



CE

Short Form Sensors

SUNX – Sensors by Panasonic Electric Works

11/0908

A new performance class of innovative sensor technology

The variety and complexity of the tasks in automation and the increasing need for quality management have resulted in more and more specialized demands being made on modern sensors. The decisive criteria here are maximum accuracy and reliability. In addition to this, factors such as ultraminiature design, flexible installation options and model diversity are becoming ever more important.

Panasonic Electric Works' innovative sensor technology takes these requirements into account.

An interesting and extensive range of sensor products is being offered under the **SUNX** name—the new sensor generations are being produced by the consistent application of state-of-the-art technology. The characteristic features of these sensors include intelligence, multifunctionality and miniature design.

The delivery program: Innovative and extensive.

As well as through-beam and retroreflective types, reflective sensors and optical fiber photoelectric sensors we also offer laser and eddy current analogue sensors that provide precise measurement results even in the most complicated of applications.

Our delivery program also includes safety light curtains, photoelectric sensors for special applications, inductive proximity switches and miniature pressure sensors for relative or differential pressure measurement.

Quality management and product safety.

Quality, from design to production to customer service, has always been and will continue to be part of the Matsushita corporate philosophy. Strict quality guidelines, with ISO9001 and ISO9002 certification, ensure that our customers are also clear about this quality requirement. Since 01.01.1996, all our sensors have carried the CE mark.

Service has priority.

We are constantly striving to optimize our service sector, to enable us to react quickly to customer requests. Whether you have specific application requests, or you simply want technical information—we are always ready to advise and assist you, you only have to call.

Our current delivery program is assembled for you in this sensor overview. As well as the most important technical data, you will find numerous illustrations of possible applications.

Of course, detailed data sheets are available on our homepage www.panasonic-electric-works.com. Our product managers, sales and application engineers will be happy to advise you.

| | Page | | Page |
|--|------|---|------|
| Fiber Optic Sensors | | Pressure Sensors | |
| FX-100..... | 4 | DP-100..... | 76 |
| FX-301..... | 6 | DP2..... | 78 |
| FX-305..... | 8 | DP4..... | 80 |
| FX-311..... | 10 | DP5/DPH..... | 81 |
| FX-CH2..... | 11 | DP-M..... | 82 |
| Upper Level Communication Units | | Inductive Proximity Sensors | |
| SC-GU1-485..... | 12 | GX-F/H..... | 83 |
| Optical Fiber Heads | 14 | GL..... | 85 |
| Standard Fibers | 18 | Measurement Sensors | |
| Sensors For Semiconductors / FPD Industry | | GP-X..... | 86 |
| FD-L40..... | 32 | Laser Analog Sensors | |
| FT/FD-V..... | 33 | HL-C1..... | 87 |
| EX-F70/F60..... | 34 | HL-C135C-BK10, HL-C1C-M-WL..... | 89 |
| FR-KV1..... | 35 | HL-T1..... | 90 |
| Fiber Heads | | Ionizers / Electrostatic Sensors | |
| FD-F705..... | 36 | ER-VW..... | 91 |
| FT-F902..... | 37 | ER-V..... | 93 |
| Laser Sensors | | EF-S1..... | 94 |
| M18-L..... | 38 | | |
| LC-100..... | 40 | | |
| LC-120..... | 42 | | |
| LS..... | 44 | | |
| Mark Sensors | | | |
| LX-100..... | 46 | | |
| Photoelectric Sensors | | | |
| CX-400..... | 48 | | |
| NX5..... | 56 | | |
| CY..... | 58 | | |
| M18..... | 59 | | |
| EX-10..... | 60 | | |
| EX-20..... | 62 | | |
| EX-30..... | 64 | | |
| PM..... | 66 | | |
| PM2..... | 68 | | |
| NA1-11..... | 70 | | |
| Trigonometric Sensors | | | |
| EQ-500..... | 52 | | |
| EQ-30..... | 54 | | |
| MQ-W..... | 55 | | |
| Light Curtains | | | |
| SF4B..... | 72 | | |
| SF2B..... | 74 | | |
| SF-C10..... | 75 | | |

FX-100



FX-100

New possibilities with digital fiber sensors.

Features

Easy to read

The digital dual-display allows you to check both the threshold value and incident light intensity at the same time, and it also makes the procedures for setting the various values much easier.

Multipurpose, M8 connector type

The connectors used are commercially-available M8 connectors, so that processing costs and lead time required for carrying out processing after purchase of the sensors can be greatly reduced.

Designed in a 3-layer structure to accommodate basic settings through to advanced settings.

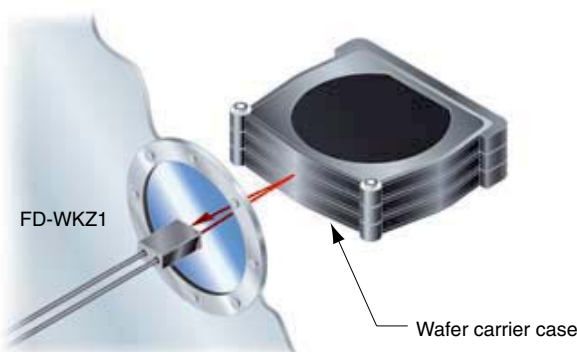
Setting details are divided into three levels for clearer operation, so that setting for normal operation are made in 'RUN mode', basic settings are made in 'SET mode', and advanced functions are set in 'PRO mode'. This makes setting operations much easier to understand and carry out.

Typical Applications

Wafer detection

FD-WKZ + FX 10□

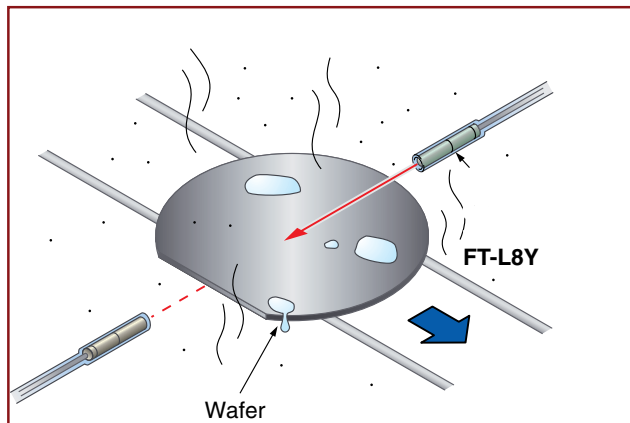
Detects wafer carrier cases through vacuum chamber's view port.



Wafer detection

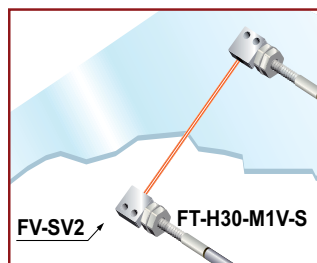
FT-L80Y + FX10□

Sensing possible in corrosive environment. Lenses at the ends of the fiber heads expand the sensing range.



Detection of break / crack of glass

FV-SV2 + FX10□



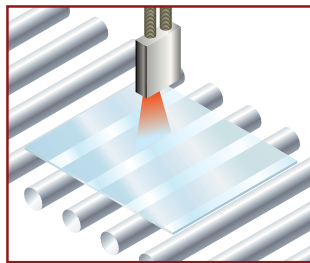
Detection over long ranges

FT-LE1 + FX10□



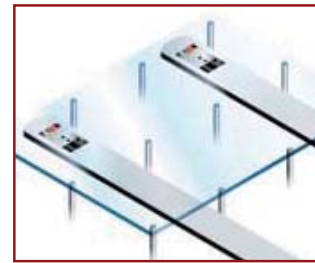
Detection of glass substrate in vacuum chamber

