ideas for life

DIGITAL FIBER SENSOR

FX-500 SERIES Ver.2

Conforming to EMC Directive Listing Certified

At the industry's leading edge

FX-SERIES HIGH END MODEL

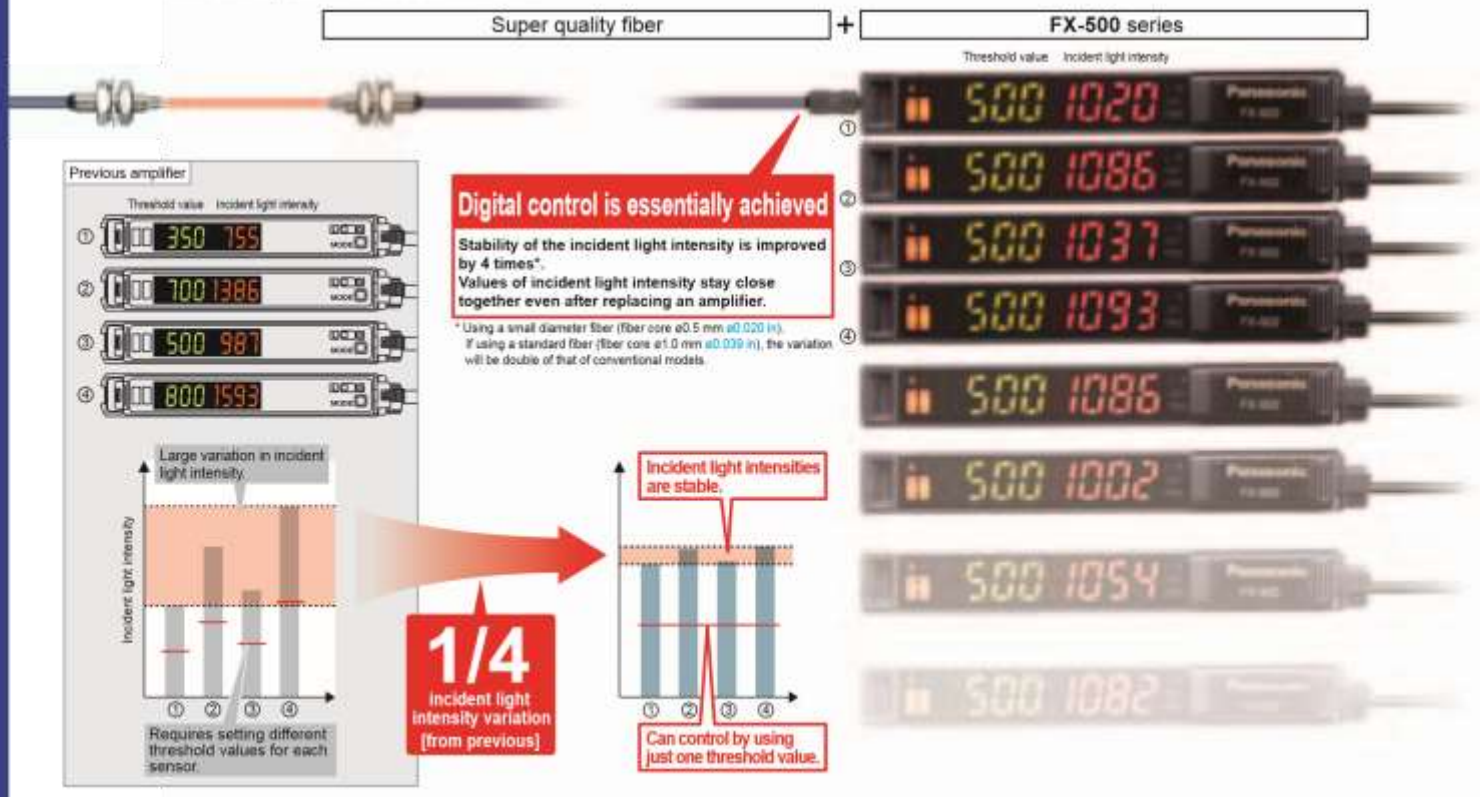
2012.08 panasonic.net/id/pidsx/global

Industry leading stability

Decrease the variation among fiber sensors

High stability!

"Why are the values different even for the same detection?" "If we try to forcibly unify all the display values of incident light intensity, we will not be able to read the actual changes."
SUNX focuses on the variation among fiber sensors and aims for absolute digitalization.
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.
By being close to absolute values instead of modified digital values, changes in detection that could not be found in the past can now be monitored.



Specifying just one value in an operation manual is possible

In the case where multiple fiber sensors are installed under the same operating conditions, the incident light intensities are nearly identical to each other, allowing for the specification of one threshold across all sensors.

Maintenance is easy on stabilized fiber sensors

Because the incident light intensity is stable, the same threshold value can be used even when an amplifier is replaced. Also, copying of settings is easy when used together with optical communication.

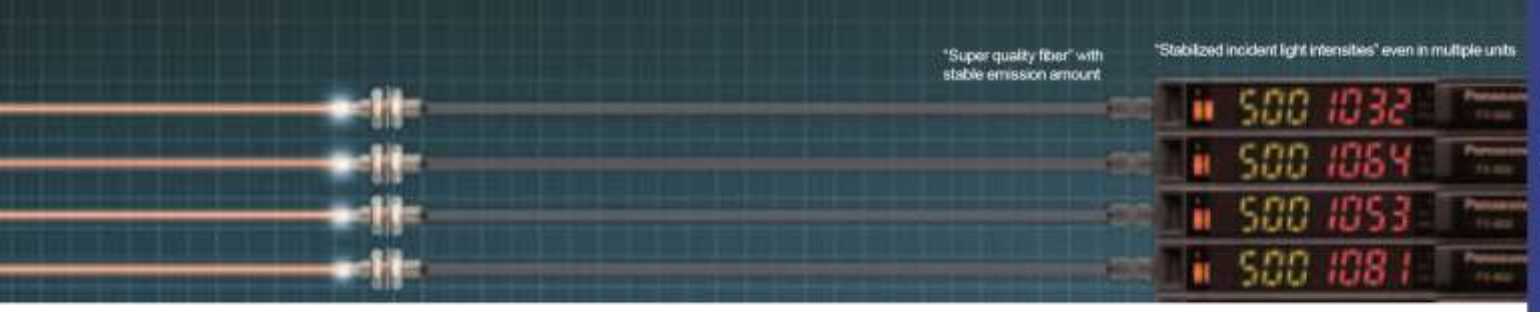
Stability in incident light intensity and confidence in beam adjustment

When setting up fiber sensors in a row in the same layout, all incident light intensities will display nearly identical values once beams are aligned. This helps to raise installation precision and prevent trouble from occurring before equipment is turned on.

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.

* Illustration is image only.

