Digital Fiber Sensor / FX-301 SERIES

Refer to the **FX-301** catalog for more details.

Conforming to EMC Directive

UL Recognition

Superior performance and advanced user-friendly multi-functionality enables expert usage on the very first day

MODE NAVI
New Advanced sensor with Visible indicator

Type	NPN output	PNP output
Model No.	**FX-301**□	**FX-301**□**P**
Sensing range (Red LED type)	Thru-beam type (**FT-B8**): 1,100 mm 43.307 in (LONG), 530 mm 20.866 in (STD) 400 mm 15.748 in (FAST), 180 mm 7.087 in (S-D) Reflective type (**FD-B8**): 480 mm 18.898 in (LONG), 220 mm 8.661 in (STD) 160 mm 6.299 in (FAST), 75 mm 2.953 in (S-D)	
Supply voltage	12 to 24 V DC ± 10%	
Output	NPN open-collector transistor	PNP open-collector transistor
Output operation	Selectable either Light-ON or Dark-ON, with jog switch	
Response time	150 μs or less (FAST), 250 μs or less [STD / S-D(Red LED type only)], 2 ms or less (LONG) selectable with jog switch	
Digital display	4 digit red LED display	
Sensitivity setting	2-level teaching / Limit teaching / Manual adjustment / Full-auto teaching(except for red LED type)	
Automatic interference prevention function	Incorporated (Up to 4 sets of fiber heads can be mounted close together.)	
Ambient temperature	− 10 to + 55°C + 14 to 131°F (If 4 to 7 units are connected in cascade: − 10 to + 50°C + 14 to 122°F, if 8 to 16 units are connected in cascade: − 10 to + 45°C + 14 to 113°F)	
Emitting element (modulated)	**FX-301**(**P**): Red LED, **FX-301B**(**P**): Blue LED, **FX-301G**(**P**): Green LED, **FX-301H**(**P**): Infrared LED	
Dimensions	W10 × H30.5 × D64.5 mm W0.394 × H1.201 × D2.575 in	

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

Main cable (3-core): **CN-73-C1** (cable length 1 m 3.281 ft)
CN-73-C2 (cable length 2 m 6.562 ft)
CN-73-C5 (cable length 5 m 16.404 ft)
Sub cable (1-core): **CN-71-C1** (cable length 1 m 3.281 ft)
CN-71-C2 (cable length 2 m 6.562 ft)
CN-71-C5 (cable length 5 m 16.404 ft)

Newly developed

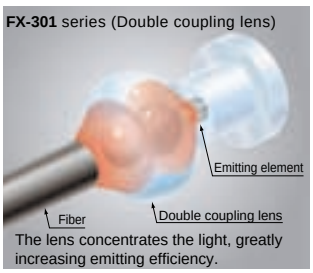
Stable long-term sensing

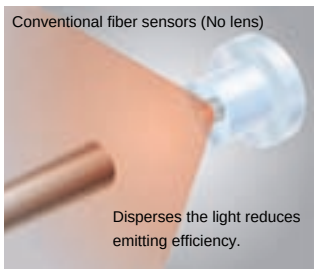
The newly developed four-chemical emitting element that uses the **FX-301** (red LED type) suppresses changes over long periods of time as much as possible, so that a stable light emitting level is maintained. There is very little element deterioration so that stable and accurate sensing can be maintained over long periods.

Innovative feature

Long-range sensing made possible with built-in optical lens

For the first time in the industry, an optical 'double coupling lens' has been incorporated directly into the fiber sensor itself. This lens maximizes the light emission efficiency, resulting in a tremendous improvement in the sensing range. Sensing ranges with small diameter fibers and ultra-small diameter fibers, which have become very popular in recent years due to the miniaturization of chip components, have been increased by 50% over previous values achieved with other amplifiers.





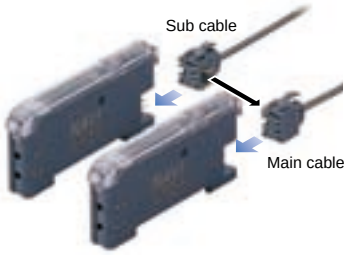
Easy operation with MODE NAVI

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

MODE NAVI (MODE indicators)

Easy maintenance, as main and sub units are identical

Both main and sub units utilize the same amplifier body. This feature allows for easy mounting in the side-by-side configuration. The main and sub unit functions are distinguished only by the proper use of the 3-core main cable and the 1-core sub cable. Moreover, by utilizing the same body for both main and sub units, inventory management and maintenance is simplified.



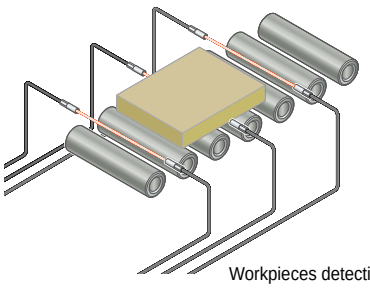
Equipped with a timer for easy fine adjustments

Fine adjustments in the workplace can be made at the sensor itself, without changing PLC settings.
Variable ON-delay/OFF-delay/ONE-SHOT timer 0.5 to 500 ms

A lineup of four light source type sensors gives a greater range of applications!

Red LED type — FX-301

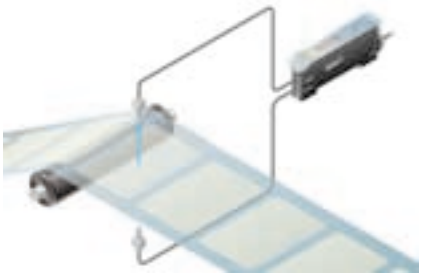
This standard type using red light has a four-chemical emitting element for stable sensing over long periods.



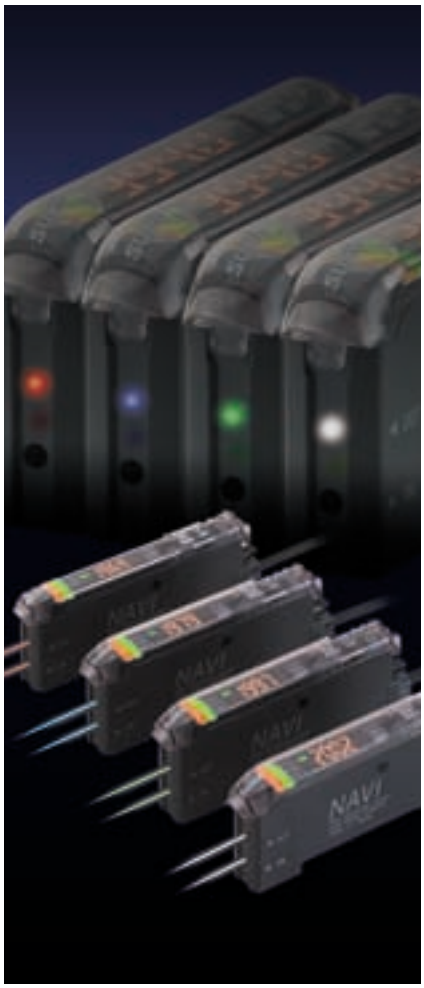
Workpieces detection

Blue LED type — FX-301B

The blue LED type greatly reduces the dampening rate, making it ideal for delicate sensing.

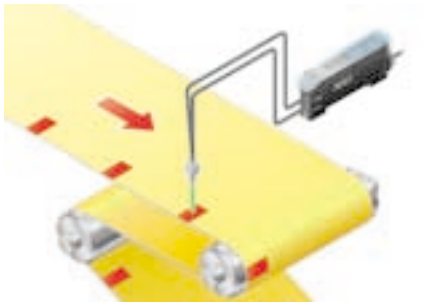


Sensing semi-transparent stickers



Green LED type — FX-301G

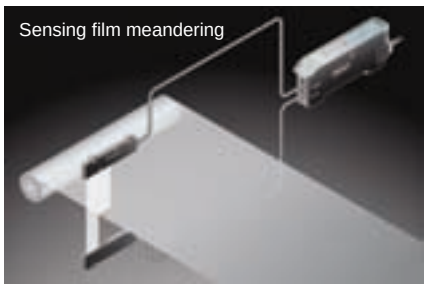
The green LED type can accurately discriminate between red and yellow, that cannot be easily detected using red LED type.



Sensing register marks

Infrared LED type — FX-301H

Infrared LED type is ideal for sensing environments with light restrictions, such as places where light-sensitive film is being handled. (The emitting peak wavelength : 940 nm.) It includes full-auto teaching function which allows sensitivity to be set without stopping the workpiece line.