FD-H30-KZ1V + FX10□



Detection of glass substrate on robot hand

FD-H30-L32V + FX10□



Technical Specifications

| Type | | Standard type | | Long sensing range type | |
|----------------------------------|------------|---|--|--|--|
| | | | Cable set | | Cable set |
| Model no. | NPN output | FX-101 (-Z) (Note 2) | FX-101-CC2 | FX-102 (-Z) (Note 2) | FX-102-CC2 |
| | PNP output | FX-101P (-Z) (Note 2) | FX-101P-CC2 | FX-102P (-Z) (Note 2) | FX-102P-CC2 |
| Supply voltage | | 12 to 24VDC±10%, Ripple P-P 10% or less | | | |
| Power consumption | | Normal operation: 720mW or less (Current consumption 30mA or less at 24V supply voltage) ECO mode: 600mW or less (Current consumption 25mA or less at 24V supply voltage) | | | |
| Output | | <NPN output type> NPN open-collector transistor | | <PNP output type> PNP open-collector transistor | |
| Output operation | | Selectable either Light-ON or Dark-ON, at SET mode | | | |
| Short-circuit protection | | Incorporated | | | |
| Response time | | Emission frequency 0: 250µs or less Emission frequency 1: 450µs or less Emission frequency 2: 500µs or less Emission frequency 3: 600µs or less | | Emission frequency 1: 2.5ms or less Emission frequency 2: 2.8ms or less Emission frequency 3: 3.2ms or less Emission frequency 4: 5.0ms or less | |
| Sensitivity setting | | 2-level teaching /Limit teaching/ Full-auto teaching | | | |
| Digital display | | 4 digit green + 4 digit red LCD display | | | |
| Timer function | | ON-delay/OFF-delay timer, switchable either effective or ineffective. [Timer period:1ms, 5ms, 10ms, 20ms, 40ms, 50ms, 100ms, 500ms, 1000ms] | | | |
| Interference prevention function | | Incorporated Selectable emission frequency method (Note 1) (Functions at emission frequency 1, 2 or 3) | | Incorporated Selectable emission frequency method (Note 1) (Functions at emission frequency 1, 2, 3 or 4) | |
| Ambient temperature | | -10 to +55°C (if 4 to 7 units are mounted close together: -10 to +50°C; if 8 to 16 units are mounted close together: -10 to +45°C (no dew condensation or icing allowed); Storage: -20 to +70°C | | | |
| Emitting element (modulated) | | Red LED (Peak emission wavelength : 632nm) | | | |
| Material | | Enclosure: polycarbonate; key switch: polycarbonate; fiber lock lever: PBT | | | |
| Connecting method | | Connector (Note 2) | | | |
| Cable extension | | Extension up to total 100m is possible with 0.3mm², or more, cable. | | | |
| Weight | | Net weight: 15g approx. Gross weight: 35g approx. | Net weight: 15g approx. Gross weight: 75g approx. | Net weight: 15g approx. Gross weight: 35g approx. | Net weight: 15g approx. Gross weight: 75g approx. |
| Accessory | | — | CN-14A-C2 (connector attached cable, 2m long): 1pc | — | CN-14A-C2 (connector attached cable, 2m long): 1pc |

Notes: 1) When using the interference prevention function, set the emission frequencies for the amplifiers to be covered by the interference prevention function to different frequency values. However, the interference prevention function does not operate at emission frequency 0 (factory default setting) for the FX-101(P)(-Z)/FX-101(P)-CC2.
2) Connector attached cable CN-14A-C2 is not attached to the models that have no '-CC2' at the end of the model names.
Make sure to use the optional cable with connector CN-14A-CM.
Model n°s. having the suffix '-Z' are M8 plug-in connector type. Make sure to use the optional M8 plug-in connector cable, UZZ808xx.

FX-301



FX-301

Enhanced functions and performance but still easy to use

Features

FX-301(P) (red LED type) version upgrade

We improved the standard model by enhancing its sensing stability and equipping it with handy functions such as the light-emitting amount selection function. This makes using a fiber sensor easier than ever while conserving the superior operability of the conventional model.

Super high speed response of 35μs

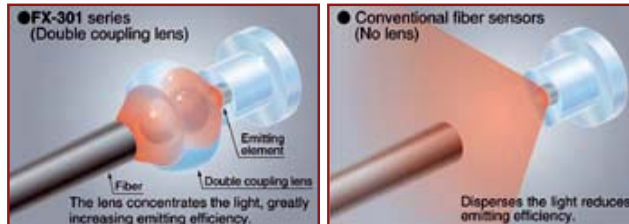
The new FX-301(P)-HS model is the digital type fiber sensor realizing a super high speed response of 35μs rendering it capable of sensing minute objects moving at high speeds. At 65μs, the standard FX-301(P) model (H-SP mode) realizes twice the speed of the conventional model.

Stable sensing over long and short periods

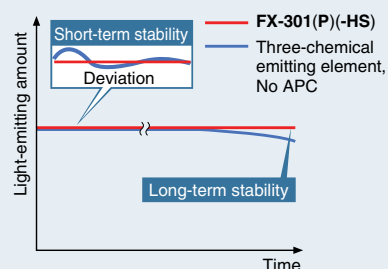
In addition to a *four-chemical emitting element* which suppresses changes in the light-emitting element over time so that a stable level of light emission can be maintained over long periods, a new *APC (Auto Power Control) circuit* has also been adopted. Because fluctuations over short periods of time have also been suppressed, stable sensing is possible very quickly once the power is turned back on after setup changes.

Sensing range has been greatly increased

All models use a *double coupling lens* that enables a much wider sensing range and maximization in the light emission efficiency. Sensing ranges with small diameter fibers and ultra small diameter fibers, which have become very popular due to the miniaturization of chip components, have been increased by 50% over previous values achieved with other amplifiers.



Stable sensing comparison

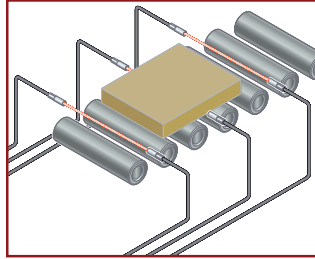


Typical Applications

Red LED type – FX-301(P)(-HS)

Workplaces detection

This standard type of FX-301(P)(-HS) using red light has a four-chemical emitting element for stable sensing over long periods.



Blue LED type – FX-301B(P)

Sensing translucent stickers

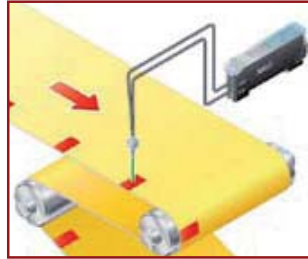
The blue LED type greatly reduces the damping rate, making it ideal for delicate sensing.



Green LED type – FX-301G(P)

Sensing register marks

The green LED type greatly reduces the damping rate, making it ideal for delicate sensing.



Infrared LED type – FX-301H(P)

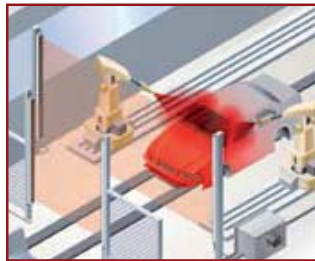
Sensing film meandering

Infrared LED type is ideal for sensing environments with light restrictions, such as places where light-sensitive film is being handled.



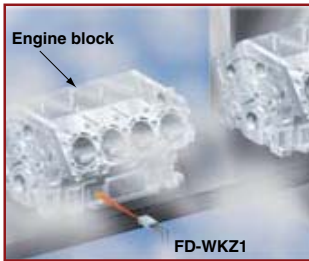
Object sensing during the painting process

Due to a sensing range of 19.5m (FX-301 long range mode) and a 10m fiber length, it can be lead through explosive atmospheres freely.



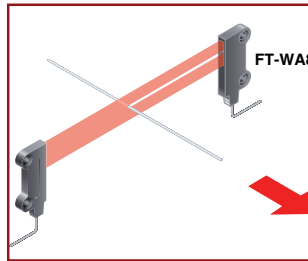
Engine block passage confirmation

FD-WKZ1 has realized a sensing range of 480mm (FX-301 long range mode). In addition, due to its powerful beam, it can even work in adverse environments such as in areas prone to dust.



Wire breakage detection

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



Technical Specifications

| Type | | Standard type ¹⁾ | High speed |
|---------------------------------|------------|--|--|
| Model. no. | NPN output | FX-301□ | FX-301-HS |
| | PNP output | FX-301□P | FX-301P-HS |
| Sensing range (Red LED type) | | Thru-beam type (FT-B8): 1100mm (LONG), 530mm (STD), 400mm (FAST), 200mm (H-SP), 180mm (S-D) Reflective type (FD-B8): 480mm (LONG), 220mm (STD), 160mm (FAST), 85mm (H-SP), 75mm (S-D) | Thru-beam type (FT-B8): 1100mm (LONG), 530mm (STD), 400mm (FAST), 160mm (H-SP), 180mm (S-D) Reflective type (FD-B8): 480mm (LONG), 220mm (STD), 160mm (FAST), 60mm (H-SP), 75mm (S-D) |
| Supply voltage | | 12 to 24VDC ±10% | |
| Output | | NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor | |
| Output operation | | Selectable either Light-ON or Dark-ON, with jog switch | |

| Type | | Standard type ¹⁾ | High speed |
|--|------------|---|---|
| Model. no. | NPN output | FX-301□ | FX-301-HS |
| | PNP output | FX-301□P | FX-301P-HS |
| Response time | | 65μs or less [H-SP (Red LED type only)]; 150μs or less (FAST); 250μs or less (STD/S-D) (Red LED type only); 2ms or less (LONG) selectable with jog switch | 35μs or less (H-SP); 150μs or less (FAST); 250μs or less (STD/S-D); 2ms or less (LONG) selectable with jog switch |
| Sensitivity setting | | 2-level teaching/Limit teaching/Manual adjustment/Full-auto teaching | |
| Digital display | | 4-digit red LED display | |
| Automatic interference prevention function | | Incorporated [(Up to 4 sets of fiber heads can be mounted close together.) (However, H-SP mode is 2 sets.)] | |
| Ambient temperature | | -10 to +55°C (If 4 to 7 units are connected in cascade: -10 to +50°C, if 8 to 16 units are connected in cascade: -10 to +45°C) | |

Note: 1) 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 1m), CN-73-C2 (cable length 2m),
CN-73-C5 (cable length 5m)
Sub cable (1-core): CN-71-C1 (cable length 1m), CN-71-C2 (cable length 2m),
CN-71-C5 (cable length 5m)

FX-305



FX-305

High level of stability and sensing performance

Features

Stable sensing over long and short periods

In addition to a 'four-chemical emitting element' which suppresses changes in the light-emitting element over time so that a stable level of light emission can be maintained over long periods, a new 'Auto Power Control (APC) circuit' has also been adopted. Because fluctuations over short periods of time have also been suppressed, stable sensing is possible very quickly once the power is turned back on after setup changes.