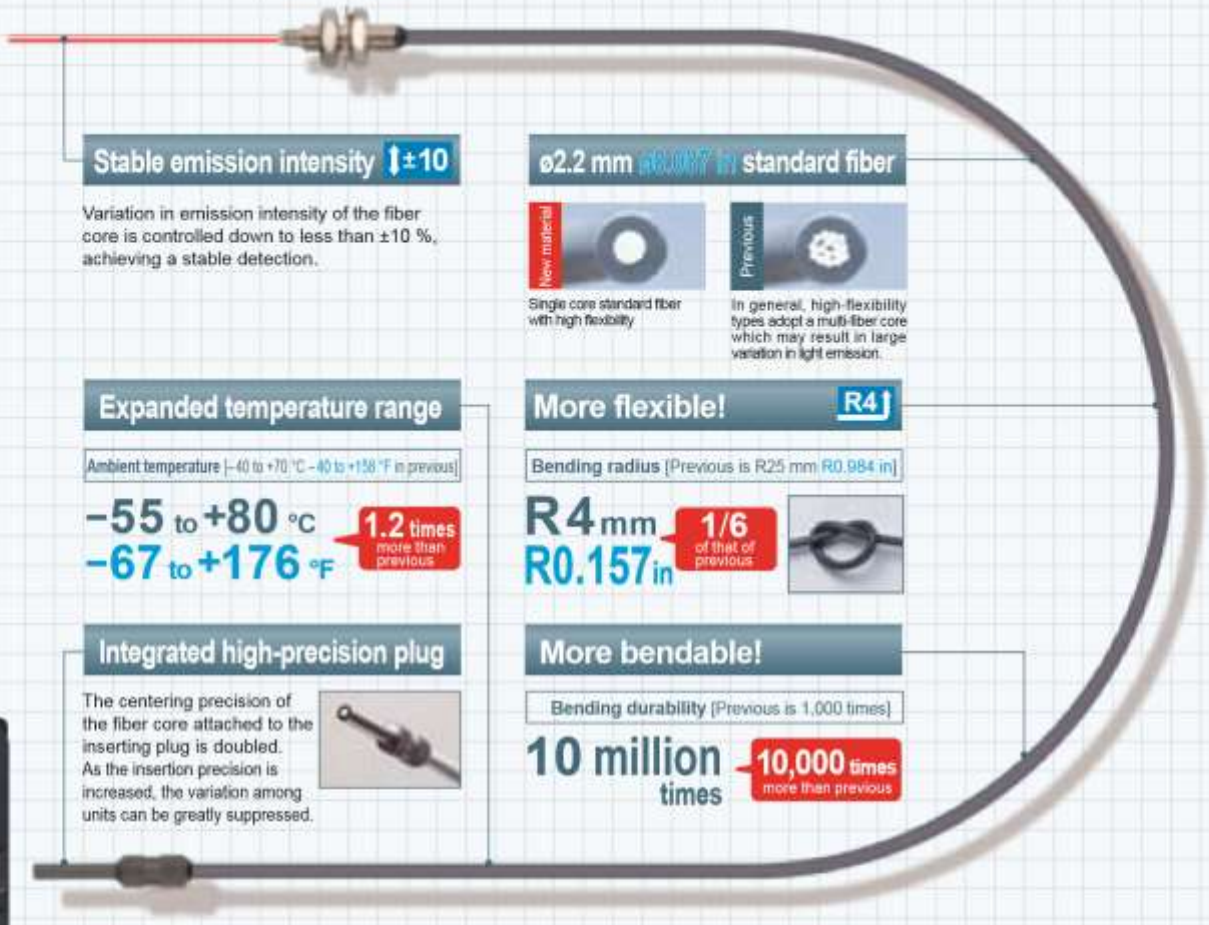


A quality that surpassed standard fiber

Introducing 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 intensity ↕±10

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

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]

–55 to +80 °C
–67 to +176 °F

1.2 times more than previous

More flexible! R4↑

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

R4 mm
R0.157 in

1/6 of that of previous

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.

More bendable!

Bending durability [Previous is 1,000 times]

10 million times

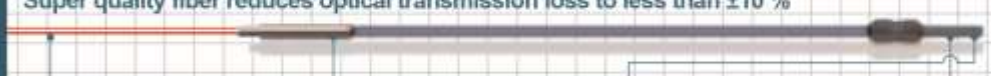
10,000 times more than previous

↕±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 optical transmission loss to less than ±10 %



Point ❶

The beam axis deviation of each unit is kept within ±2 ° 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

* For custom-ordered fibers of your required length, contact the sales office near you.

Speed & Distance

Industry leading sensing performance

Ultra high-speed & 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

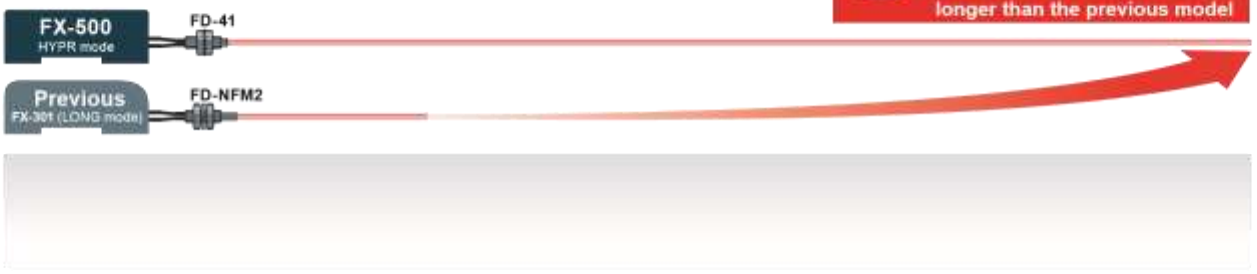
FX-500 with its ultra high response time improves productivity.

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 super long sensing range.

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



Long sensing range with small diameter fibers

Small diameter fibers with a compact head can perform long range and stable detection for minute objects.

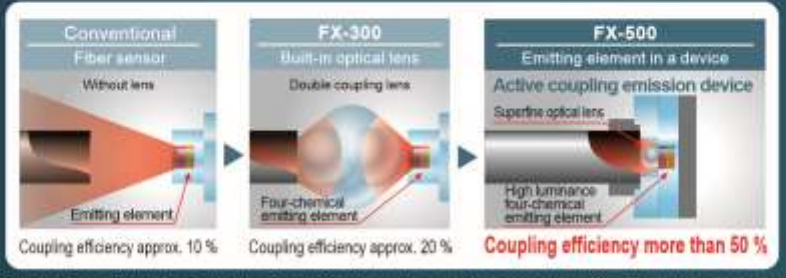
Long sensing range even in high speed mode

A high speed response time of 25 µs, which is 2.6 times more than previous, and a long sensing range are now possible in high speed mode.

Satisfying both high speed and long range

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.



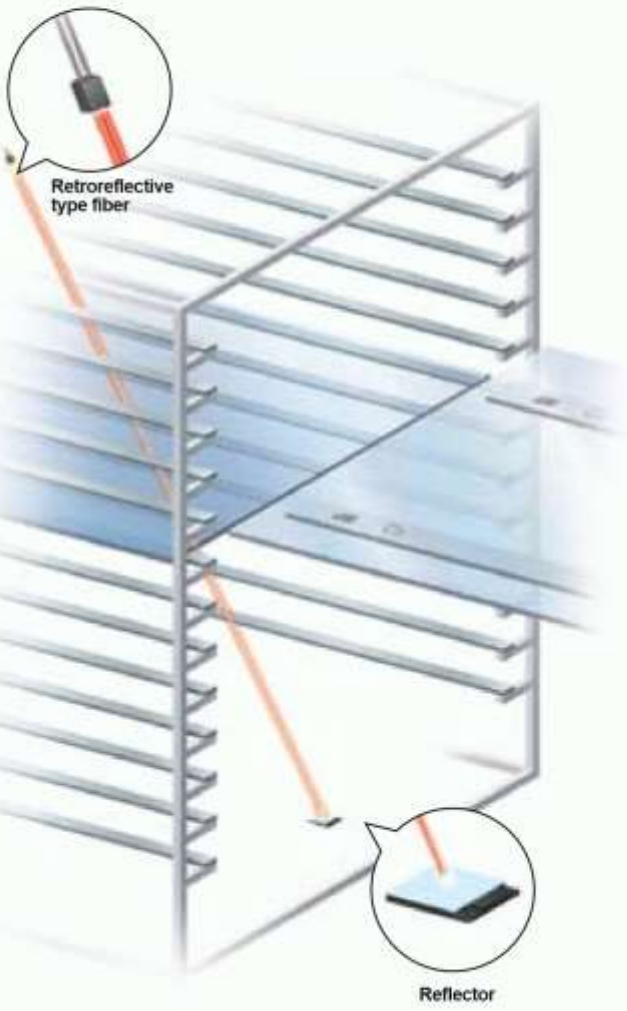
Coupling efficiency approx. 10 % | Coupling efficiency approx. 20 % | **Coupling efficiency more than 50 %**

Coupling efficiency = (light intensity directed into the fiber / emission intensity of active coupling emission device) × 100 * Illustration is image only.