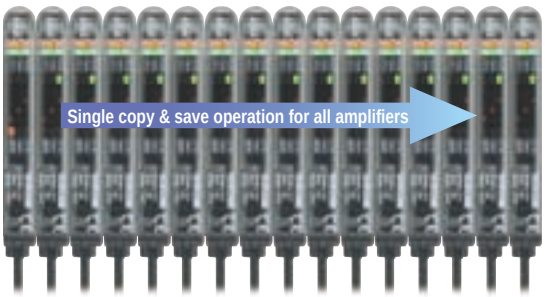
Color combinations that can be discerned during mark sensing

Mark color / Background color	White	Yellow	Orange	Red	Green	Blue	Black
White		●	●	●●	●●●	●●●	●●●
Yellow	●		●	●	●●●	●●●	●●●
Orange	●	●		●●	●●●	●●●	●●●
Red	●●	●	●●		●	●●	●●
Green	●●●	●●●	●●●	●		●	●
Blue	●●●	●●●	●●●	●●	●		●
Black	●●●	●●●	●●●	●●	●	●	

●: Red light
●: Blue light
●: Green light

Optical communication function lets multiple sensors be adjusted all at once

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



High Speed Digital Fiber Sensor / FX-303

CE Conforming to EMC Directive

Applied for UL Recognition

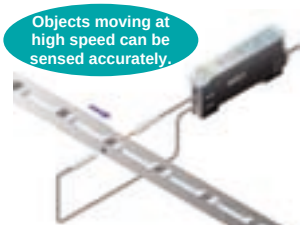
High-speed sensing of 90 μs

90 μs high-speed response

FX-303 is high-speed type with response time of 90 μs.
This is ideal for applications which require high-speed sensing and sensing of minute objects.

Chip component sensing

Objects moving at high speed can be sensed accurately.



Solves saturation problems at close distances

The light amount can be set to one of three levels at a fixed response time (90 μs).

H-SP MODE Normal (standard)	Used for general sensing.
S-D1 MODE Approx. 50% of standard	Used when the received light amount becomes saturated during **H-SP** mode.
S-D2 MODE Approx. 80% of standard	

Supply voltage: 12 to 24 V DC ± 10 %
Output: NPN open-collector transistor (NPN output type) or PNP open-collector transistor (PNP output type)

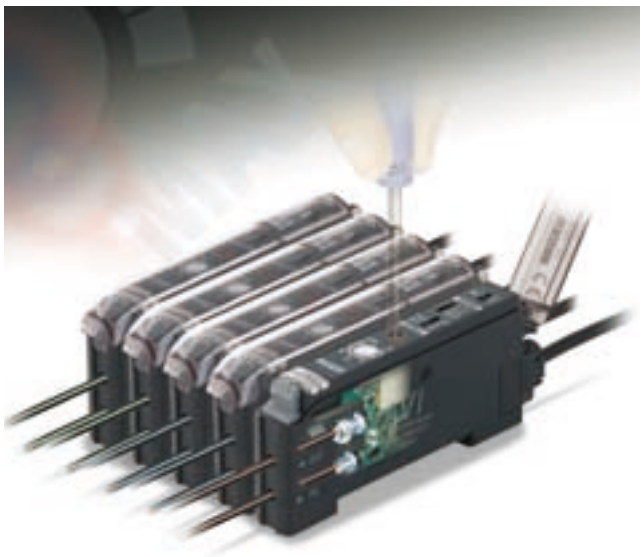
Manually Set Fiber Sensor / FX-311 SERIES

Refer to the **FX-311** catalog for more details.

Conforming to EMC Directive

UL Recognition

Sensing New Frontiers
Highly sensitive manual tuning made easy.



Type	NPN output	PNP output
Model No.	**FX-311**□	**FX-311**□**P**
Sensing range (Red LED type)	Thru-beam type (**FT-B8**): 1,100 mm 43.307 in (LONG), 530 mm 20.866 in (STD), 180 mm 7.087 in (S-D) Reflective type (**FD-B8**): 480 mm 18.898 in (LONG), 220 mm 8.661 in (STD), 75 mm 2.953 in (S-D)	
Supply voltage	12 to 24 V DC ± 10%	
Output	NPN open-collector transistor	PNP open-collector transistor
Output operation	Selectable either Light-ON or Dark-ON, with selection switch	
Response time	150 μs or less {FAST[**FX-311B**(**P**)/**311G**(**P**) only]}, 250 μs or less (STD / S-D), 2 ms or less (LONG) selectable with selection switch	
Timer function	Incorporated with OFF-delay timer, selectable either effective (10ms or 40ms approx.) or ineffective	
Automatic interference prevention function	Incorporated (Up to 4 sets of fiber heads can be mounted close together.)	
Ambient temperature	−10 to +55°C +14 to 131°F (If 4 to 7 units are connected in cascade: −10 to +50°C +14 to 122°F, if 8 to 16 units are connected in cascade: −10 to +45°C +14 to 131°F)	
Emitting element (modulated)	**FX-311**(**P**): Red LED, **FX-311B**(**P**): Blue LED, **FX-311G**(**P**): Green LED	
Dimensions	W10 × H30.5 × D64.5 mm W0.394 × H1.201 × D2.575 in	

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

Main cable (3-core): **CN-73-C1** (cable length 1 m 3.281 ft)
CN-73-C2 (cable length 2 m 6.562 ft)
CN-73-C5 (cable length 5 m 16.404 ft)

Sub cable (1-core): **CN-71-C1** (cable length 1 m 3.281 ft)
CN-71-C2 (cable length 2 m 6.562 ft)
CN-71-C5 (cable length 5 m 16.404 ft)

Newly developed

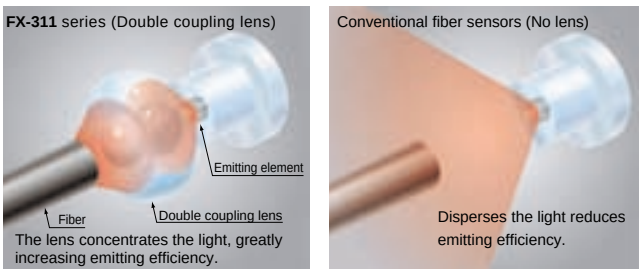
Stable long-term sensing

The newly developed four-chemical emitting element that uses the **FX-311** (red LED type) suppresses changes over long periods of time as much as possible, so that a stable light emitting level is maintained. There is very little element deterioration so that stable and accurate sensing can be maintained over long periods.

Innovative feature

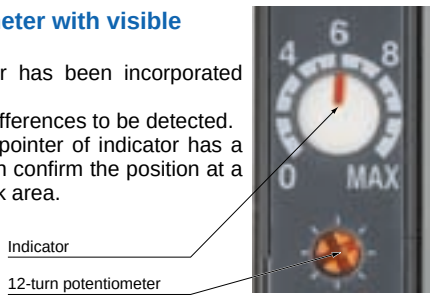
Long-range sensing made possible with built-in optical lens

For the first time in the industry, an optical 'double coupling lens' has been incorporated directly into the fiber sensor itself. This lens maximizes the light emission efficiency, resulting in a tremendous improvement in the sensing range. Sensing ranges with small diameter fibers and ultra-small diameter fibers, which have become very popular in recent years due to the miniaturization of chip components, have been increased by 50% over previous values achieved with other amplifiers.



12-turn potentiometer with visible indicator

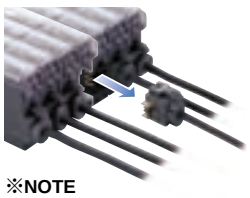
12-turn potentiometer has been incorporated for fine adjustments.
It enables very fine differences to be detected.
Moreover, since the pointer of indicator has a red backlight, you can confirm the position at a glance, even in a dark area.



Side-by-side connection with FX-301 is also possible, which saves space and makes installation quick

Each sub cable is a single output wire, reducing wiring and simplifying installation. Quick-connection cables are the same type as used on the **FX-301** series and **FX-302**(**P**), facilitating side-by-side connection. Furthermore, the connectors are the sliding type, which allows them to be removed without shifting amplifier positions. This eliminates the need to provide extra maintenance space around the amplifiers.

