounting bracket)
- **MS-FD-F7-1** (SUS mounting bracket for **FD-F71**)
- **MS-FD-F7-2** (PVC mounting bracket for **FD-F71**)

- **RF-003**

- **RF-13**

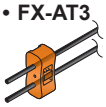
- **FX-CT2**

- **FX-CT3**

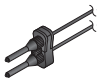
- **FX-CT4**

- **FX-AT2**

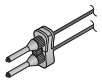
- **FX-AT3**



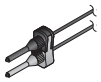
- **FX-AT4**



- **FX-AT5**



- **FX-AT6**

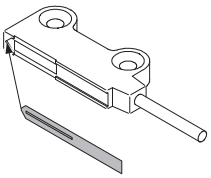


- **FX-AT4G1**

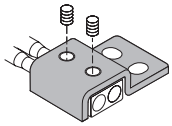
- **FX-AT5G1**

- **FX-AT6G1**

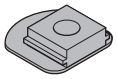
- **FX-SL1**
- **FX-SL2**
- **FX-SL3**



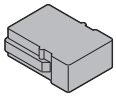
- **MS-FD-2**



- **MS-FD-F7-1**
  (SUS mounting bracket for **FD-F71**)



- **MS-FD-F7-2**
  (PVC mounting bracket for **FD-F71**)



Disclaimer

The applications described in the catalog are all intended for examples only. The purchase of our products described in the catalog shall not be regarded as granting of a license to use our products in the described applications. We do NOT warrant that we have obtained some intellectual properties, such as patent rights, with respect to such applications, or that the described applications may not infringe any intellectual property rights, such as patent rights, of a third party.

Please contact .....

Panasonic Corporation
Industrial Device Business Division
■ 7-1-1, Morofuku, Daito-shi, Osaka 574-0044, Japan
industrial.panasonic.com/ac/e/

Panasonic®

No.CE-FX500550-7 June, 2021