Sharp detection with suppressed hysteresis

A different accuracy!

FX-500 with its accurate detection catches fractional difference in light intensity, fulfilling high precision and low-hysteresis applications.

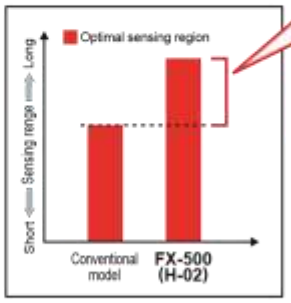


H-02 mode

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

FX-500 series achieves a long sensing range by its suppressed hysteresis and high intensity beam. Detection of minute objects over a long range is now more accurate compared to the past.

■Comparison image of optimal sensing region

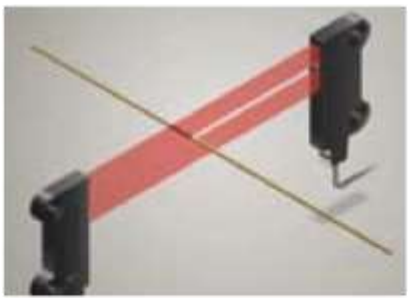


Long range detection of a glass target is now possible due to the ability of the sensor to detect small changes in light intensity.

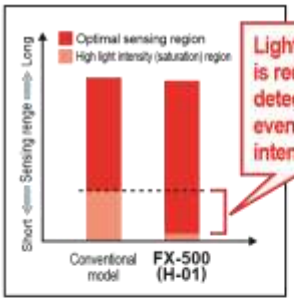
H-01 mode

Highly accurate detection while avoiding saturation

Even when the received light becomes saturated, the **FX-500** series cuts down hysteresis to the utmost limit in order to produce the optimal margin for detection.



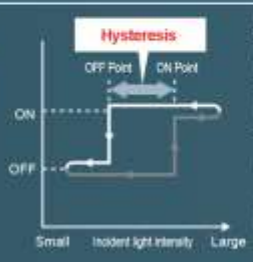
■Comparison image of optimal sensing region



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

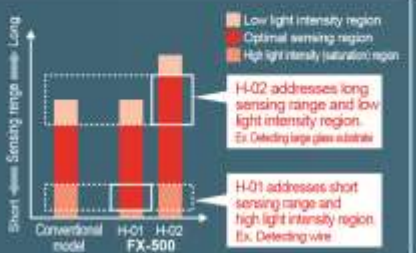
Three hysteresis modes

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, but SUNX provides three hysteresis modes to suit the need of fiber sensors.



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 chattering prevention. 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.

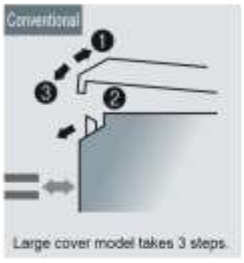
Streamlined fiber clutch

While the conventional fiber installation is done after opening up the cover, the **FX-500** series adopts a guard structure, eliminating the cover so that the fiber installation 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 clutch



■NAVI display (lights out during RUN mode)

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

CUST
Allows direct change by selecting one of the setting of response time / hysteresis / emitting power. (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.

Time

Saves maintenance time

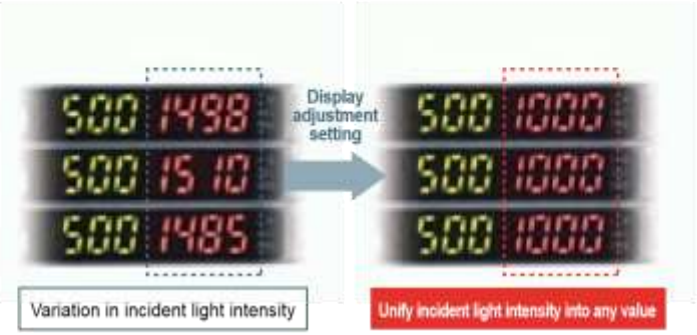
Threshold tracking function

A variety of functions at the industry's leading edge

Resolves variation in incident light intensity display

Display adjustment setting

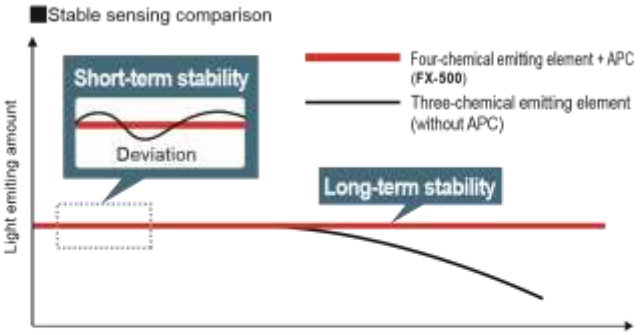
Even if there is no problem in detection, the variation in display may make it difficult for an operator to verify proper operation. By using the display adjustment setting, random values can be adjusted, and the visual variation can be resolved to help define proper operation in an operation manual.

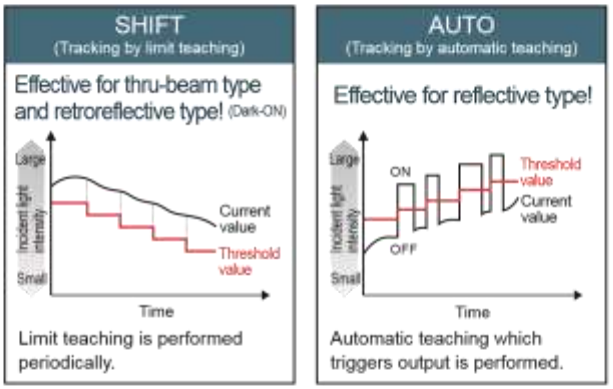


Stable detection over long and short periods

Stabilized emission intensity

The "four-chemical emitting element" was first incorporated in the conventional model **FX-300** to maintain a stable level of light emission and 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.

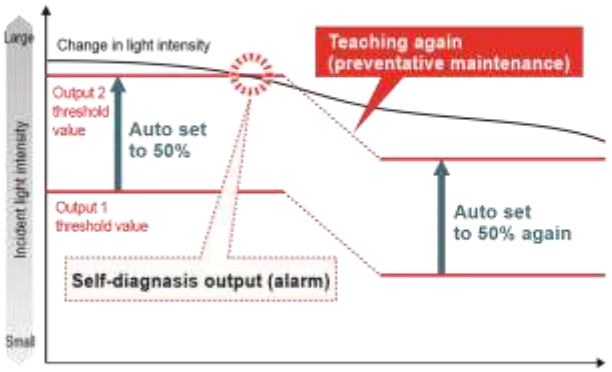




FX-502(P) / 505(P)-C2

FX-502(P) / 505(P)-C2 can set Output 2 as self-diagnosis output. When Output 1's threshold value teaching is carried out, Output 2 is set concurrently with the setting randomly shifted by the amount of surplus of threshold value.

■Detect drops in light intensity
(e.g. used in dusty environment)



This function seeks changes in the light emitting amount resulting from

changes in the environment over long periods (such as dust levels), so that the incident light intensity can be checked at desired intervals and the threshold values can be reset automatically.