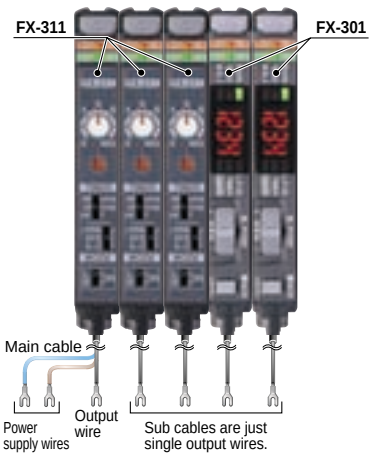
Sliding connectors are easy to insert and remove



※NOTE

Only the interference prevention settings can be transmitted between between this product and digital fiber sensor **FX-301** series and **FX-302**(**P**).

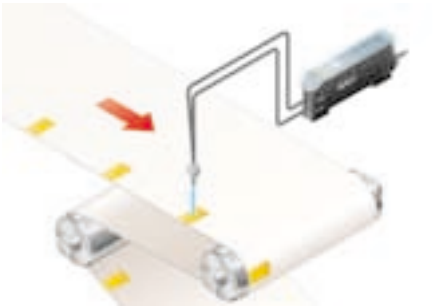
Therefore, if both models of amplifiers are mounted in cascade, make sure to mount identical models together.



New 2 type lineup boosts the range of applications

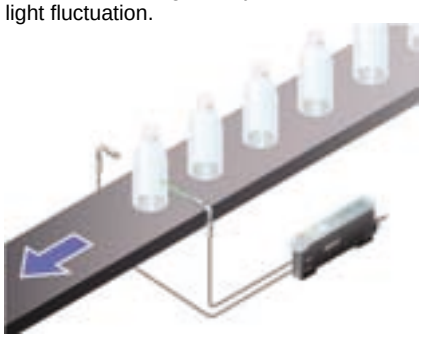
Blue LED type FX-311B

The blue LED type can accurately sense yellow marks on white backgrounds that are difficult to sense using the red LED type.



Green LED type FX-311G

The green LED type is ideal for stably sensing objects such as transparent containers which give only small amounts of light fluctuation.



Color combinations that can be discerned during mark sensing

Mark color / Background color	White	Yellow	Orange	Red	Green	Blue	Black
White		●	●	●●	●●●	●●●	●●●
Yellow	●		●	●	●●●	●●●	●●●
Orange	●	●		●●	●●●	●●●	●●●
Red	●●	●	●●		●	●●	●●
Green	●●●	●●●	●●●	●		●	●
Blue	●●●	●●●	●●●	●●	●		●
Black	●●●	●●●	●●●	●●	●	●	

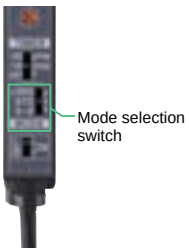
●: Red light
●: Blue light
●: Green light

Mode can be selected in three steps to suit the application

The mode select switch can change the mode to one of three modes to suit a variety of sensing applications.

Long range mode (LONG)	Ideal for cases where long-distance sensing is required (Response time: 2 ms)
Standard mode (STD)	Used for general sensing (Response time: 250 μs)
High-speed mode (FAST) (Note)	Ideal for cases where fast sensing is required (Response time: 150 μs)
Reduced intensity mode (S-D) (Note)	Effective for fine detection (Response time: 250 μs)

Note: High-speed mode is only available for the **FX-311B** (**P**) and **FX-311G** (**P**).
S-D (reduced intensity) mode is only available with the **FX-311** (**P**).



Easy operation by using a convenient, hand-turned adjusting knob on cover

An optional hand-turned knob attached to the cover (**FX-AJ1**) is available, which makes a screwdriver unnecessary. You can adjust sensitivity on site at any time quickly and easily.

OFF-delay Timer with Selectable Timer Period

The **FX-311** series incorporates an OFF-delay timer.
It is useful when the connected device has a slow response time or when small objects are being sensed and the output signal width is small. You can select the timer period not only 40 ms but also 10 ms. It is also suitable for increased PLC speeds.

Rapid flashing 'Assist Function' eases adjustment for optimum sensitivity

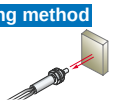
Innovative feature

The **FX-311** series has a convenient built-in 'Assist Function' which indicates the optimum sensitivity position by flashing rapidly when optimum sensitivity is reached. This enables easy and reliable sensitivity adjustment, which is convenient for a narrow sensing range requiring fine tuning.

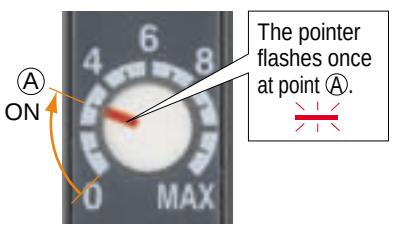
※In order enable the 'Assist Function', switch the operation selection switch from L-ON→D-ON→L-ON.

1 Find the point Ⓐ where the sensor is switched ON in the sensing condition.

Sensing method

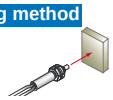


Sensing (beam received) condition

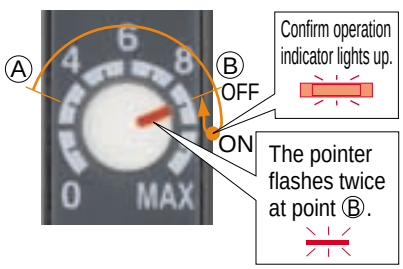


2 In the non-sensing condition, turn the adjuster until ON state again, turn the adjuster counterclockwise and find the point Ⓑ where it is switched OFF.

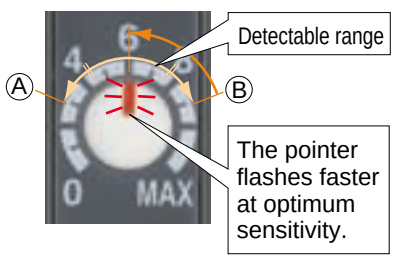
Sensing method



Non-sensing (beam not received) condition



3 Optimum sensitivity point located.



High-functional Digital Fiber Sensor / FX-302

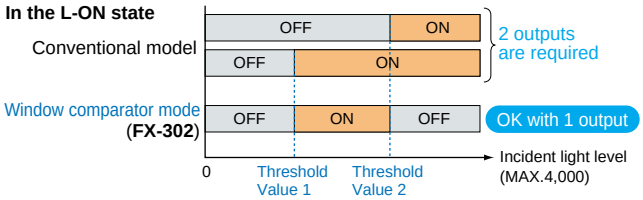
Building upon our existing multi-functionality and usability, **FX-302** further extends the state of the art by incorporating a Window Comparator Mode

Conforming to EMC Directive | UL Recognition

New concept

Arithmetic processing is no longer required Incorporates a convenient single-output window comparator mode

In addition to standard ON / OFF operation, **FX-302** comes fully equipped with a window comparator mode, which sets maximum and minimum threshold values and controls the incident light level through ON / OFF operation within this range. With its single output, only one wire is required, making PLC processing unnecessary.

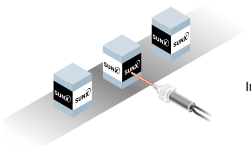


Teaching Methods There are 3 types of teaching methods: 1-level teaching / 2-level teaching / 3-level teaching.

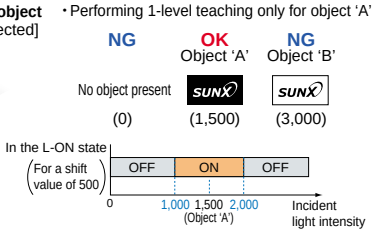
1-level Teaching

This function allows the unit to perform 1-level teaching (object 'A'). If an arbitrary shift value has been selected, then threshold values are set at 2 positions.

Identifying the orientation of the object
[When only object 'A' must be detected]



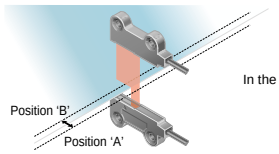
• Performing 1-level teaching only for object 'A'



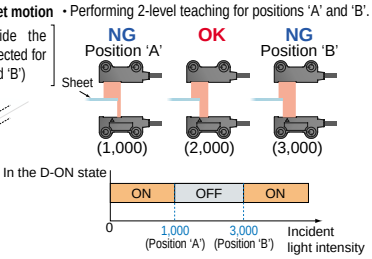
2-level Teaching

If teaching is performed for 2 positions (positions 'A' and 'B'), then the threshold values will be set for these 2 positions.