Light-emitting amount selection function

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

Large display 9999

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



(During STDF, LONG and U-LG modes)

High-speed response 65μs

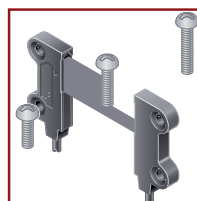
High-speed response that is about twice as fast as before has been achieved. Even small objects moving at high speeds can be sensed. In addition, interference between two units is prevented in high-speed mode (H-SP).

Automatic interference prevention of up to 16 units.

Can be used even in places where fibers need to be installed close together.



Position detection



Height evaluation



Object detection

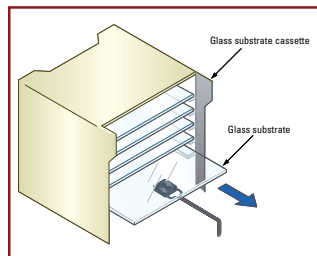
Independent dual outputs

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

Typical Applications

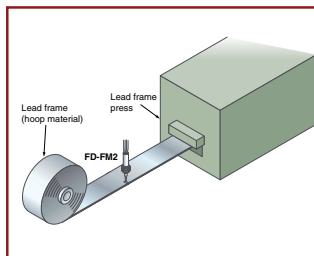
Sensing glass substrate taken out from cassette

With superior range restriction characteristics, it can accurately detect the glass substrate at the specified position in the cassette.



Detecting markings on hoop material

Markings for the cutting position on the hoop can be detected.



Parts feeder surplus detection

The head is rectangular and mountable with just two M2 screws enabling easy installation and beam axis alignment.



Technical Specifications

| Type | NPN output | PNP output |
|------------------------------------|--|-------------------------------|
| Model. no. | FX-305 | FX-305P |
| Sensing range | Thru-beam type (FT-B8): 1600 (U-LG), 1100 (LONG), 700 (STDF), 530 (STD), 400 (FAST), 200 (H-SP) Reflective type (FD-B8): 600 (U-LG), 480 (LONG), 280 (STDF), 220 (STD), 160 (FAST), 85 (H-SP) | |
| Supply voltage | 12 to 24VDC $\pm 10\%$ | |
| Output (Output 1, Output 2) | NPN open-collector transistor | PNP open-collector transistor |
| Output operation | Selectable either Light-ON or Dark-ON, with jog switch | |
| Response time | 65 μ s or less (H-SP); 150 μ s or less (FAST); 250 μ s or less (STD); 700 μ s or less (STDF); 2.5ms or less (LONG); 4.5ms or less (U-LG), selectable with jog switch | |
| Sensitivity setting | Normal mode: 2-level teaching/limit teaching/full-auto teaching/max. sensitivity teaching/manual adjustment Window comparator mode: teaching (1-level, 2-level, 3-level)/manual adjustment | |

| Type | NPN output | PNP output |
|---|--|------------|
| Model. no. | FX-305 | FX-305P |
| Automatic interference prevention function | Incorporated [up to 4 sets of fiber heads can be mounted close together. (However, U-LG mode is 8 sets, H-SP mode is 2 sets.)] | |
| Automatic interference prevention function | Incorporated (Up to 4 sets of fiber heads can be mounted close together. However, H-SP mode is 2 sets.) | |
| Ambient temperature | -10 to +55°C If 4 to 7 units are connected in cascade: -10 to +50°C; If 8 to 16 units are connected in cascade: -10 to +45°C | |
| Emitting element | Red LED (modulated) | |
| Dimensions (W×H×D) | 10×30.5×64.5mm | |

Notes: The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below.
 Main cable (4-core): CN-74-C1 (cable length 1m), CN-74-C2 (cable length 2 m) CN-74-C5 (cable length 5m)
 Sub cable (2-core): CN-72-C1 (cable length 1m), CN-72-C2 (cable length 2 m) CN-72-C5 (cable length 5m)

FX-311



FX-311

**Remarkably easy to use, yet
employs the latest in technology**

Features

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.

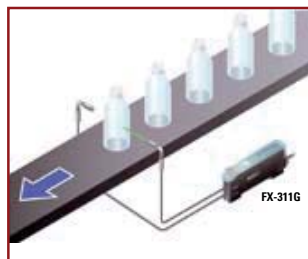
Three light source types (red, green, blue) are made available for expanding applications

Rapid blinking 'assist function' eases adjustment for optimum sensitivity.

Typical Applications

Detecting transparent PET bottles

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



Register mark detection bottles

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



Technical Specifications

| Model no. | NPN output | FX-311 |
|--|---|---------|
| | PNP output | FX-311P |
| Supply voltage | 12 to 24VDC \pm 10%, Ripple P-P 10% or less | |
| Power consumption | 840mW or less (Current consumption 35mA or less at 24V supply voltage) | |
| Output | <NPN output type> NPN open-collector transistor (FX-311) <PNP output type> PNP open-collector transistor (FX-311P) | |
| Output operation | Selectable either Light-ON or Dark-ON, with selection switch | |
| Short-circuit protection | Incorporated | |
| Response time | 250 μ s or less (STD / S-D), 2ms or less (LONG) selectable with selection switch | |
| Operation indicator | Orange LED (lights up when the output is ON) | |
| Timer function | Incorporated with OFF-delay timer, selectable either effective (approx. 10ms or 40ms) or ineffective | |
| Automatic interference prevention function | Incorporated (Up to 4 sets of fiber heads can be mounted closely.) (Note 1) | |
| Ambient temperature | -10 to +55°C (if 4 to 7 units are mounted close together: -10 to +50°C; if 8 to 16 units are mounted close together: -10 to +45°C (no dew condensation or icing allowed); Storage: -20 to +70°C | |
| Emitting element (modulated) | Red LED | |
| Material | Enclosure: Heat-resistant ABS, Case cover: Polycarbonate | |
| Connecting method | Connector (Note 2) | |
| Cable extension | Extension up to total 100m is possible with 0.3mm ² , or more, cable. | |
| Weight | 15g approx. | |

Notes: 1) When the power supply is switched on, the emission timing are automatically set for interference prevention.
2) 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 1m), CN-73-C2 (cable length 2m), CN-73-C5 (cable length 5m).
Sub cable (1-core): CN-71-C1 (cable length 1m), CN-71-C2 (cable length 2m), CN-71-C5 (cable length 5m).



FX-CH2

External input unit for digital sensor

Features

Up to 16 sensors can be set/switched simultaneously by an external signal

Up to 16 digital fiber sensors can be set/switched simultaneously not by directly operating the sensors but from a PLC, a touch panel, a push button, or some other external signal generating device.

Simultaneous teaching

- Full-auto teaching
- Limit teaching '1'
- Limit teaching '2'
- 2-level teaching

Key lock setting

Even the enable/disable command for the key lock setting, a function designed to prevent operational mistakes, can be effected simultaneously from an external signal.

Batch loading and saving of bank settings

The bank settings for 3 previously set channels can be loaded and saved all together using an external signal.

Technical Specifications

| Type | NPN input type | PNP input type |
|----------------------------------|--|--|
| Model. no. | FX-CH2 | FX-CH2-P |
| Applicable sensor | FX-301(P) (Version upgrade) (Note), FX-305(P) | |
| Supply voltage | 12 to 24VDC \pm 10% | |
| Input | Low: 0 to +2VDC High: +5V to +VDC, or open | Low: 4V to +VDC High: 0 to +0.6VDC, or open |
| Power indicator | Green LED | |
| Transmission operation indicator | Green LED (lights up when loaded, and 2-level/limit teaching blinks → lights up when saved, and full-auto teaching) | |
| Ambient temperature | -10 to +55°C (If 4 to 7 sensors are mounted close together: -10 to +50°C, If 8 to 16 sensors are mounted close together: -10 to +45°C) | |
| Dimensions | 10×27×68.5mm | |

Note: Only the upgraded version of the **FX-301(P)** model can be used. Do not use the conventional **FX-301(P)** model.