Suitable for preventative maintenance

Self-diagnosis output

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

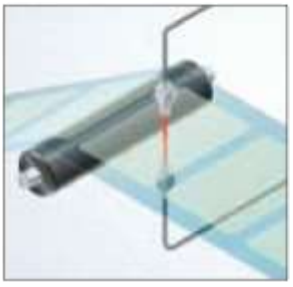
A variety of functions at the industry's leading edge

Stable detection while being eco-friendly

Emission power & gain setting

For cases when the incident light intensity saturates the receiver, the light intensity can be attenuated to the optimal level by AUTO without changing the response time. This allows for stable detection while maintaining an optimal S/N ratio and saves energy by controlling the emitting electric current.

■Detecting a transparent sheet



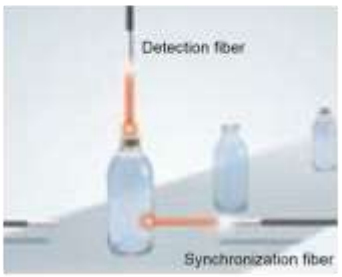
Auto mode (AUTO) and 3-level manual mode (3 levels: H / M / L [adjustable]) are incorporated.

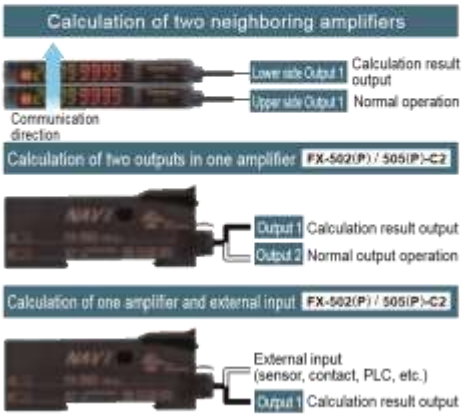
Built-in logic functions

No PLC necessary saving material and programming costs

■Logical calculation functions

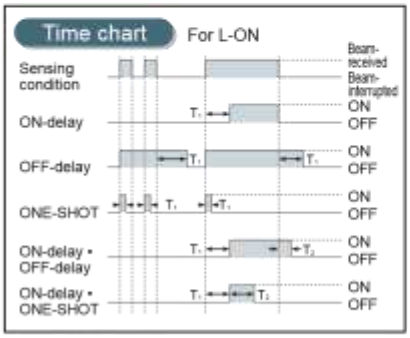
Three logical calculations (AND, OR, XOR), are selectable using Output 1 of multiple **FX-500** series amplifiers.
A PLC is not required which helps to reduce material and programming and costs.





■Equipped with 5 types timers

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

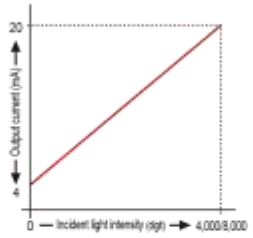


Timer period: 0.05 ms to 32 s
Output 1 has ON-delay • OFF-delay and ON-delay • ONE-SHOT timers.

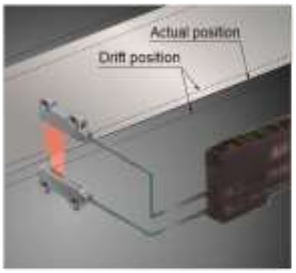
Analog control is possible

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

A 4 to 20 mA analog output represents the digital value of incident light intensity



■Edge tracking of film or sheet



Drifting path can be tracked 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 worksite that manufactures multiple models.

External input

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

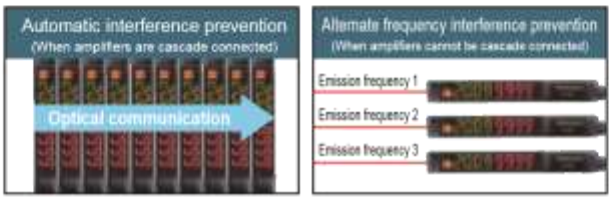
Work efficiency can be improved by operating via a PLC output or other external signal.
(**FX-502(P)** can operate via external signal when switching from Output 2 to external input.)

■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)

Selectable interference prevention

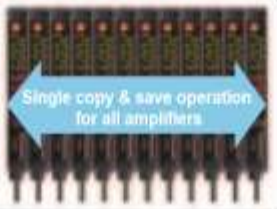
In addition to the automatic interference prevention function which is enabled through the optical communication of cascade connected amplifiers, an alternate frequency interference prevention function is also incorporated. So even for layouts where optical communication cannot be carried out, switching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



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

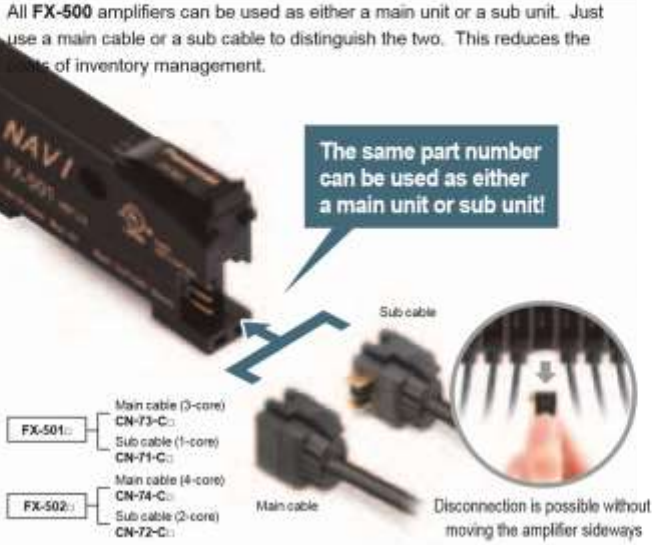
An optical communication function allows sensors to be adjusted simultaneously

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.



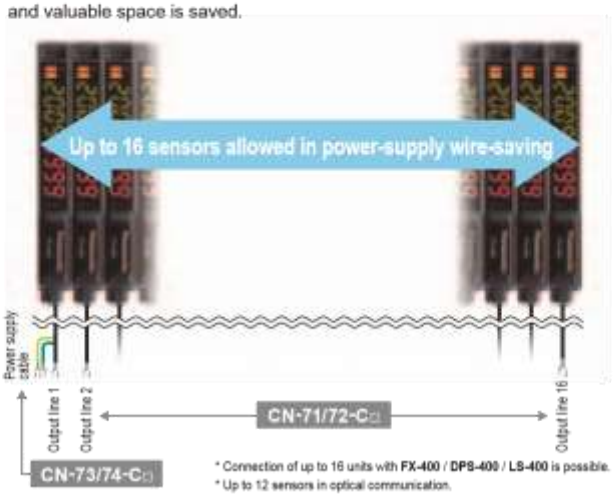
No need to specify a main unit or sub unit

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.

■ PRO mode functions

PRO1		Response time setting
		Timer setting
		Hysteresis setting
		Shift amount setting
		Emission power setting
		Timer range setting
PRO2		Teaching lock setting
		Digital display item setting
		Digital display turning on setting
		ECO setting
		Period hold setting
PRO3		Data bank loading setting
		Data bank saving setting
		Back up setting
		Input / output setting *1
PRO4		Copy setting
		Copy action setting
		Copy lock setting
		Communication protocol setting
		External input setting *2

PRO5		Code setting
		Display adjustment setting
		Reset setting
		CUSTOM setting
		Interference prevention setting
PRO6	Sensing output mode	Normal mode
		Window comparator mode *3
		Rising differential mode
		Trailing differential mode
		Hysteresis mode
		Forced ON output mode
		Forced OFF output mode
		Self-diagnosis output mode *4
		Answer back output mode *5
PRO7		Logical operation setting *6
	Setting of threshold value tracking	Setting of threshold tracking
		Sensing output setting
		Storage cycle setting
		Algorithm setting

*1: **FX-502(P)** only *2: **FX-502(P)** and **FX-505(P)-C2** only *3: Output 1 only
*4: Output 2 only of **FX-502(P)** and **FX-505(P)-C2** *5: Output 2 only of **FX-505(P)-C2**
*6: **FX-501(P)** can do a part of operations.