Sensing side-to-side fluctuations in sheet motion
When side-to-side fluctuations, outside the permissible range of motion, must be detected for a moving sheet (between positions 'A' and 'B')



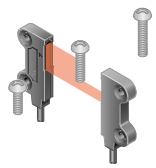
• Performing 2-level teaching for positions 'A' and 'B'.



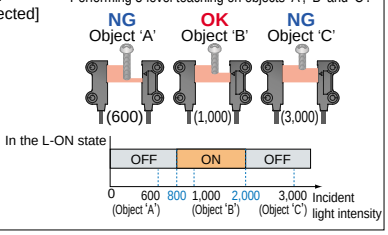
3-level Teaching

If 3-level teaching is performed for 3 positions (objects 'A', 'B' and 'C'), then the threshold values will be set in between objects 'A' & 'B', and objects 'B' & 'C'.

Identifying the length of a screw
[When only object 'B' must be detected]



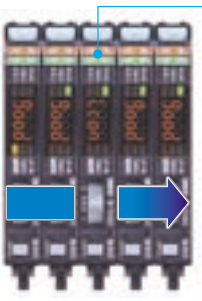
• Performing 3-level teaching on objects 'A', 'B' and 'C'.



Communications setting change function can be locked

Once optical communication has been used for the single-step copying of settings, or for the single-step read-out / saving of databank data, then new data cannot be overwritten into fiber sensors with locked settings.

This function is useful when all data must be read out in a single step, at the time that sensing objects are about to be rearranged, or when the existing settings of synchronized fiber sensors must be maintained.



Overwriting will be prevented when fiber sensor amplifier settings have been locked.

New concept

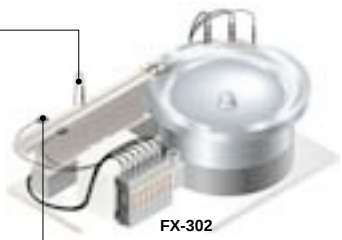
Lower total cost, as PLC and timer are not required Incorporates an ON-delay / OFF-delay timer and an ON-delay / ONE-SHOT timer

In addition to the 3 timer modes incorporated in **FX-301** (ON-delay, OFF-delay and ONE-SHOT), **FX-302** also adds an ON-delay / OFF-delay timer and an ON-delay / ONE-SHOT timer. Timer operations that were previously controlled by the PLC and timer can now be controlled by the fiber sensor unit itself, resulting in space savings and a lower cost.

Application example for the ON-delay / OFF-delay timer and the ON-delay / ONE-SHOT timer

Utilization of high pressure air for chip sorting after identification of top and bottom surfaces

Only chips with the bottom surface facing upward will be detected. These chips, once detected, will be blown to the side with a jet of air.
The ON-delay function cancels the detection signals of the electrodes.
By detecting the distance between the fiber head and the air outlet, and the rate of vibration, either the ON-delay / OFF-delay timer, or the ON-delay / ONE-SHOT timer will be set.

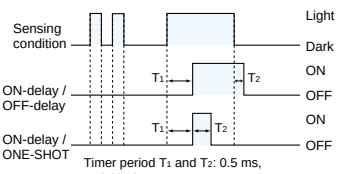


Application example for the ON-delay / OFF-delay timer

Detecting chip congestion status on a straight transport feeder

The ON-delay function is used to output a signal containing the chip congestion status, in order to determine whether the feeder is too crowded with chips. This signal controls the rate of vibration at the ball feeder area.
The OFF-delay function keeps the vibration of the ball feeder area stopped, until chip congestion decreases and chips are again transported smoothly.

Time Chart In the L-ON state



Timer period T_1 and T_2: 0.5 ms, variable from 1 ms to 5 sec.

Timer period	Settings Changing Unit
0.5 ms, 1 ms to 30 ms	1 ms
30 ms to 100 ms	5 ms
100 ms to 500 ms	10 ms
500 ms to 1 sec.	50 ms
1 sec. to 5 sec.	0.5 sec.

Up to 8 fiber heads can be installed closely together

The optical communications feature allows up to 8 fiber heads to be installed closely together, without causing mutual interference.

However, when connecting **FX-301/311** units, a maximum of 4 units can be installed without mutual interference.

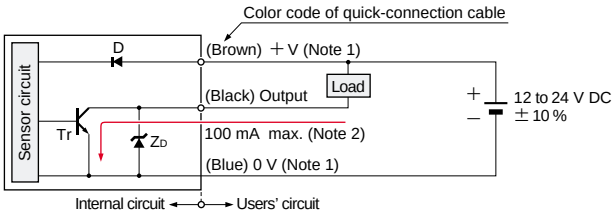
SPECIFICATIONS

Type	NPN output	PNP output
Model No.	**FX-302**	**FX-302P**
Supply voltage	12 to 24 V DC ± 10 % 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: 600 mW or less (Current consumption 25 mA or less at 24 V supply voltage)	
Output	NPN open-collector transistor • Maximum sink current: 100 mA (Note 1) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less [at 100 mA (Note 1) sink current]	PNP open-collector transistor • Maximum source current: 100 mA (Note 1) • Applied voltage: 30 V DC or less (between output and + V) • Residual voltage: 1.5 V or less [at 100 mA (Note 1) source current]
Output operation	Selectable either Light-ON or Dark-ON, with jog switch	
Short-circuit protection	Incorporated	
Response time	300 μs or less (FAST), 500 μs or less (STD / S-D), 4 ms or less (LONG) selectable with jog switch	
Operation indicator	Orange LED (lights up when the output is ON)	
Stability indicator	Green LED (lights up under stable light received condition or stable dark condition)	
MODE indicator	RUN: Green LED, TEACH • ADJ • L / D ON • TIMER • PRO: Yellow LED	
Digital display	4 digit red LED display	
Sensitivity setting	Normal mode: 2-level teaching / Limit teaching / Manual adjustment Window comparator mode: Teaching (1-level / 2-level / 3-level) / Manual adjustment	
Fine sensivity adjustment function	Incorporated	
Timer function	Incorporated with variable ON-delay, OFF-delay, ONE-SHOT, ON-delay / OFF-delay, ON-delay / ONE-SHOT timer, switchable either effective or ineffective (timer period. 0.5 ms to 5 sec. approx.)	
Automatic interference prevention function	Incorporated (Up to 8 sets of fiber heads can be mounted closely.)	
Ambient temperature	− 10 to + 55°C + 14 to 131°F (If 4 to 7 units are connected in cascade: − 10 to + 50°C + 14 to 122°F, if 8 to 16 units are connectedin cascade: − 10 to + 45°C + 14 to 113°F) (No dew condensation or icing allowed) Storage: − 20 to + 70°C − 4 to + 158°F	
Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH	
Emitting element	Red LED (modulated)	
Material	Enclosure: Heat-resistant ABS, Case cover: Polycarbonate, Switch: Acrylic	
Connecting method	Connector connection (Note 4)	
Cable extension	Extension up to total 100 m 328.084 ft is possible with 0.3 mm² 0.012 in², or more, cable.	
Weight	20 g 0.705 oz approx.	

Notes: 1) 50 mA, if five or more amplifiers are connected in cascade.
2) When connecting the **FX-301** series digital fiber sensors and the **FX-311** series manually set fiber sensors, a maximum of 4 units can be installed without mutual interference.
3) When the power supply is switched on, the emission timing is automatically set for interference prevention.
4) The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below.
Main cable (3-core): **CN-73-C1** (cable length 1 m 3.281 ft)
CN-73-C2 (cable length 2 m 6.562 ft)
CN-73-C5 (cable length 5 m 16.404 ft)
Sub cable (1-core): **CN-71-C1** (cable length 1 m 3.281 ft)
CN-71-C2 (cable length 2 m 6.562 ft)
CN-71-C5 (cable length 5 m 16.404 ft)

I/O CIRCUIT DIAGRAMS

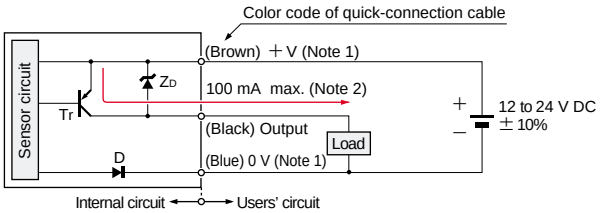
FX-302 NPN output



Notes: 1) The quick-connection sub cable does not have + V (brown) and 0 V (blue).
2) 50 mA max., if five or more amplifiers are connected in cascade.