Typical Application

Setup changes (external automatic teaching/data bank switching)

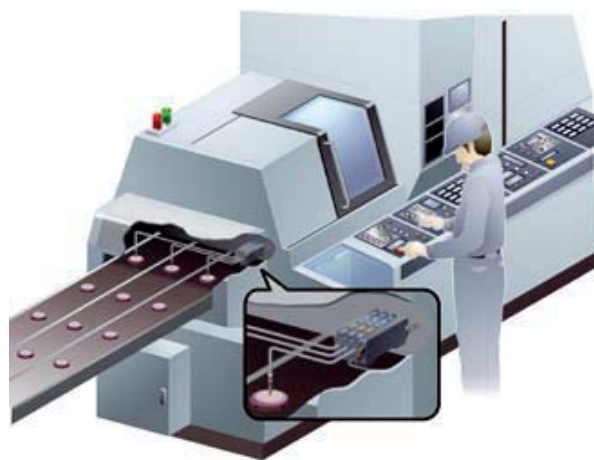
Digital fiber settings can be changed using input from a touch screen or switch, so that production line setup changes can be carried out more easily.

External teaching

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

Data bank switching

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



SC-GU1-485



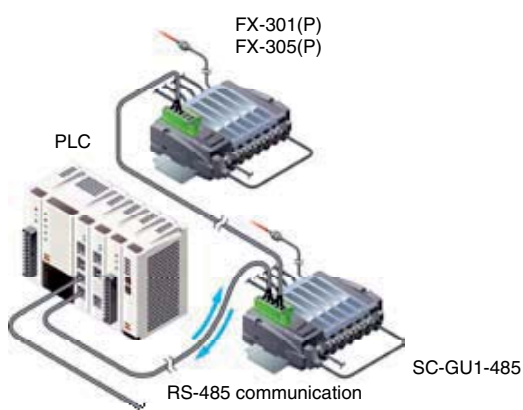
SC-GU1-485

We now offer remote maintenance for digital sensors.

Features

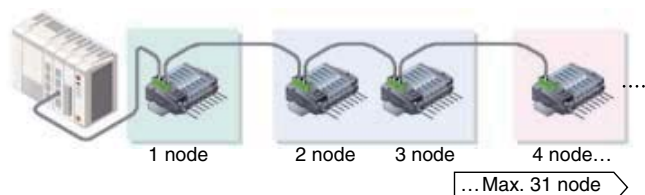
Function handy for startup and maintenance

Using a PLC or PC, this communication unit not only facilitates inputs (teaching, bank switching) to a digital fiber sensor [FX-301(P)/305(P)] but also received-light amount and output status verifications greatly enhance workability during startup and maintenance.



Series connection (RS485) of a maximum of 31 nodes is possible

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

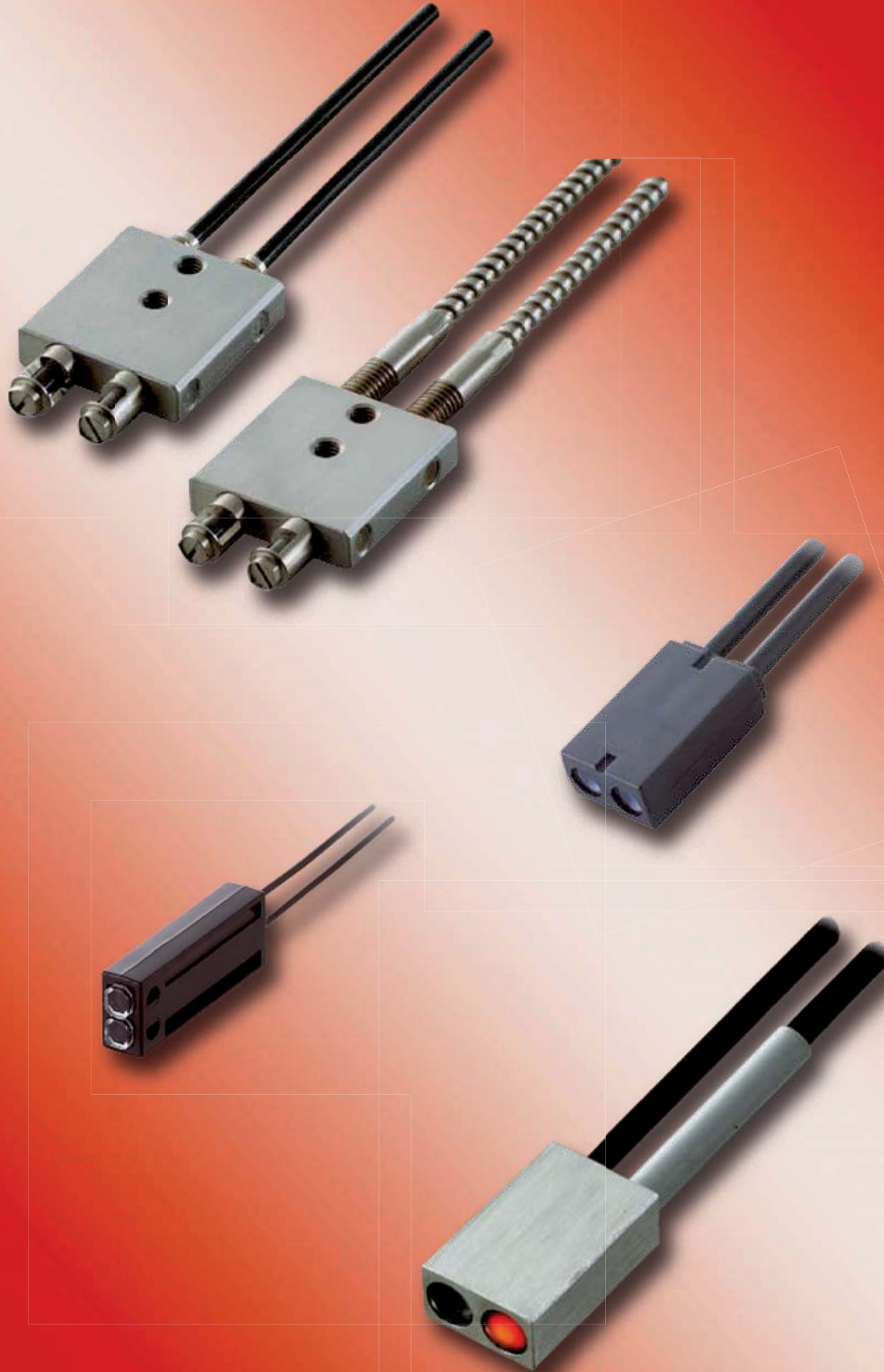


Technical Specifications

| Type | Main Unit |
|---------------------|---|
| Model. no. | SC-GU1-485 |
| Applicable sensor | FX-301 (P) (Note), FX-305 (P) |
| Supply voltage | 24VDC±10% Ripple P-P10% or less |
| Ambient temperature | −10 to +55°C (if 4 to 7 sensors are connected: −10 to +50°C, If 8 to 16 sensors are mounted close together: −10 to +45°C) (No dew condensation or icing allowed), Storage: −20 to +70°C |
| Material | Enclosure: Heat-resistant ABS |
| Weight | 35g approx. (10g approx. for SC-GU1-EU) |

Note: Only the upgraded version of the FX-301(P) model can be used.
Do not use the conventional FX-301(P) model.

Optical Fiber Heads





Sharp bending fiber

Now, an even greater variety of sharp bending fibers

FT/FD-W

Compact bending same as electrical wires

With the smallest bending radius being over R1mm and the coaxial types capable of highly accurate sensing (FD-WG4 and FD-WSG4) being over R2mm, this fiber can bend sharply like a cable to reduce wasted space.

All 24 models! Complete lineup!

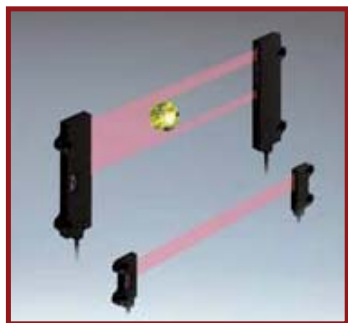
13 thru-beam models and 11 reflective models are available for a total of 24 models. You are sure to find the sharp bending fiber that is best for you.

Does not break even at sharp bends

It does not break even at sharp bends. Further, due to low loss in light intensity, there is almost no affect on the sensing range.



Fiber cable won't break,
even when bent to this extent!



Wide beam fiber

Sensing possible across a wide area

FT-WA30/A30, FT-WA8/A8, FD-A15

Wide range

It has a wide sensing width of 11mm for FT-WA8/A8 and 32mm for FT-WA30/A30 enabling long distance sensing of objects as far as 3500mm (with FX-301 in LONG mode). Optimal for detecting unsteady objects or small objects.