ORDER GUIDE

Amplifiers

Quick-connection cable is not supplied with **FX-501(P)** and **FX-502(P)**. Please order it separately.

Type	Appearance	Model No.	Emitting element	Output	External input
Standard type		**FX-501**	Red LED	NPN open-collector transistor	–
		FX-501P		PNP open-collector transistor	
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	

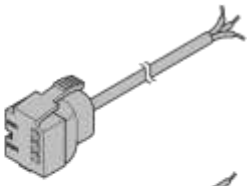
Quick-connection cables

For FX-501(P)

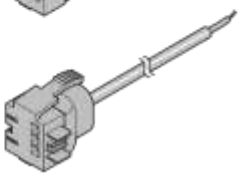
Quick-connection cable is not supplied with the amplifier. Please order it separately.

Type	Model No.	Description	
Main cable (3-core)	**CN-73-C1**	Length: 1 m 3.281 ft	0.15 mm² 3-core cabtyre cable, with connector on one end Cable outer diameter: ø3.0 mm ø0.118 in
	CN-73-C2	Length: 2 m 6.562 ft	
	CN-73-C5	Length: 5 m 16.404 ft	
Sub cable (1-core)	**CN-71-C1**	Length: 1 m 3.281 ft	0.15 mm² 1-core cabtyre cable, with connector on one end Cable outer diameter: ø3.0 mm ø0.118 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□**

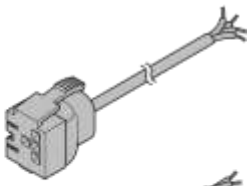


For FX-502(P)

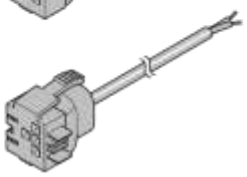
Quick-connection cable is not supplied with the amplifier. Please order it separately.

Type	Model No.	Description	
Main cable (4-core)	**CN-74-C1**	Length: 1 m 3.281 ft	0.15 mm² 4-core cabtyre cable, with connector on one end Cable outer diameter: ø3.0 mm ø0.118 in
	CN-74-C2	Length: 2 m 6.562 ft	
	CN-74-C5	Length: 5 m 16.404 ft	
Sub cable (2-core)	**CN-72-C1**	Length: 1 m 3.281 ft	0.15 mm² 2-core cabtyre cable, with connector on one end Cable outer diameter: ø3.0 mm ø0.118 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□**

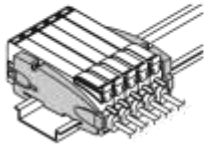


Sub cable
• **CN-72-C□**



End plates

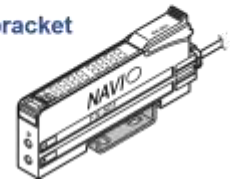
End plates are not supplied with the amplifier. Please order them separately when the amplifiers are mounted in cascade.

Appearance	Model No.	Description
	**MS-DIN-E**	When cascading multiple amplifiers, or when it 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

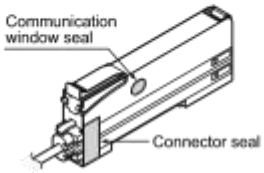
Amplifier mounting bracket

- **MS-DIN-2**



Amplifier protection seal

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



SPECIFICATIONS

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
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-delay • OFF-delay / ON-delay • ONE SHOT timer, switchable either effective or ineffective	<Output 1> Incorporated with variable OFF-delay / ON-delay /ONE SHOT / ON-delay • 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		
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 specifi ed 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.

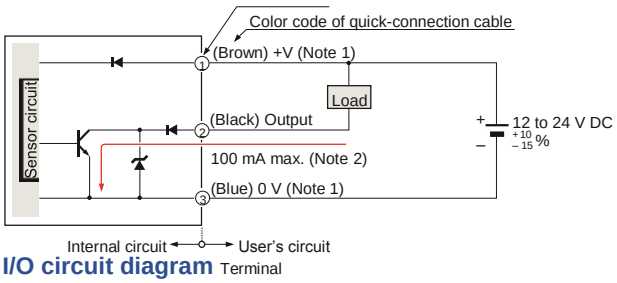
• Number of sensor heads mountable closely (Unit: set)

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

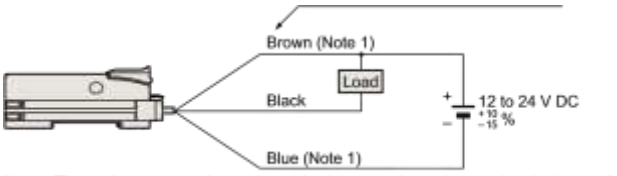
I/O CIRCUIT AND WIRING DIAGRAMS

FX-501

NPN output type

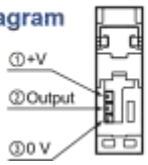


I/O circuit diagram Terminal No.



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

Terminal arragement diagram



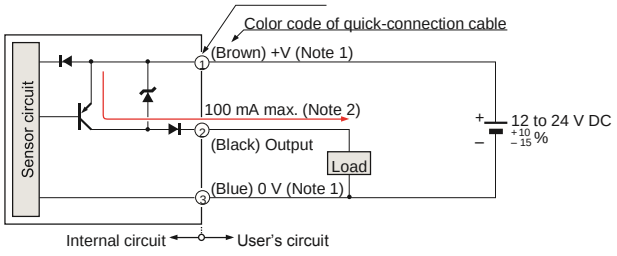
Wiring diagram Color code of quick-connection cable

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 fi ve amplifi ers, or more, are connected together.

FX-501P

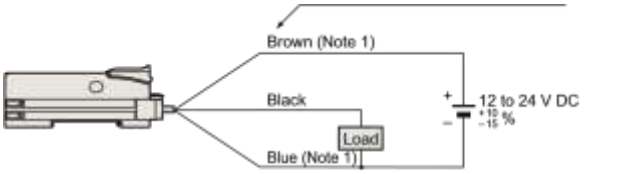
PNP output type

I/O circuit diagram Terminal No.



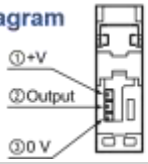
Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable. 2) 50 mA max., if fi ve amplifi ers, or more, are connected together.

Wiring diagram Color code of quick-connection cable



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

Terminal arragement diagram

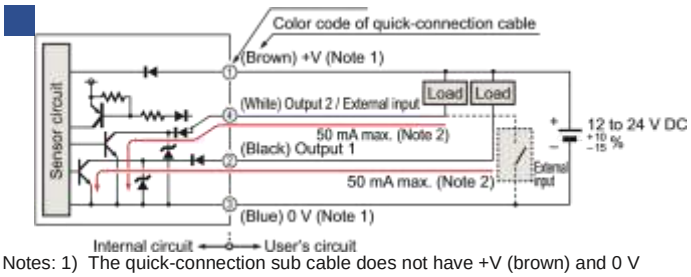


FX-502

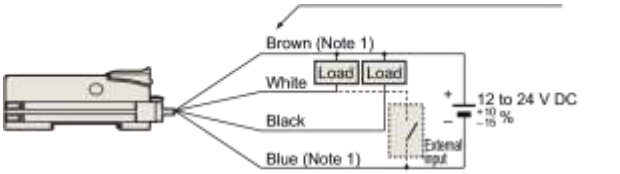
NPN output type

I/O circuit diagram Terminal No.