Symbols ... D : Reverse supply polarity protection diode
ZD: Surge absorption zener diode
Tr : NPN output transistor

FX-302P PNP output

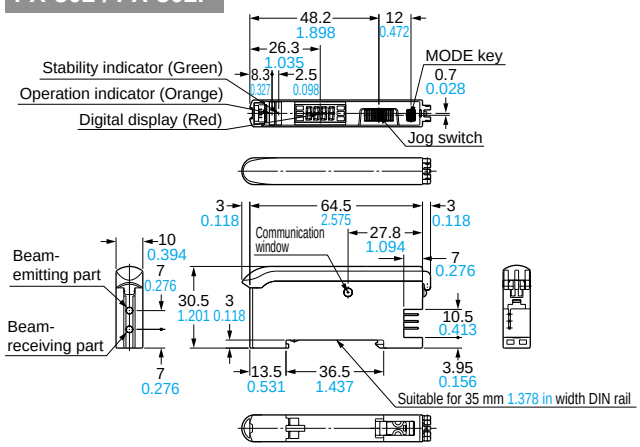


Notes: 1) The quick-connection sub cable does not have + V (brown) and 0 V (blue).
2) 50 mA max., if five or more amplifiers are connected in cascade.

Symbols ... D : Reverse supply polarity protection diode
ZD: Surge absorption zener diode
Tr : PNP output transistor

DIMENSIONS (Unit : mm in)

FX-302 / FX-302P



Digital Fiber Sensor **For leak detection fiber / liquid fiber only**

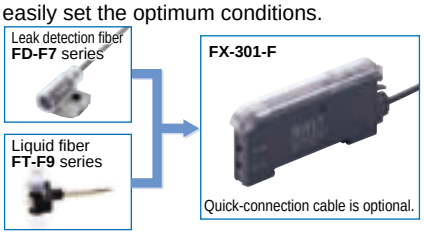
FX-301-F

Refer to **FX-301-F** catalog for more details.

Optimum settings can be realized with simple operations.

For use with leak detection or liquid fiber only

FX-301-F is designed specifically for use with the leak detection fiber (**FD-F7** series) or the liquid fiber (**FT-F9** series). You can easily set the optimum conditions.



Flashing function incorporated

When the leak detection fiber is connected (F7 mode), if a leak is detected, you will recognize which fiber detects the leak at a single glance because the emitter will start flashing.

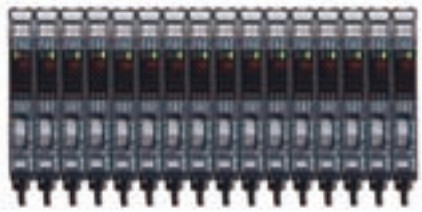
Easy to operate with individual / collective teaching mode

Individual teaching mode (TEACH)

After you select the **FD-F7** series or the **FT-F9** series with the jog switch, the optimum threshold level is automatically set by just pressing the jog switch.

Collective teaching mode (ALL)

You can set the optimum sensitivity for all cascaded units in one step by the optical communications function. Moreover, since the settings are also copied to all units, the time involved is considerably reduced.



Communication direction

Collective teaching mode is possible for 16 units max.

Supply voltage: 12 to 24 V DC ± 10 %
Output: NPN open-collector transistor (NPN output type) or PNP open-collector transistor (PNP output type)

Bank Selection Unit / FX-CH SERIES

CE Conforming to EMC Directive | Applied for UL Recognition

Settings for up to 16 fiber sensors can be changed at once by means of external signals

Settings can be changed by external signals

The settings for fiber sensors with bank functions can be changed using a switch or PLC signals.

Both loading and saving can be performed

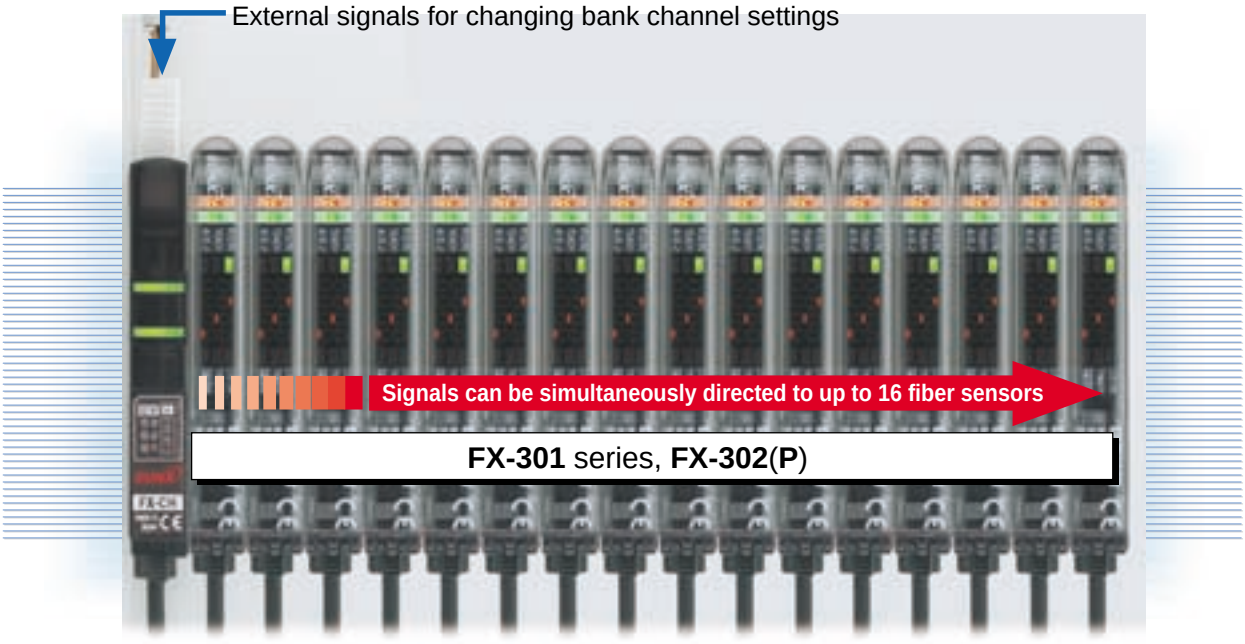
It is possible to perform both load (read-out settings) and save (save settings) operations by designating the bank channel.

Settings for 16 fiber sensors can be changed at once

Settings for up to 16 **FX-301** series and **FX-302**(**P**) sensors connected in series can be changed at once. This makes it much easier to reset sensors after tooling changes.

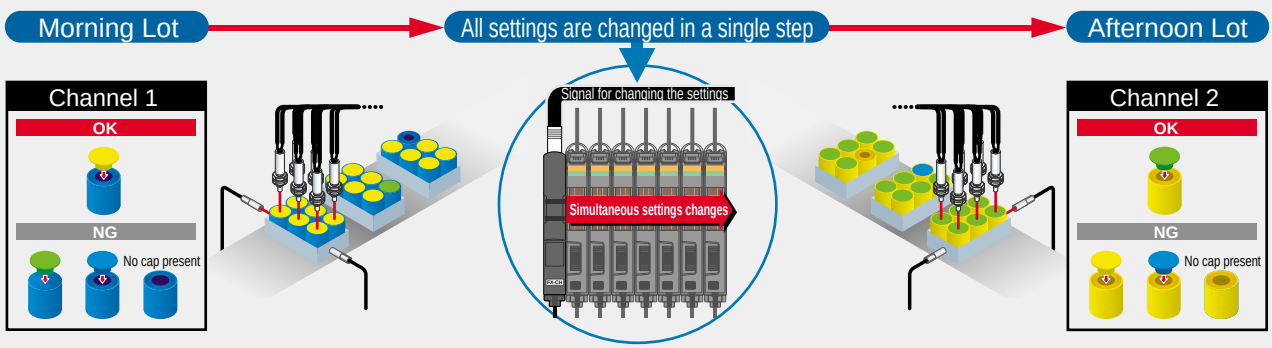
Suitable for a wide range of applications

Bank settings include response times, threshold values, output operation settings, timer settings, hysteresis, stability, digital display settings (incident light intensity / percentage / peak hold / bottom hold), digital display inversion and ECO mode. These can all be changed at once using external signals to correspond to a variety of different applications.



Application Example

In production lines containing target objects that vary in color from lot to lot, the fiber sensor's settings must be changed in accordance with the characteristics of the target objects (see illustration below). However, it can be very troublesome to change sensor settings for each different arrangement or type of work. Making these changes to settings takes time and requires extra care, in order to avoid possible malfunctions.
The **FX-CH** series allows preset bank settings to be changed, all in a single step, by utilizing an external signal, without having to handle individual sensors.