Seal slit mask is available

A seal slit mask reduces the width and thereby the intensity of the emitting beam, which enables much smaller objects to be detected.

Space saving installation possible

FT-WA30/A30 and FT-WA8/A8 depth fibers boast a slim size of 20mm and 13.5mm respectively that enables mounting in even the narrowest of lines.

Checking ICs for burrs

Wide beam fiber enables accurate detection even if burrs fluctuate in size and position.

Heat-resistant M4 Head Reflective Fiber

Heat resistant fiber uses less setting-up space



Heat-resistant fixed-focus reflective fiber
Glass substrate detection in high temperature production line

FD-H30-L32 FD-H18-L31

2 types to choose from to match your working environment

High precision detection

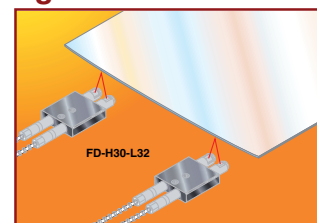
In addition to excellent heat resistance, these fibers have achieved a repeatability of 0.06mm for transparent glass substrates.

Extended detection range

Now available with full-range detection capabilities containing no dead zones (in both LONG and STD modes). Also, an extended detection distance of 15mm (in LONG mode) has been achieved, which even allows warping in glass substrates to be detected.

Glass substrate sensing

High-temperature (300°C) production line glass substrate sensing possible. Accurately detects transparent glass substrates even at a 300°C temperature.



Heat-resistant M4 head reflective fiber
Heat resistant fiber uses less setting-up space

FD-H20-21 FD-H35-20S

Heat-resistant fiber saves installation space

The fiber head has M4 screw threads allowing installation space savings when using many fibers.

High-precision positioning is possible

The 200°C heat-resistant fiber (FD-H20-21) uses a coaxial fiber that makes high-precision positioning possible.

Heat-resistant fiber with sleeve (FD-H35-20S)

The sleeve is useful for cases when the fiber head cannot be installed close to the sensing location.

Can be installed in narrow spaces

A flexible metal jacket sheath that allows cables to be routed easily has been adopted.



Sharp bending fiber

Now, an even greater variety of sharp bending fibers

FR-KZ21/KZ21E

Stable sensing of transparent objects is possible!

A unique optical system gives excellent performance in sensing transparent objects at close ranges.

Uses an exclusive reflector (RF-003) for stable sensing of transparent objects such as transparent sheets on transparent mounts and transparent tubes.

Ultra compact fiber head & compact reflector!

The fiber head size is ultra compact at $W9.52 \times H5.22 \times D21$ mm (side sensing type: $W9.52 \times H252 \times D5.2$ mm). The reflector is also a compact $W10.62 \times H282 \times D10.1$ mm so that it is very space efficient.

Two types of fiber head for different installation directions

Two types of fiber head are available: a *Top* sensing type (FR-KZ21) and a *Side* sensing type (FR-KZ21E). Whichever type best suits the installation conditions can be selected.



Narrow beam retroreflective type fiber

Ideal for sensing transparent objects!

FR-WKZ11

Compact head and long sensing range

This fiber has a compact head of $W9.5 \times H5.2 \times D15$ mm. It is a retroreflective type with a polarizing filter that has a long sensing range of 3200 mm.

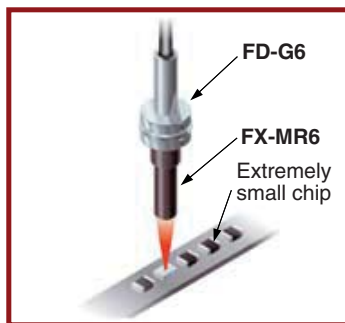
Unaffected by surface reflection from transparent objects

FR-WKZ11 has a built-in polarizing filter in its tip, so that it is unaffected by surface reflection from transparent objects and specular objects directly in front of it.

Gives stable detection of transparent objects

Because it is a retroreflective type, light passes through transparent objects twice, so differences in the amount of light can be easily picked up and glass substrate and transparent films can be detected with good stability.





Coaxial M3 head reflective fiber
High-precision & space saving

FD-G6

Fiber allows installation space saving

The fiber head has M3 screw threads, allowing installation space saving when using many fibers.

High-precision positioning is possible

This coaxial fiber has the emitting fiber at the center and the receiving fiber around it. This fiber is ideal for high-precision positioning.

Allows sensing of very small objects

FX-MR6 and **FX-MR3** finest spot lenses can be attached making this fiber ideal for sensing very small objects or e.g. the orientation of chips.



Long sensing range rectangular head reflective fiber
Narrow field of view/long distance detection!

FD-WKZ1

Compact fiber head

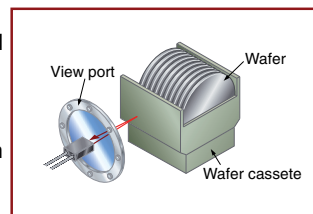
FD-WKZ1 has a compact head with dimensions of $9.2 \times 5.2 \times 15\text{mm}$ (W×H×D).

Narrow-view reflective type fiber allows for accurate aiming through narrow aperture obstruction

The beam spread of FD-WKZ1 has been reduced to approximately 1/5 of that of conventional fiber, enabling detection through narrow apertures.

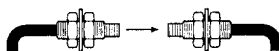
Long sensing range

Sensing can now be performed over distances of 480mm. Furthermore, the implementation of a powerful light beam allows the sensor to perform detection under difficult sensing conditions where high levels of dust and coarse particulates are present.



Optical Fibers for FX 100 Series

Thru-beam type (one pair set)



Fibers are listed in alphabetic order.

| Model No. | Sensing range (mm) (Note 1) | |
|------------------------|-----------------------------|---------------------------------|
| | Standard type FX-101□ | Long sensing range type FX-102□ |
| FT-A8 | 1500 | 3500 (Note 2) |
| FT-A30 | 3500 (Note 2) | 3500 (Note 2) |
| FT-AFM2 | 280 | 720 |
| FT-AFM2E | 240 | 670 |
| FT-B8 | 400 | 1,150 |
| FT-E12 | 6 | 19 |
| FT-E22 | 15 | 60 |
| FT-FM2 | 300 | 800 |
| FT-FM2S | | |
| FT-FM2S4 | | |
| FT-FM10L | 9300 | 15,000 |
| FT-H13-FM2 | 250 | 700 |
| FT-H20-J20-S (Note 3) | 135 | 420 |
| FT-H20-J30-S (Note 3) | | |
| FT-H20-J50-S (Note 3) | | |
| FT-H20-M1 | 210 | 540 |
| FT-H20-VJ50-S (Note 3) | 150 | 500 |
| FT-H20-VJ80-S (Note 3) | | |
| FT-H20W-M1 | 100 | 300 |
| FT-H30-M1V-S (Note 4) | 110 | 280 |
| FT-H35-M2 | 170 | 490 |
| FT-H35-M2S6 | | |
| FT-HL80Y | 990 | 2340 |
| FT-K8 | 1000 | 3000 |
| FT-KV1 | 135 | 500 |
| FT-KV8 | 1000 | 3000 |
| FT-L80Y | 1100 | 2600 |
| FT-NFM2 | 130 | 280 |
| FT-NFM2S | | |
| FT-NFM2S4 | | |
| FT-P2 | 120 | 330 |
| FT-P40 | 80 | 240 |
| FT-P60 | 130 | 300 |
| FT-P80 | 230 | 650 |
| FT-P81X | 260 | 800 |

| Model No. | Sensing range (mm) (Note 1) | |
|------------|-----------------------------|---------------------------------|
| | Standard type FX-101□ | Long sensing range type FX-102□ |
| FT-PS1 | 40 | 90 |
| FT-R80 | 180 | 430 |
| FT-SFM2 | 300 | 800 |
| FT-SFM2L | 760 | 2400 |
| FT-SFM2SV2 | 180 | 470 |
| FT-SNFM2 | 130 | 280 |
| FT-T80 | 300 | 800 |
| FT-V10 | 1000 | 2350 |
| FT-V22 | 140 | 380 |
| FT-V41 | 40 | 120 |
| FT-V80Y | 340 | 800 |
| FT-W4 | 80 | 220 |
| FT-W8 | 260 | 650 |
| FT-WA8 | 1500 | 3500 (Note 2) |
| FT-WA30 | 3500 (Note 2) | 3500 (Note 2) |
| FT-WKV8 | 700 | 2200 |
| FT-WR80 | 215 | 570 |
| FT-WR80L | 430 | 1150 |
| FT-WS3 | 150 | 600 |
| FT-WS4 | 80 | 220 |
| FT-WS8 | 260 | 650 |
| FT-WS8L | 600 | 1500 |
| FT-WV42 | 30 | 80 |
| FT-WZ4 | 230 | 670 |
| FT-WZ4HB | 80 | 230 |
| FT-WZ7 | 330 | 1000 |
| FT-WZ7HB | 190 | 580 |
| FT-WZ8 | 330 | 950 |
| FT-WZ8E | 700 | 2100 |
| FT-WZ8H | 1200 | 2800 |
| FT-Z8 | 360 | 1000 |
| FT-Z8E | 800 | 1850 |
| FT-Z8H | 1400 | 3100 |
| FT-Z802Y | 520 | 3100 |

Notes: 1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.