Wiring diagram Color code of quick-connection cable

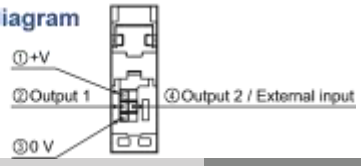


Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable. 2) 25 mA max., if fi ve amplifi ers, or more, are connected together.



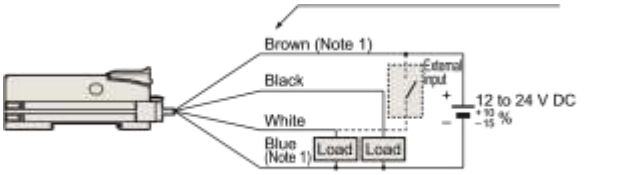
Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

Terminal arragement diagram



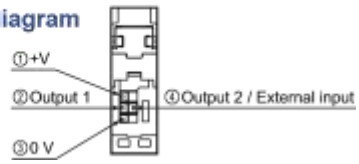
FX-502P

PNP output type

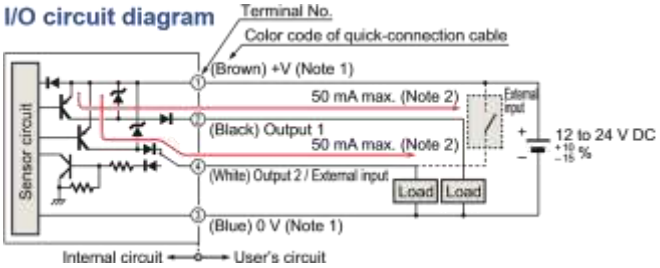


Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

Terminal arragement diagram



I/O circuit diagram



Wiring diagram

Wiring diagram Color code of quick-connection cable

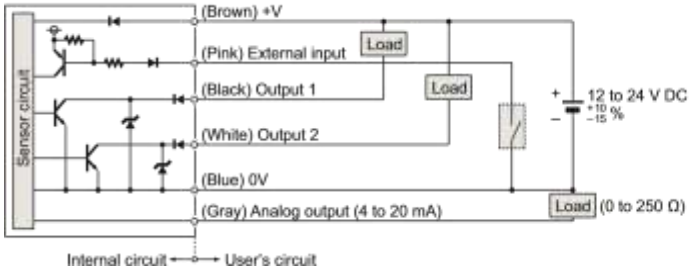
Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 25 mA max., if fi ve amplifi ers, or more, are connected together.

I/O CIRCUIT AND WIRING DIAGRAMS

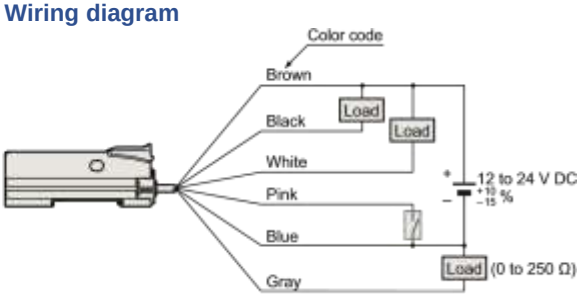
FX-505-C2

NPN output type

I/O circuit diagram



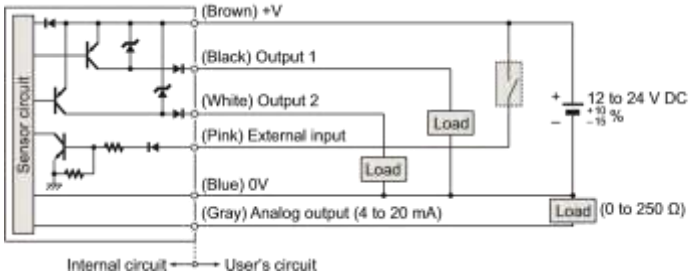
Wiring diagram



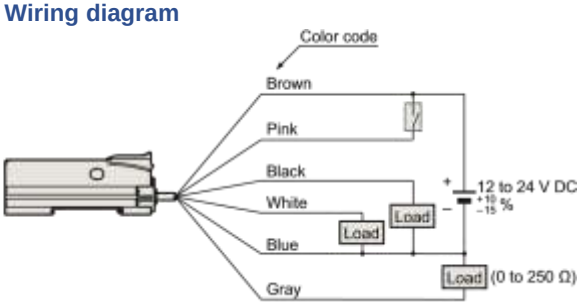
FX-505P-C2

PNP output type

I/O circuit diagram



Wiring diagram



FX-500

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

depending upon how the fi ber is cut.
2) The sensing range is specifi ed for white non-glossy paper.
3) The fi ber cable length practically limits the sensing range.
4) The allowable cutting range is 700 mm 27.559 in from the end that the amplifi er inserted. depending upon how the fi ber is cut.
2) The fi ber cable length practically limits the sensing range.

LIST OF FIBERS

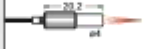
Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

Type			Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut (Note 1)	Sensing range FX-500 STD mode (mm in)
Sleeve	Thru-beam	Threaded M3	Sleeve 40mm M3 ø0.88 10	Tough FT-31S	R2 Bending durability (Note 3)	✂ 2 m	315 12.402
		Threaded M4	Sleeve 40mm M4 ø1.48 12	Tough FT-42S	R4 Bending durability (Note 3)		1,130 44.488
		Ultra-small diameter ø3	Narrow beam ø0.125mm ø0.25 ø3 Sleeve part cannot be bent. 5 15	Tough FT-E13	R2 Bending durability	✂ 1 m	15 0.591
			Narrow beam ø0.25mm ø0.4 ø3 Sleeve part cannot be bent. 5 15	Tough FT-E23			75 2.953
		Side-view ø2	Sleeve part cannot be bent. ø1 ø2 20 15	Tough FT-V23	R4 Bending durability	✂ 2 m	450 17.717
			Sleeve part cannot be bent. ø1 ø2 15 15	Tough FT-V25	R2 Bending durability		240 9.449
			Sleeve part cannot be bent. ø1 ø2 15 15	FT-V24W	R1		110 4.331
		Side-view ø2.5	Sleeve part cannot be bent. ø1.5 ø2.5 20 15	Tough FT-V30	R4 Bending durability		680 26.772

Type			Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut (Note 1)	Sensing range FX-500 STD mode (mm in)
Sleeve	Reflective (Note 2)	Threaded Ultra-small diameter M3	Sleeve 15 mm M3 ø0.8 15 Sleeve part cannot be bent.	FD-EG30S	R4	1 m	50 1.969
		Threaded M4	Sleeve 40 mm M4 ø1.48 12	Tough FD-41S	R2 Bending durability (Note 3)	✂ 2 m	125 4.921
			Sleeve 40 mm M4 ø1.48 12	FD-41SW	R1 (Note 3)		80 3.150
		Threaded M6	Sleeve 40 mm M6 ø2.5 15	Tough FD-61S	R4 Bending durability (Note 3)		420 16.535
		Cylindrical Ultra-small diameter ø1.5	ø1.5 ø0.48 15 Sleeve part cannot be bent.	FD-E13	R4	1 m	12 0.472
		Ultra-small diameter ø3	ø3 ø0.63 15 15 Sleeve part cannot be bent.	FD-E23			55 2.165
		Side-view ø3	Small diameter 15 15 ø3 ø1.5 Sleeve part cannot be bent.	Tough FD-V30	R2 Bending durability	✂ 2 m	65 2.559
			15 15 ø3 ø1.5 Sleeve part cannot be bent.	FD-V30W	R1		20 0.787
		Side-view ø5	15 20 ø5 ø2 Sleeve part cannot be bent.	Tough FD-V50	R4 Bending durability		120 4.724

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max.