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ORDER GUIDE

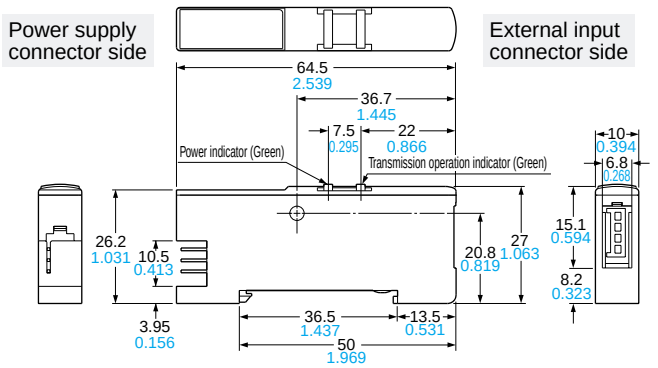
Designation		Model No.	Description	
Bank selection unit		**FX-CH**	NPN input type	By using an external signal, this unit can change the bank channel settings for up to 16 fiber sensors [of both the **FX-301** series and **FX-302**(**P**)], all in a single step.
		FX-CH-P	PNP input type	
4-pin type male snap connector		**SL-CP1** (White)	For 0.08 to 0.2 mm^2 Wire diameter: ϕ0.7 to ϕ1.2 mm ϕ0.028 to ϕ0.047 in	This male snap connector is used to connect the channel changing input to the bank selection unit. The bank selection unit includes one **SL-CP1**.
		SL-CP2 (Black)	For 0.3 mm^2 Wire diameter: ϕ1.1 to ϕ1.6 mm ϕ0.043 to ϕ0.063 in	
		SL-CP3 (Greenish blue)	For 0.5 mm^2 Wire diameter: ϕ1.7 to ϕ2.5 mm ϕ0.067 to ϕ0.098 in	
Quick-connection cable	Main cable	**CN-73-C1**	Length: 1 m 3.281 ft	This one-touch cable is utilized when connecting the **FX-301** series and **FX-302**(**P**) fiber sensors and the **FX-CH** series bank selection unit together in side-by-side configuration. 0.15 mm^2 3-core cabtyre cable, with connector on one end Cable outer diameter: ϕ3 mm ϕ0.12 in
		CN-73-C2	Length: 2 m 6.562 ft	
		CN-73-C5	Length: 5 m 16.404 ft	
	Sub cable	**CN-71-C1**	Length: 1 m 3.281 ft	This one-touch cable is utilized when connecting the **FX-301** series and **FX-302**(**P**) fiber sensors and the **FX-CH** series bank selection unit together in side-by-side configuration. 0.15 mm^2 1-core cabtyre cable, with connector on one end Cable outer diameter: ϕ 3 mm ϕ0.12 in
		CN-71-C2	Length: 2 m 6.562 ft	
		CN-71-C5	Length: 5 m 16.404 ft	
End plates		**MS-DIN-E**	After the **FX-CH** series and the fiber sensors have been attached to the DIN rail, all of these devices must be secured firmly together by placing end plates at each of the ends and sandwiching the **FX-CH** series and the fiber sensors in between. Ensure that these end plates are used for this purpose.	

SPECIFICATIONS

Type	NPN input	PNP input
Model No.	**FX-CH**	**FX-CH-P**
Supply voltage	12 to 24 V DC ± 10 % Ripple P-P10 % or less	
Current consumption	25 mA or less	
Bank selection input	Low: 0 to 2 V DC (Source current: 0.5 mA Input impedance: 10 kΩ approx.) High: 5 V to +V DC or open	High: 4 V to +V DC (Sink current: 0.5 to 3 mA Input impedance: 10 kΩ approx.) Low: 0 to 0.6 V DC or open
Power indicator	Green LED (Lights up when the power is ON)	
Transmission operation indicator	Green LED (Lights up when loaded, blinks→lights up when saved)	
Ambient temperature	−10 to +55°C +14 to 131°F (No dew condensation or icing allowed), Storage: −20 to +70°C −4 to +158°F	
Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH	
Material	Enclosure: Heat-resistant ABS	
Weight	20 g 0.705 oz approx.	
Accessory	**SL-CP1** (Male snap connector): 1 pc.	

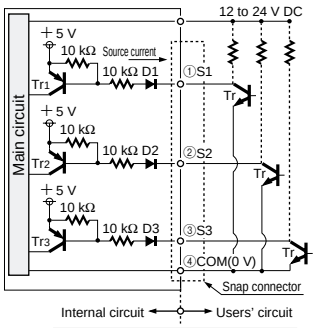
DIMENSIONS (Unit : mm in)

FX-CH / FX-CH-P



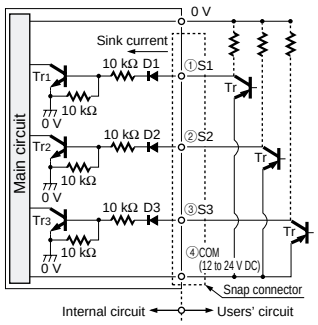
I/O CIRCUIT DIAGRAMS

FX-CH



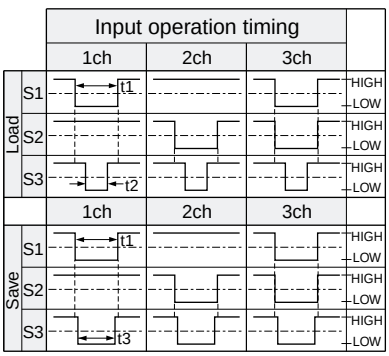
D1,D2,D3: Input protection diodes
Tr1,Tr2,Tr3: Input transistors

FX-CH-P



D1,D2,D3: Input protection diodes
Tr1,Tr2,Tr3: Input transistors

OPERATION TIMING CHART



	Load / Save		
	1ch	2ch	3ch
S1	●	○	●
S2	○	●	●
S3	●	●	●

①Select bank channel using S1 and S2.
②Keep S1 and S2 in the same state.
③Load using S3. (Input the timing period t2) (Input the timing period t3 for saving)
④Cancel input using S3.
* Input may be performed again after 10 sec.

Note) t1 : t1>t2, t1>t3
t2 : 1 ms to more than 2 sec.
t3 : 2 sec. or more

Notes: 1) The above diagram is for **FX-CH** (NPN input).
For **FX-CH-P** (PNP input), HIGH and LOW are reversed.

Sensor-PLC Connection System / SC SERIES

CE Conforming to EMC Directive | Applied for UL Recognition

Up to 16 I/O devices can be connected at once using MIL connectors

Up to 16 I/O devices can be connected at once

Devices such as fiber sensors and amplifiers built-in compact sensors that are used in concentrated groups can be connected together efficiently using MIL connectors.

Separated installation possible

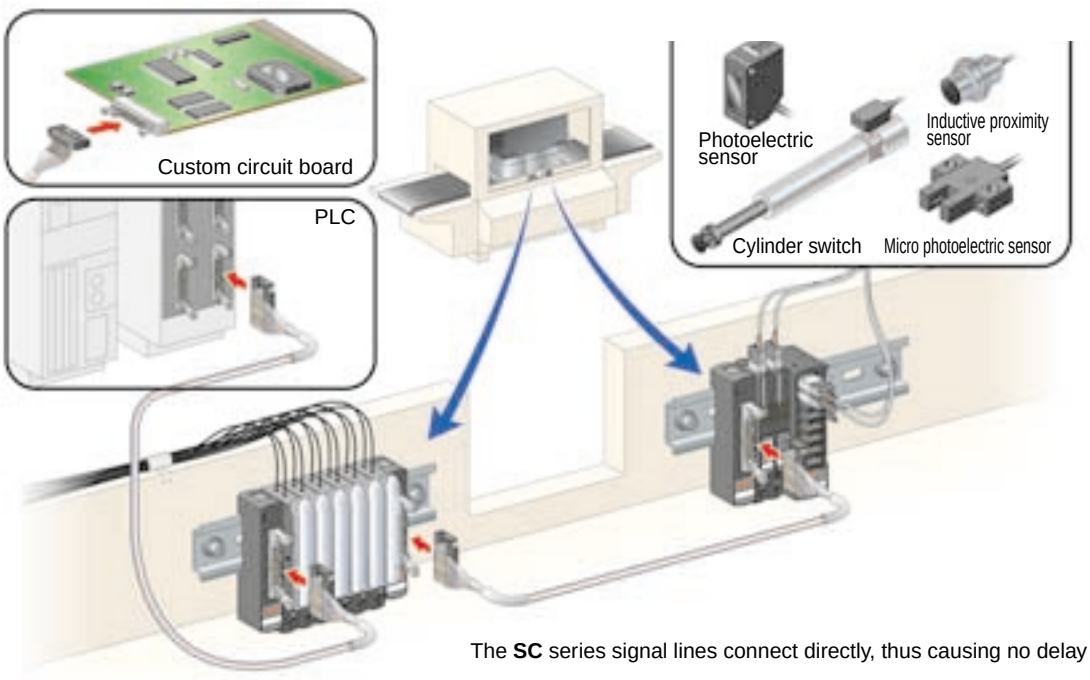
Separate unit **SC-MIL-S** is available for connecting sensors at a distance from each other using MIL connectors. This makes it possible to finely tune the sensor layout to suit the setup location.