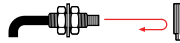
2) The fiber cable length practically limits the sensing range to 3500mm long.

3) Heat-resistant joint fibers and ordinary-temperature side fibers (FT-FM2) are sold as a set.

4) Sold as a set comprising vacuum-resistant type fiber + photo-terminal (FV-BR1) + fiber at atmospheric side (FT-J8).

Optical Fibers for FX 100 Series

Retroreflective type



Fibers are listed in alphabetic order.

| Model No. | Sensing range (mm) (Notes 1, 2) | |
|-----------|---------------------------------|---------------------------------|
| | Standard type FX-101□ | Long sensing range type FX-102□ |
| FR-KV1 | 15 to 200 | 15 to 360 |
| FR-KZ21 | 200 | 200 |
| FR-KZ21E | 200 | 200 |
| FR-WKZ11 | 100 to 550 | 100 to 830 |

Notes: 1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
The sensing range of **FR-WKZ11** is specified for the **RF-13**. The sensing range of **FR-KZ21**, **FR-KZ21E** and **FR-KV1** is specified for the attached reflector.
The sensing ranges when using in combination with the **FR-WKZ11** reflector (optional) are given in the below table.

| Reflector \ Amplifier | FX-101□ | FX-102□ |
|-----------------------|-------------|-------------|
| FR-WKZ11 + RF-210 | 100 to 700 | 100 to 1100 |
| FR-WKZ11 + RF-220 | 100 to 1300 | 100 to 2600 |
| FR-WKZ11 + RF-230 | 100 to 2000 | 100 to 4000 |

- 2) The sensing range of **FR-WKZ11** is the possible setting range for the reflector or reflective tape. The fiber can detect an object less than 100mm away. However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier unit before use.
The sensing range of **FR-KZ21(E)** is the possible setting range for the reflector. However, if setting the fiber to detect objects passing within 0 to 20mm from the fiber head, unstable detection may result.
The sensing range of **FR-KV1** is the possible setting range for the reflector. The fiber can detect an object less than 15mm away.

Reflective type



Fibers are listed in alphabetic order.

| Model No. | Sensing range (mm) (Note 1, 2) | |
|------------|--|---------------------------------|
| | Standard type FX-101□ | Long sensing range type FX-102□ |
| FD-A15 | 125 | 250 |
| FD-AFM2 | 105 | 285 |
| FD-AFM2E | 85 | 245 |
| FD-B8 | 170 | 440 |
| FD-E12 | 3.5 | 13 |
| FD-E22 | 16 | 45 |
| FD-EG1 | 18 | 50 |
| FD-EG2 | 10 | 30 |
| FD-EG3 | 7 | 22 |
| FD-EN500S1 | 1 | 4 |
| FD-ENM1S1 | 15 | 48 |
| FD-F4 | Applicable pipe diameter: Outer dia. ø6 to ø26mm transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1mm] | |
| FD-F41 | Applicable pipe diameter: Outer dia. ø6 to ø26mm transparent pipe [PVC (vinyl chloride), fluorine resin, polycarbonate, acrylic, glass, wall thickness 1 to 3mm] | |
| FD-F8Y | — | |
| FD-FM2 | 100 | 410 |
| FD-FM2S | 100 | 345 |
| FD-FM2S4 | | |
| FD-G4 | 50 | 120 |

| Model No. | Sensing range (mm) (Notes 1, 2) | |
|---------------------------|---------------------------------|-----------------------------------|
| | Standard type FX-101□ | Long sensing range type FX-102□ |
| FD-G6 | 50 | 120 |
| FD-G6X | 45 | 160 |
| FD-H13-FM2 | 100 | 280 |
| FD-H18-L31 | 0 to 10 | 0 to 25 |
| FD-H20-21 | 90 | 280 |
| FD-H20-M1 | 120 | 300 |
| FD-H30-KZ1V-S (Note 3) | 25 to 80 | 10 to 220 |
| FD-H30-L32 | 2 to 9 | 0 to 17 |
| FD-H30-L32V-S (Note 3) | 2.5 to 6.5 | 0 to 11 |
| FD-H35-20S | 85 | 200 |
| FD-H35-M2 | 75 | 280 |
| FD-H35-M2S6 | | |
| FD-L4 | 5 to 8 (Convergent point 6) | 1 to 17 (Convergent point 6) |
| FD-L41 | 3 to 14 (Convergent point 8) | 1.5 to 16 (Convergent point 8) |
| FD-L43 | 0 to 19 | 0 to 25 |
| FD-L44 | 0 to 6 | 0 to 8 |
| FD-L44S | 0 to 4.5 | 0 to 5.5 |
| FD-L45 | 0 to 40 | 0 to 50 |
| FD-L46 | 16 to 30 | 12 to 50 |
| FD-NFM2 | 35 | 100 |
| FD-NFM2S | | |
| FD-NFM2S4 | | |
| FD-P2 | 25 | 65 |

- Notes: 1) The standard sensing objects of the sensing ranges vary depending on the fibers.
2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
3) Sold as a set comprising vacuum-resistant type fiber + photo-terminal (**FV-BR1**) + fiber at atmospheric side (**FT-J8**).

Optical Fibers for FX 100 Series

Reflective type



Fibers are listed in alphabetic order.

| Model No. | Sensing range (mm) (Note 1, 2) | |
|------------|--------------------------------|---------------------------------|
| | Standard type FX-101□ | Long sensing range type FX-102□ |
| FD-P40 | 8 | 30 |
| FD-P50 | 45 | 150 |
| FD-P60 | 45 | 150 |
| FD-P80 | 90 | 200 |
| FD-P81X | 70 | 220 |
| FD-R80 | 70 | 180 |
| FD-S80 | 100 | 345 |
| FD-SFM2SV2 | 30 | 90 |
| FD-SNFM2 | 35 | 100 |
| FD-T40 | 35 | 100 |
| FD-T80 | 100 | 345 |
| FD-V41 | 25 | 70 |
| FD-W8 | 80 | 230 |
| FD-W44 | 15 | 40 |

| Model No. | Sensing range (mm) (Note 1, 2) | |
|-----------|---------------------------------|-----------------------------------|
| | Standard type FX-101□ | Long sensing range type FX-102□ |
| FD-WG4 | 28 | 75 |
| FD-WKZ1 | 20 to 180 | 20 to 480 |
| FD-WL41 | 7 to 12 (Convergent point 8) | 6 to 13.5 (Convergent point 8) |
| FD-WL48 | 1 to 4.5 | 0.5 to 6.5 |
| FD-WS8 | 80 | 230 |
| FD-WSG4 | 28 | 75 |
| FD-WT4 | 15 | 40 |
| FD-WT8 | 80 | 230 |
| FD-WV42 | 6 | 20 |
| FD-WZ4 | 2 to 20 | 1 to 70 |
| FD-WZ4HB | | |
| FD-WZ7 | 1 to 55 | 160 |
| FD-WZ7HB | 1 to 60 | 0.5 to 180 |

Notes: 1) The standard sensing objects of the sensing ranges vary depending on the fibers. Refer to p.71~ for details.

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

Optical Fibers for FX 300 Series

Thru-beam type (one pair set)



The FX-305 and FX-301(-HS) have different sensing modes.
 FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)
 FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type | Shape of fiber head (mm) | Sensing range (mm) (Note 1) | U-LG LONG STDF STD | FAST H-SP S-D | Min. sensing object (Note 3) | Fiber cable length Free-cut | Bending radius | Model No. |
|--------------------|------------------------------------|-----------------------------|-----------------------------|---------------------|------------------------------|--------------------------------|--------------------|-----------------|
| Threaded type | Lens mountable | | | | ø0.04mm opaque object | 2m | R25mm | FT-B8 |
| | Lens mountable | | | | | | | FT-FM2 |
| | Sleeve 90mm | | | | ø0.03mm opaque object | | Fiber R25mm Sleeve | FT-FM2S |
| | Sleeve 40mm | | | | | | R10mm | FT-FM2S4 |
| | Lens mountable | | | | ø0.03mm opaque object | 2m | R1mm | FT-W8 |
| | Lens mountable | | | | ø0.04mm opaque object | | R4 mm Flexible | FT-P80 |
| | Lens mountable | | | | ø0.05mm opaque object | 1m | R10mm | FT-P81X |
| | Tough flexible | | | | | | | |
| | Lens mountable | | | | ø0.04mm opaque object | 2m | R4 mm Flexible | FT-P60 |
| | Square head type | | | | ø0.06mm opaque object | 2m | R1mm | NEW FT-WR80 |
| | With lens | | | | ø0.04mm opaque object | 2m | | NEW FT-WR80L |
| | Elbow | | | | ø0.04mm opaque object | 2m | R25mm | FT-R80 |
| | Lens mountable (except FX-LE2) | | | | ø0.03mm opaque object | 2m | R25mm | FT-T80 |
| | | | | | | | | FT-NFM2 |
| | Sleeve 90mm | | | | ø0.025mm opaque object | | Fiber R25mm Sleeve | FT-NFM2S |
| | Sleeve 40mm | | | | | | R10mm | FT-NFM2S4 |
| | | | | | ø0.02mm opaque object | | R1mm | FT-W4 |
| | | | | | | | R4 mm Flexible | FT-P40 |
| Long sensing range | With lens | | | | ø0.4mm opaque object | 10m | R25mm | FT-FM10L |

Notes: 1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
 2) The minimum sensing object size is the value for red LED type. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type.
 The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.