3) Bending radius of sleeve part is R10 mm or more.

Type	Designation	Shape of fiber head (mm)	Spot diameter (mm in) (Note)	Distance to focal point (mm in) (Note)	Lens		Applicable fibers				
					Model No.	Ambient temp.	Model No.	Fiber cable length ✂: Free-cut	Bending radius (mm)	Protection	Ambient temp.
Small spot	Finest spot lens		ø0.1 ø0.004	7±0.5 0.276±0.020	FX-MR6	–20 to +60 °C	FD-EG31	500 mm	R4	IP40	–20 to +60 °C
			ø0.2 ø0.008				FD-EG30				–40 to +70 °C
			ø0.4 ø0.016				Tough FD-42G	2 m	R2 Bending durability		–55 to +80 °C
							FD-42GW		R1		–40 to +60 °C
							Tough FD-32G		R2 Bending durability		–55 to +80 °C
							FD-32GX	✂1 m	R2		
			ø0.15 ø0.006	7.5±0.5 0.295±0.020	FX-MR3	–40 to +70 °C	FD-EG31	500 mm	R4		–20 to +60 °C
			ø0.3 ø0.012				FD-EG30				–40 to +70 °C
			ø0.5 ø0.020				Tough FD-42G	2 m	R2 Bending durability		–55 to +80 °C
							FD-42GW		R1		–40 to +60 °C
							Tough FD-32G		R2 Bending durability		–55 to +80 °C
							FD-32GX	✂1 m	R2		
	Pinpoint spot lens		ø0.5 ø0.020	6±1 0.236±0.039	FX-MR1	–40 to +70 °C	Tough FD-42G	2 m	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.18.5 to 43 Approx. 0.728 to 1.693	FX-MR2	–40 to +70 °C	Tough FD-42G		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.13 to 30 Approx. 0.512 to 1.181	FX-MR5	–40 to +70 °C	Tough FD-42G		R2		–55 to +80 °C
							FD-42GW		R1		–40 to +60 °C

Note: Spot diameter and distance to focal point are specified for **FX-500/FX-100** series.

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

3) The fi ber cable length practically limits the sensing range.
4) The sensing range is the possible setting range for the attached refl ector. The fi ber can detect an object less than setting range for the refl ector.
5) The sensing range is specifi ed 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).

LIST OF FIBERS

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length (✂: Free-cut (Note 1))	Sensing range FX-500 STD mode (mm in)
Chemical-resistant	Thru-beam	Easy mounting • Rectangular head SEMI S2 compliant W/T × H15 × D13	FT-Z802Y	R25	✂ 2 m	3,100 122.047
		Heat-resistant 115 °C ø6.5 (25)	FT-HL80Y	R30	✂ 2 m (Note 3)	3,600 141.732 (Note 2)
		ø6.5 (25)	FT-L80Y			
		Side view ø5.5 (25)	FT-V80Y			1,300 51.181

Type		Heat-resistant temp.	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length (✂: Free-cut (Note 1))	Sensing range FX-500 STD mode (mm in)
Heat-resistant	Thru-beam Joint	350°C	Lens mountable (FX-LE1/LE2/SV1) M4 30	FT-H35-M2	R25	2 m	430 16.929
			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	470 18.504
			Lens mountable (FX-LE1/LE2/SV1) M4 23	FT-H20-M1	R25		540 21.260
		130°C	Lens mountable (FX-LE2 only) M4 16	FT-H13-FM2		✂ 2 m	700 27.559
		200°C	Lens mountable (FX-LE1/LE2/SV1) M4 23	FT-H20-J20-S (Note 4)	Heat-resistant side R18 (Note 5)	✂ 200 mm (Note 6)	470 18.504
				FT-H20-J30-S (Note 4)		✂ 300 mm (Note 6)	
				FT-H20-J50-S (Note 4)		✂ 500 mm (Note 6)	
			Side view 24 ø3.8 ø4	FT-H20-VJ50-S (Note 4)			600 23.622
				FT-H20-VJ80-S (Note 4)		✂ 800 mm (Note 6)	
	Reflective (Note 7) Threaded	350°C	Coaxial M6 25	FD-H35-M2	R25	2 m	260 10.236
			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	
		200°C	Coaxial M6 28	FD-H20-M1	R25		330 12.992
			Coaxial M4 27	FD-H20-21			230 9.055
		130°C	M6 21	FD-H13-FM2		✂ 2 m	350 13.780
	Convergent reflective (Note 7) Glass substrate detection	300°C	W19 × H27 × D5	FD-H30-L32	R25	2 m	17 0.669
		250°C	W21 × H33.2 × D5	FD-H25-L43		3 m	1.5 to 26 0.059 to 1.024
			W21 × H34.5 × D5	FD-H25-L45			5 to 42 0.197 to 1.654
		180°C	W19 × H27 × D5	FD-H18-L31		✂ 2 m	16 0.630

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length (✂: Free-cut (Note 1))	Sensing range FX-500 STD mode (mm in)
Vacuum-resistant	Thru-beam	300 °C Lens mountable (FV-LE1/SV2) M6 30	FT-H30-M1V-S (Note 9)	R18	1 m	270 10.630
	Reflective (Note 8)	300 °C, Rectangular head W9.5 × H5.2 × D15	FD-H30-KZ1V-S (Note 9)			20 to 200 0.787 to 7.874
	Convergent reflective (Note 8)	300 °C, Glass substrate detection W19 × H5 × D27	FD-H30-L32V-S (Note 9)		3 m	8 0.315
Metal-free	Thru-beam Threaded M4	M4 15	FT-41	R25	✂ 2 m	1,100 43.307
	Reflective Threaded M4	Coaxial M4 25	FD-G40			140 5.512
	Reflective Threaded M6	Coaxial M6 20	FD-G60			420 16.535

Type			Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length (✂: Free-cut (Note 1))	Sensing range FX-500 STD mode (mm in)
Liquid leak / Liquid detection	Reflective Pipe-mountable type	Liquid level sensing Contact type	Heat resistant 125 °C Fluorine resin coating ø5	FD-F8Y	Protective tube R40 Fiber R15	✂ 2 m (Note 10)	Liquid surface not contacted: Beam received, Liquid surface contacted: Beam not received
			Heat resistant 105 °C Fluorine resin coating ø4	FD-HF40Y	Protective tube R20 Fiber R10	✂ 2 m	
			Heat resistant 70 °C Fluorine resin coating throughout the fiber ø4	FD-F41Y			
		Liquid leak detection	SEMI S2 compliant W20 × H30 × D10	Tough FD-F71	R4 Bending durability	✂ 5 m	Leak absent: Beam received, Leak present: Beam interrupted
		Liquid level sensing	Standard W25 × H13 × D20	FD-F41	R10	✂ 2 m	Leak absent: Beam received, Leak present: Beam interrupted
			For 1 mm thick PFA pipe W25 × H13 × D20	FD-F4			
		Liquid sensing	Mountable on pipe-array fiber W8.5 × H28.3 × D17	Tough FD-FA93	R4 Bending durability		
	Thru-beam	Liquid sensing	SEMI S2 compliant W23 × H20 × D17	Tough FT-F93	Protective tube R20 Fiber R2 Bending durability		Liquid absent: Beam not received, Liquid present: Beam received

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 allowable cutting range is 500 mm 19.685 in from the end that the amplifier inserted.
4) Heat-resistant side fiber + ordinary temperature fiber (**FT-FM2**, From production since October, 2012: **FT-42**) are sold together as a set.
5) R25 mm R0.984 in or more for ordinary temperature side.
6) Fiber length (fixed-length) for heat-resistant fiber side. Fiber length for ordinary temperature side is 2 m 6.562 ft (free-cut).
7) 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**, **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**).
8) The sensing range of reflective type is the value for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in.
9) Sold as a set comprising vacuum type fiber + photo-terminal (**FV-BR1**) + fiber at atmospheric side (**FT-J8**).
10) The allowable cutting range is 1,000 mm 39.370 in from the end that the amplifier inserted.