Freely expandable as required

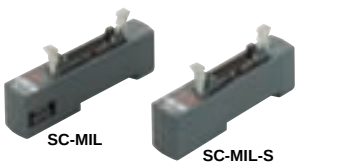
The abbreviated wiring system is economical and lets you expand the system by any amount required, from one up to 16 channels.

Compatible with a variety of input and output devices

In addition to NPN open collector and PNP open collector output sensors and switches, input from other devices such as DC 2-wire sensors is also possible. Output to many different types of devices is also available.

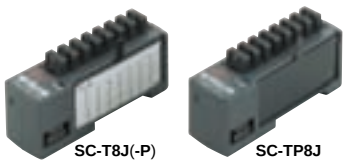


The **SC** series signal lines connect directly, thus causing no delay in response.



Main unit **SC-MIL**
Separate unit **SC-MIL-S**

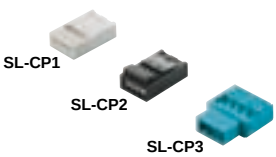
1-channel connector input extension unit **SC-T1J(-P)**



8-channel connector input extension unit **SC-T8J(-P)**
8-channel connector I/O mixed extension unit **SC-TP8J**

W27.5 × H19.6 × D14.1 mm
W1.083 × H0.772 × D0.555 in

Non-line connector **CN-70**



4-pin type male snap connector (1 set: 10 pcs.)
SL-CP1 SL-CP2 SL-CP3

End plates (1 set: 2pcs.) **MS-DIN-E**

ORDER GUIDE

Designation	Model No.	Description	
Main unit	**SC-MIL**	The MIL connector allows up to 16 input / output device connections to a PLC or custom circuit board, in a single step.	
Separate unit	**SC-MIL-S**	Distributed installations are possible through the use of a main unit and MIL connectors.	
1-channel connector input extension unit	**SC-T1J**	For NPN output devices	Allows the connection of input devices, such as sensors or switches. Incorporates a power indicator and an input signal indicators (1 ch).
	SC-T1J-P	For PNP output devices	
8-channel connector input extension unit	**SC-T8J**	For NPN output devices	Allows the connection of input devices, such as sensors or switches. Incorporates a power indicator and input signal indicators (8 ch).
	SC-T8J-P	For PNP output devices	
8-channel connector I/O mixed extension unit	**SC-TP8J**	Allows the connection of a variety of input and output devices. This unit does not contain input / output signal indicators.	
Non-line connector	**CN-70**	This one-touch connector is used to connect the main unit to the following devices: The **FX-301/302/303/311** series fiber sensors, the **FX-CH** series bank selection unit and the 1-channel connector input extension unit.	
4-pin type male snap connector (1 set: 10 pcs.)	**SL-CP1** (White)	For 0.08 to 0.2 mm² Wire diameter: ϕ0.7 to ϕ1.2 mm ϕ0.028 to 0.047 mm	Male snap connectors are utilized to connect input / output devices to both the 1-channel and the 8-channel connector input units, as well as to the 8-channel connector combined input / output unit. The 1-channel connector input extension unit includes one **SL-CP1**.
	SL-CP2 (Black)	For 0.3 mm² Wire diameter: ϕ1.1 to ϕ1.6 mm ϕ0.043 to 0.063 mm	
	SL-CP3 (Greenish blue)	For 0.5 mm² Wire diameter: ϕ1.7 to ϕ2.5 mm ϕ0.067 to 0.098 mm	
End plates (1 set: 2 pcs.)	**MS-DIN-E**	After the **SC** series units have been attached to the DIN rail, all these devices must be secured firmly together by placing end plates at each of the ends and sandwiching the devices in between. Ensure that these end plates are used for this purpose.	

OPTIONS

Designation	Model No.	Description
Index seals (1 set: 10 sheets.)	**SC-MA1**	An identifier for each connector should be marked on each seal, then the seals should be applied to the number plates attached to both the 8-channel connector input unit and the 8-channel connector input / output unit.
Connector end caps (1 set: 8 pcs.)	**SC-PK**	Connector end caps are utilized to protect the unconnected ends of connectors, for both the 8-channel connector input unit and the 8-channel connector input / output unit.

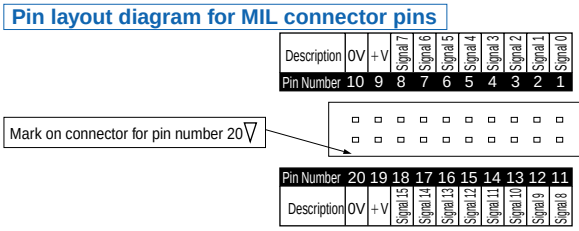
SPECIFICATIONS

Sensor unit

Type	Main unit	Separate unit
Model No.	**SC-MIL**	**SC-MIL-S**
Supply voltage	12 to 24 V DC ±10% (Note 1)	Depends on the supply voltage from **SC-MIL**
Allowable through current	2 A or less (Note 2)	1 A or less (Note 3)
Signal channel No.	Connectable up to 16 channels (Note 4)	
Max. distance between units	10 m or less (the distance between **SC-MIL** and PLC and that between **SC-MIL** and **SC-MIL-S** put together)	
Ambient temperature	−10 to +45°C +14 to 113°F (No dew condensation or icing allowed), Storage: −20 to +70°C −4 to +158°F	
Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH	
Material	Enclosure: Heat-resistant ABS	
Weight	25 g 0.882 oz approx.	20 g 0.705 oz approx.
Accessory	Connector protection seal: 1 pc.	

Notes: 1) In combination with **SC-TP8J**, the unit can be also used with a power supply of 5 to 24 V DC ±10%.
When connecting the **FX-301/302/303/311** series, set the power voltage to 12 to 24 V DC ±10%, ripple to P-P 10% or less.
2) Same as maximum permissible current consumption of all units connected to **SC-MIL**. When either the permissible current amount of the power supply unit or the permissible current amount of the to be connected is 2 A or less, adjust the current to the smallest value.
3) Same as maximum permissible current consumption of all units connected to **SC-MIL**, or permissible current amount of general cable with MIL connector. When the permissible current amount of cable with MIL connector to connect is 1 A or less, adjust it to the specification.
4) The signal from up to 16th point (counting from unit adjacent to **SC-MIL**) of all units connected to **SC-MIL** is transferred. However, the signal thereafter is not transferred. Note that **SC-MIL-S** does not occupy any signal point.

Pin layout diagram for MIL connector pins



* The MIL connector pin layout is compatible with **SL-BMW** sensor block, which is utilized to simplify wiring and save space.

Non-line connector

Type	Non-line connector
Model No.	**CN-70**
Applicable unit	Refer to the list of 'Applicable unit of non-line connector'
Supply voltage	Depends on the supply voltage from **SC-MIL** (Note)
Supply current for units	100 mA or less
Signal channel No.	1 channel
Ambient temperature	−10 to +45°C +14 to 113°F (No dew condensation or icing allowed) Storage: −20 to +70°C −4 to +158°F
Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH
Material	Enclosure: ABS
Weight	4 g 0.141 oz approx.

Note: In case the **FX-301/302/303/311** series is connected in cascade, the supply voltage should be 12 to 24 V DC + 10% ripple P-P10% or less.