Optical Fibers for FX 300 Series

Thru-beam type (one pair set)



The FX-305 and FX-301(-HS) have different sensing modes.
 FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)
 FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type | Shape of fiber head (mm) | Sensing range (mm) (Note 1) | U-LG LONG STDF STD | FAST H-SP S-D | Min. sensing object (Note 2) | Fiber cable length Free-cut | Bending radius | Model No. |
|------------------|--|--|--------------------------------------|-----------------------|--|--------------------------------|----------------|------------|
| Cylindrical type | With lens • Long sensing range $\phi 3$ | 1,500 1,200 750 600 | 420 200 210 | | $\phi 0.02\text{mm}$ opaque object | 2m | R1mm | FT-WS8L |
| | | 780 570 340 290 | 200 90 100 | | $\phi 0.05\text{mm}$ opaque object | | | FT-WS3 |
| | With lens • Long sensing range $\phi 2.5$ | 2,000 1,600 820 800 | 580 170 280 | | $\phi 0.02\text{mm}$ opaque object | | R25mm | FT-SFM2L |
| | | 1,000 780 500 400 | 280 150 130 | | $\phi 0.03\text{mm}$ opaque object | 2m | | FT-SFM2 |
| | $\phi 2.5$ | 750 350 290 | 200 90 100 | | | | R1mm | FT-WS8 |
| | | 400 270 200 140 | 100 55 49 | | $\phi 0.025\text{mm}$ opaque object | 2m | R25mm | FT-SNFM2 |
| | $\phi 1.5$ | 220 160 100 | 55 25 28 | | $\phi 0.02\text{mm}$ opaque object | | R1mm | FT-WS4 |
| | | 350 280 160 120 | 90 40 42 | | | 1m | R4 mm | FT-P2 |
| | $\phi 1$ | 100 80 50 40 | 30 13 17 | | $\phi 0.02\text{mm}$ opaque object | 500mm | Flexible | FT-PS1 |
| | | 20 18 13 10 | 8 3 3 | | | | | |
| | Ultra small diameter | Beam diameter $\phi 0.25$ $\phi 3$ $\phi 0.125$ mm Sleeve part cannot be bent. | 130 80 60 50 | 36 18 15 | $\phi 0.02\text{mm}$ opaque object | 500mm | R5mm | FT-E12 |
| | | Beam diameter $\phi 0.4$ $\phi 3$ $\phi 0.25$ mm Sleeve part cannot be bent. | | | | 1m | | FT-E22 |
| | Side-view | $\phi 4$ $\phi 3$ | 2,350 2,000 1,400 1,000 | 800 340 350 | $\phi 0.05\text{mm}$ opaque object | 2m | | FT-V10 |
| | | $\phi 1.5$ $\phi 2.5$ $\phi 3$ | 550 400 240 200 | 140 65 70 | | | R25mm | FT-SFM2SV2 |
| | | $\phi 1$ $\phi 2$ $\phi 3$ | 410 390 220 180 | 125 60 63 | | 1m | | FT-V22 |
| | | $\phi 1$ $\phi 2.5$ $\phi 3$ | 220 175 100 80 | 60 25 27 | $\phi 0.02\text{mm}$ opaque object | 2m | | FT-V41 |
| | | $\phi 1$ $\phi 2$ $\phi 3$ | 120 90 55 40 | 30 13 15 | | | R1mm | FT-WV42 |
| | | $\phi 1$ $\phi 2$ $\phi 3$ | | | | | | |

Notes: 1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
 2) The minimum sensing object size is the value for red LED type. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type.
 The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.

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

Optical Fibers for FX 300 Series

Thru-beam type (one pair set)



The **FX-305** and **FX-301(-HS)** have different sensing modes.
FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)
FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type | Shape of fiber head (mm) | Sensing range (mm) (Note 1) | U-LG LONG STDF STD | FAST H-SP S-D | Min. sensing object (Note 2) | Fiber cable length Free-cut | Bending radius | Model No. |
|-------------|---|--|--|---------------------|------------------------------------|--------------------------------|-----------------|-----------|
| Rectangular | Easy mounting • Top sensing W3 × H8 × D12 | 3,500 2,500 1,600 1,200 | 400 410 | 850 | ø0.08mm opaque object | 2m | R1mm | FT-WZ8H |
| | | 3,100 2,700 1,550 1,400 | 420 490 | 1,000 | ø0.03mm opaque object | | R4mm Flexible | FT-Z8H |
| | Easy mounting • Side sensing W3 × H12 × D8 | 2,100 1,500 950 700 | 200 210 | 500 | ø0.05mm opaque object | | R1mm | FT-WZ8E |
| | | 1,850 1,600 950 800 | 250 280 | 600 | ø0.03mm opaque object | | R4mm Flexible | FT-Z8E |
| | Easy mounting • Front sensing W8.5 × H12 × D3 | 950 700 420 330 | 100 120 | 240 | ø0.04mm opaque object | 1m | R1mm | FT-WZ8 |
| | | 1,100 800 500 400 | 120 140 | 300 | ø0.03mm opaque object | | R4mm Flexible | FT-Z8 |
| | Front sensing W10 × H7 × D2 | 300 200 140 100 | 40 40 | 70 | ø0.08mm opaque object | 1m | NEW R1mm | FT-WZ4 |
| | Fiber bending type W2 × H10 × D10 | 220 150 105 75 | 30 30 | 50 | ø0.08mm opaque object | | NEW R1mm | FT-WZ4HB |
| | Front sensing W14 × H7 × D3.5 | 660 440 308 220 | 80 80 | 150 | ø0.08mm opaque object | 2m | NEW R1mm | FT-WZ7 |
| | | 870 580 406 290 | 110 110 | 210 | ø0.03mm opaque object | | NEW R1mm | FT-WZ7HB |
| Special | Narrow beam ø3.5 ø3.7 | 3,000 2,000 1,500 1,000 | 300 350 | 800 | | 2m | R25mm R0.984 in | FT-K8 |
| | | 2,200 1,700 1,000 700 | 280 300 | 600 | ø0.06mm opaque object | | R1mm | FT-WKV8 |
| | | 3,000 2,000 1,500 1,000 | 300 350 | 800 | | | R25mm R0.984 in | FT-KV8 |
| | Wide beam W2 × H1.5 × D20 | 600 500 300 250 | 180 90 100 | | ø0.02mm opaque object | 2m | R10mm | FT-KV1 |
| | | (Note 3) 3,500 (Note 3) 3,500 (Note 3) 3,500 (Note 3) 3,500 | (Note 4) 3,500 (Note 4) 3,000 (Note 4) 3,500 | | ø0.3mm opaque object | | R1mm | FT-WA30 |
| | | (Note 3) 3,500 (Note 3) 3,500 (Note 3) 3,500 (Note 3) 3,500 | (Note 4) 1,100 (Note 4) 1,080 (Note 4) 750 | | ø0.25mm opaque object | | R1mm | FT-WA8 |
| | Wide area sensing Sensing width 32mm W5 × H69 × D20 | (Note 3) 3,500 (Note 3) 3,500 (Note 3) 3,500 (Note 3) 3,500 | (Note 4) 3,500 (Note 4) 3,000 (Note 4) 3,500 | | | 2m | R10mm | FT-A30 |
| | | (Note 3) 3,500 (Note 3) 3,500 (Note 3) 3,500 (Note 3) 3,500 | (Note 4) 1,100 (Note 4) 1,080 (Note 4) 750 | | | | R1mm | FT-WA8 |
| | | (Note 3) 3,500 (Note 3) 3,500 (Note 3) 3,500 (Note 3) 3,500 | (Note 4) 1,100 (Note 4) 1,080 (Note 4) 750 | | | | R10mm | FT-A8 |
| | Array Top sensing W5 × H15 × D15 | 850 650 380 330 | 220 100 115 | | Horizontal: ø0.025mm opaque object | 2m | R25mm | FT-AFM2 |
| | | 800 590 350 290 | 200 90 100 | | Vertical: ø0.45mm opaque object | | R25mm | FT-AFM2E |

- Notes:**
1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
2) The minimum sensing object size is the value for red LED type. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type. The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.
3) The fiber cable length practically limits the sensing range to 3500mm long.