PRECAUTIONS FOR PROPER 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 amplifi ers.
- Note that if a voltage exceeding the reted 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 the connection of the controller.
  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.
- Make sure that stress by forcible bending or pulling is not applied to the sensor cable joint and fi ber cable.

Others

- This product has been developed / produced for industrial use only.
- The specifi cation may not be satisfi ed in a strong magnetic fi eld.
- 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 (H-SP, FAST, STD: 0.5 sec., LONG, U-LG, HYPR: 1 sec.) after the power supply is switched ON.
- This product is suitable for indoor use only.
- 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 infl ammable or explosive gases.
- Never disassemble or modify this product.
- This product adopts EEPROM. Settings cannot be done 100 thousand times or more because of the EEPROM's lifetime.

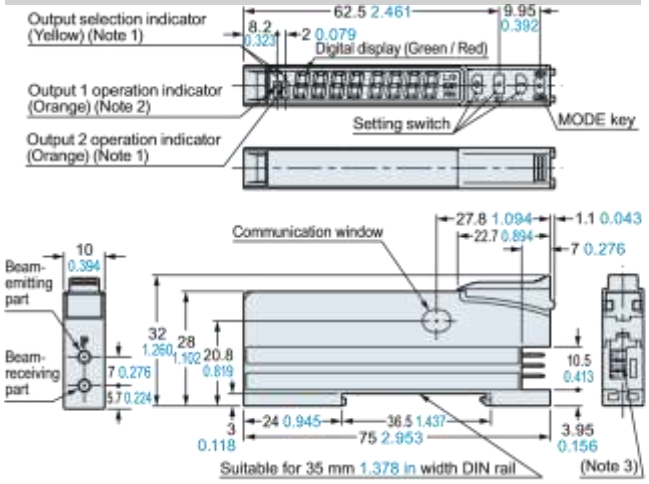
Disclaimer

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.

DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from our website.

FX-501(P) FX-502(P) Amplifier



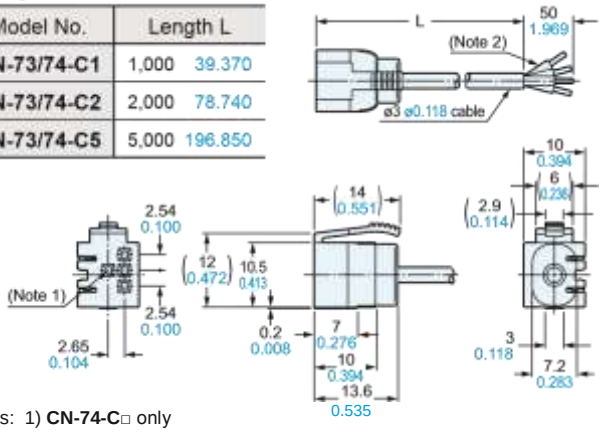
Notes: 1) **FX-502(P)** only
2) **FX-501(P)**: Operation indicator
3) **FX-501(P)**: 3-pin, **FX-502(P)**: 4-pin

Note: T he shape of setting switch and cable will be changed from production at the end of November, 2011. Please see drawing below.

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

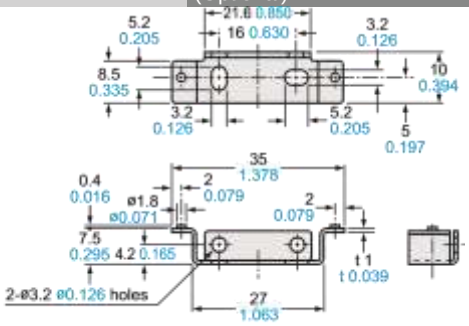
• Length L

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



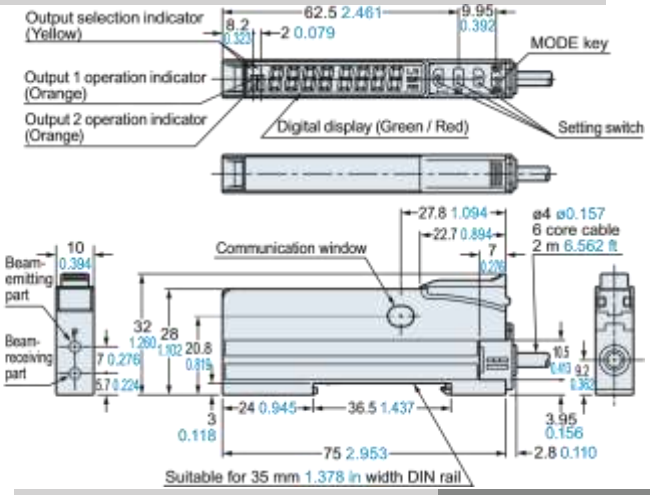
Notes: 1) **CN-74-C□** only
2) **CN-73-C□**: 3-core

MS-DIN-2 Amplifier mounting bracket (Optional)



Material: Cold rolled carbon steel (SPCC)

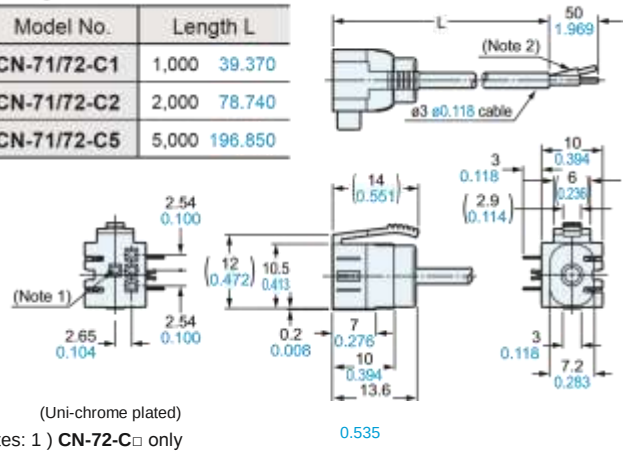
FX-505-C2 FX-505P-C2 Amplifier



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

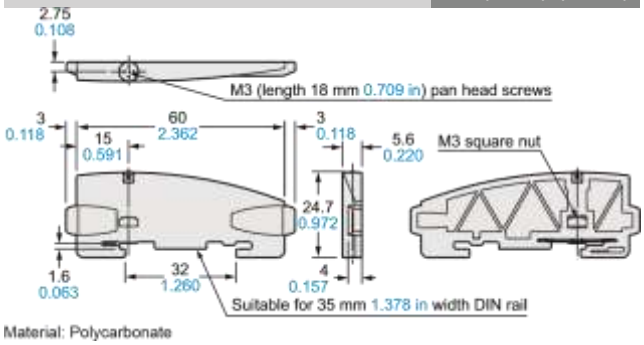
• Length L

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-E End plate (Optional)



Material: Polycarbonate

Introduction of Related Products

Communication Unit for Open Network

SC-GU3 SERIES

The digital sensor can be connected directly to the 3 types of open network!

Other types of analog input sensors can also be connected!

CC-Link
SC-GU3-01

DeviceNet
SC-GU3-02

EtherCAT
SC-GU3-03

Scattered digital sensors can be centrally managed and set through an open network.

Applicable Digital Sensor	Digital Fiber Sensor	Digital Laser Sensor	Digital Pressure Sensor
	FX-501 FX-502	LS-403	DPS-401 DPS-402

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No. CE-FX500-2-6 August, 2012

Specifications are subject to change without notice.

PRINTED IN JAPAN