Applicable unit of non-line connector

Designation	Model No.	Description
1-channel input extension units	**SC-T1J**	For NPN output devices
	SC-T1J-P	For PNP output devices
Digital fiber sensors	**FX-301(B/G/H)**	For NPN output devices
	FX-301(B/G/H)P	For PNP output devices
	FX-302	For NPN output devices
	FX-302P	For PNP output devices
Manually set fiber sensors	**FX-311(B/G)**	For NPN output devices
	FX-311(B/G)P	For PNP output devices
Digital fiber sensors for leak detection fiber / liquid fiber	**FX-301-F**	For NPN output devices
	FX-301P-F	For PNP output devices
Bank selection unit	**FX-CH**	For NPN output devices
	FX-CH-P	For PNP output devices

Connector extension units

Type	Connector input extension unit				Connector I/O mixed extension unit
	For NPN output devices		For PNP output devices		
	1 channel	8 channels	1 channel	8 channels	8 channels
Model No.	**SC-T1J**	**SC-T8J**	**SC-T1J-P**	**SC-T8J-P**	**SC-TP8J**
Supply voltage	12 to 24 V DC ±10 %				5 to 24 V DC ±10 % (Note 1)
Current consumption (Note 2)	20 mA or less (when all indicators light up)	60 mA or less (when all indicators light up)	20 mA or less (when all indicators light up)	60 mA or less (when all indicators light up)	7 mA or less
Signal channel No.	1 input	8 inputs (Note 3)	1 input	8 inputs (Note 3)	8 inputs / outputs (Note 4)
Connectable device	NPN open-collector, or DC 2-wire output type sensor, or switch etc.	NPN open-collector output sensor or switch etc. (Note 5)	PNP open-collector, or DC 2-wire output type sensor, or switch etc.	PNP open-collector output sensor or switch etc. (Note 5)	Commercial I/O device
Supply current for units (Note 6)	100 mA or less	800 mA or less (At a total of 8 channels)	100 mA or less	800 mA or less (At a total of 8 channels)	
Power indicator	Green LED (Lights up when the power is ON)				
Input indicator	Green LED [**SC-T8J**(**-P**): 8 Nos.] (Lights up when each channel input is ON)				———
Ambient temperature	−10 to +45°C +14 to 113°F (No dew condensation or icing allowed), Storage: −20 to +70°C −4 to +158°F				
Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH				
Material	Enclosure: Heat-resistant ABS, Frame: Polycarbonate	Enclosure: Heat-resistant ABS	Enclosure: Heat-resistant ABS, Frame: Polycarbonate	Enclosure: Heat-resistant ABS	
Weight	10 g 0.353 oz approx.	40 g 1.411 oz approx.	10 g 0.353 oz approx.	40 g 1.411 oz approx.	40 g 1.411 oz approx.
Accessories	**SL-CP1** (Male snap connector): 1 pc.	Index seal: 1 pc.	**SL-CP1** (Male snap connector): 1 pc.	Index seal: 1 pc.	

Notes: 1) It depends on the power supply from **SC-MIL**.
2) The current consumption and input current of the input unit connected are not included.
3) The signal for 8 channels is occupied regardless of number of input units connected.
4) The signal for 8 channels is occupied regardless of number of I/O units connected.
5) DC 2-wire type sensor and switch etc. cannot be connected.
6) Set the maximum current passing through input / output line to 50 mA or less.

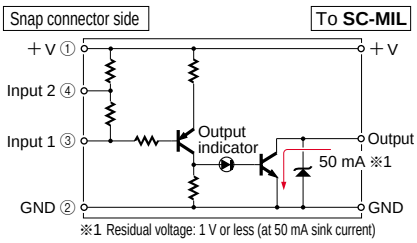
I/O CIRCUIT DIAGRAMS

SC-T1J / SC-T8J

Male snap connector pin position

Pin No.	SC-T1J(-P) SC-T8J(-P)	SC-T8PJ
1	+V	+V
2	GND	GND
3	Input 1	Input
4	※Input 2	Not connected

※For DC 2-wire type input device [**SC-T1J(-P)** only]



※1 Residual voltage: 1 V or less (at 50 mA sink current)

Conditions

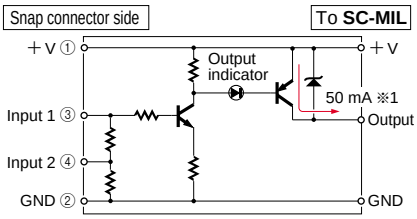
Leak current :
1 mA or less (when the power is OFF)
Offset voltage :
3 V or less (when the power is ON)
The product of which the load current range contains 5 to 8 mA.

SC-T1J-P / SC-T8J-P

Male snap connector pin position

Pin No.	SC-T1J(-P) SC-T8J(-P)	SC-TP8J
1	+V	+V
2	GND	GND
3	Input 1	Input
4	※Input 2	Not connected

※For DC 2-wire type input device [**SC-T1J(-P)** only]



※1 Residual voltage: 1 V or less (at 50 mA source current)

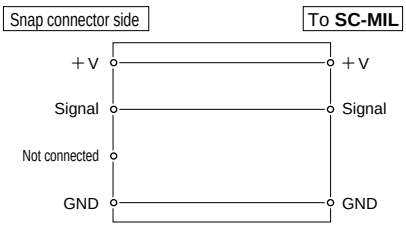
Conditions

Leak current :
1 mA or less (when the power is OFF)
Offset voltage :
3 V or less (when the power is ON)
The product of which the load current range contains 5 to 8 mA.

SC-TP8J

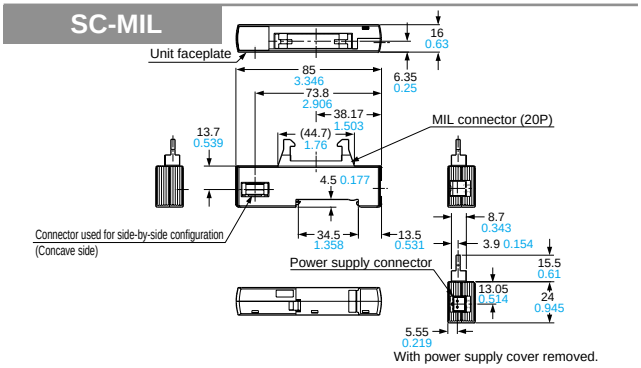
Male snap connector pin position

Pin No.	SC-TP8J
1	+V
2	GND
3	Signal
4	Not connected

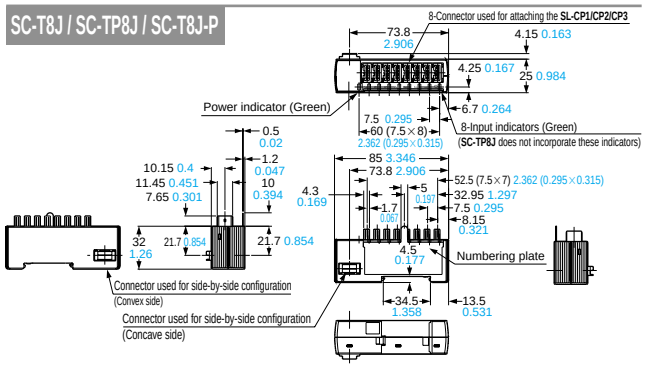


DIMENSIONS (Unit : mm in)

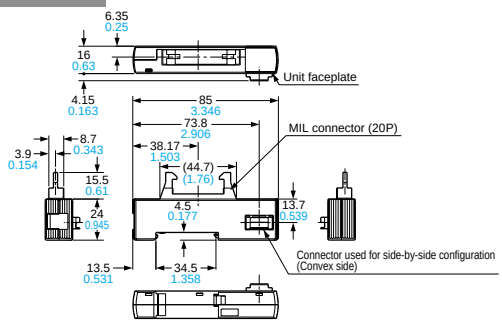
SC-MIL



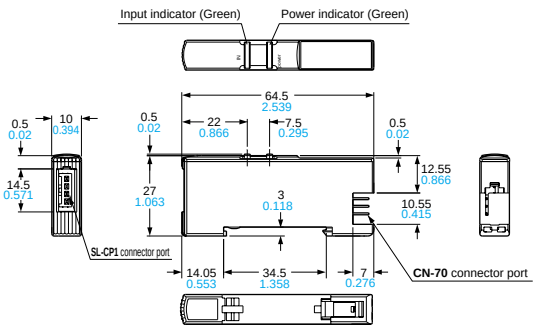
SC-T8J / SC-TP8J / SC-T8J-P



SC-MIL-S



SC-T1J / SC-T1J-P



All information is subject to change without prior notice.

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Printed on 100% recycled paper PRINTED IN JAPAN
No. CE-FIBERG-1-5 OCTOBER, 2002