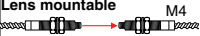


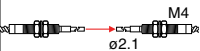
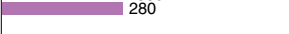
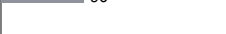

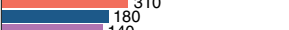


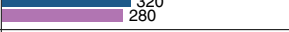
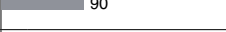

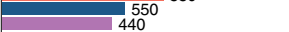



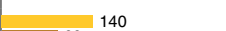

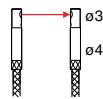









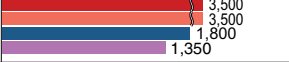
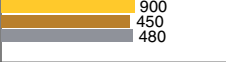
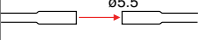
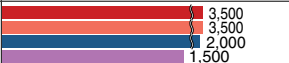

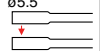
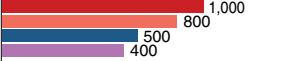
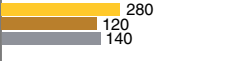

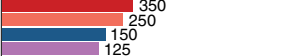
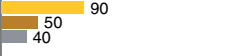
Optical Fibers for FX 300 Series

Thru-beam type (one pair set)



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

The **FX-305** and **FX-301(-HS)** have different sensing modes.
FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)
FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type | Shape of fiber head (mm) | Sensing range (mm) (Note 2) | | | Min. sensing object (Note 3) | Fiber cable length ✂ : Free-cut | Bending radius | Model No. |
|---------|--|--|--|--|--|--|--|--|
| Special | Heat-resistant | 350°C Lens mountable  |  |  | ø0.04mm opaque object | 2m | R25mm | FT-H35-M2 |
| | 350°C Sleeve 60mm  |  |  | Fiber R25mm Sleeve R10mm | | | FT-H35-M2S6 | |
| | Allows flexible wiring, 200°C Lens mountable  |  |  | ø0.02mm opaque object | 1m | R10mm | FT-H20W-M1 | |
| | 200°C Lens mountable  |  |  | ø0.04mm opaque object | 1m | R25mm | FT-H20-M1 | |
| | 130°C Lens mountable (FX-LE2 only)  |  |  | ø0.06mm opaque object | 2m | | FT-H13-FM2 | |
| | Heat-resistant • Joint | Lens mountable (FX-LE1)  |  |  | ø0.12mm opaque object |  200mm (Note 4) | Heat-resistant fiber R18mm (Note 5) | NEW FT-H20-J20-S (Note 6) |
| | | Side-view  |  |  | |  300mm (Note 4) | | NEW FT-H20-J30-S (Note 6) |
| | | | | | |  500mm (Note 4) | | NEW FT-H20-J50-S (Note 6) |
| | Chemical-resistant | Easy mounting • Rectangular head SEMI S2 compliant W7 × H15 × D13  |  |  | ø4mm opaque object |  2m | | R25mm |
| | | Heat-resistant 115°C  |  |  | | | ø0.2mm opaque object | |
| | |  |  |  | FT-L80Y | | | |
| | | Side-view  |  |  | FT-V80Y | | | |
| | | Vacuum-resistant | 300°C Lens mountable (FV-LE1/SV2 only)  |  |  | ø0.03mm opaque object | 1m | R1mm |

Notes: 1) Contact our office for details regarding the sensing ranges of the **FX-301-HS** in H-SP mode and the **FX-301B/G/H**.

2) Please take care that

the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
 3) The minimum sensing object size is the value for red LED type. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type.

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

4) This is the fiber length (fixed length) for heat-resistant fibers. The ordinary-temperature fibers are free-cut to 2m.

5) The bending radius for the ordinary-temperature fiber is R25mm or more.

6) Heat-resistant joint fibers and ordinary-temperature fibers (**FT-FM2**) are sold as a set.

7) The allowable cutting range is 500mm from the end that the amplifier inserted.

8) Sold as a set comprising vacuum type fiber + photo-terminal (**FV-BR1**) + fiber at atmospheric side (**FT-J8**). Please refer to p.91~ for details.

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

FT-H20-J20 (one pair set)

FT-H20-J30 (one pair set)

FT-H20-J50 (one pair set)

FT-H20-VJ50 (one pair set)

FT-H20-VJ80 (one pair set)

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

Vacuum-resistant fiber

Photo-terminal

Fiber at atmospheric side

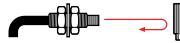
FT-H30-M1V (one pair set)

FV-BR1 (one pair set)

FT-J8 (one pair set)



















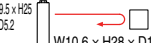










Optical Fibers for FX 300 Series

Retroreflective type



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

The **FX-305** and **FX-301(-HS)** have different sensing modes.
FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)
FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)


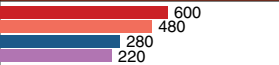
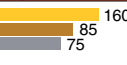

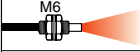
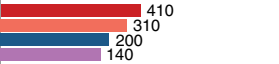
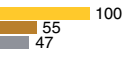
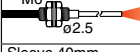
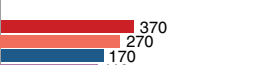
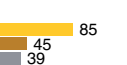
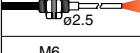
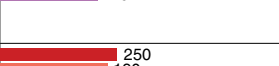
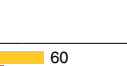

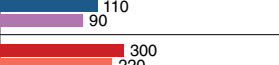
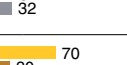
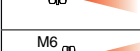
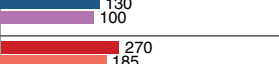
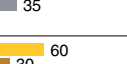
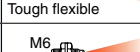
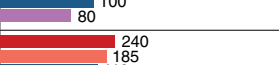
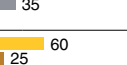



| Type | Shape of fiber head (mm) | Sensing range (mm) (Note 2, 3) | | ■ U-LG ■ LONG ■ STDF ■ STD | ■ FAST ■ H-SP ■ S-D | Min. sensing object (Note 4) | Fiber cable length ✂ : Free-cut | Bending radius | Model No. |
|--|---|---|---|--|-------------------------------------|---|---|--|-----------|
| Sharp bending With polarizing filters | W8.5 x H5.2 x D15  W30 x H30 x D0.5 W9.5 x H5.2 x D21 |  100 to 910  100 to 730  100 to 600  100 to 520 (Note 3) | Cannot use Cannot use |  100 to 460 | | ø0.3mm opaque object |  2m |  R1mm | FR-WKZ11 |
| Narrow beam | Top sensing  W10.6 x H28 x D10.1 |  200  200  200  200 |  200  200  200 | | Horizontal: ø5.5mm opaque object |  2m |  R10mm | FR-KZ21 | |
| | Side sensing  W8.5 x H25 x D52 W10.6 x H28 x D10.1 | | | Vertical: ø0.06mm opaque object | FR-KZ21E | | | | |
| Wafer mapping |  W7.5 x H2.2 x D11.2 W4 x H2 x D21.5 |  15 to 370  15 to 330  15 to 240  15 to 210 |  15 to 170  15 to 80  15 to 90 | | ø0.12mm opaque object |  2m |  R10mm | FR-KV1 | |

- Notes:** 1) Contact our office for details regarding the sensing ranges of the **FX-301(-HS)** in H-SP mode and the **FX-301B/G/H**.
2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
The sensing range of **FR-WKZ11** is specified for the **RF-13**. The sensing range of **FR-KZ21**, **FR-KZ21E** is specified for the attached reflector **RF-003**. The sensing range of **FR-KV1** is specified for the attached reflector.
3) The sensing range of **FR-KV1** is the possible setting range for the reflector. The fiber can detect an object less than 15mm away.
The sensing range of **FR-KZ21** and **FR-KZ21E** is the possible setting range for the reflector. However, if setting the fiber to detect objects passing within 0 to 20mm from the fiber head, unstable detection may result.
The sensing range of **FR-WKZ11** is the possible setting range for the reflective tape. The fiber can detect an object less than 100mm away.
However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier unit before use.
4) The minimum sensing object size is the value for red LED type.
The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.

Reflective type



The **FX-305** and **FX-301(-HS)** have different sensing modes.
FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)
FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type | Shape of fiber head (mm) | Sensing range (mm) (Notes 1, 2) | | U-LG LONG STDF STD | FAST H-SP S-D | Min. sensing object (Note 3) | Fiber cable length Free-cut | Bending radius | Model No. |
|---------------------|---|---|---|-----------------------------|---------------------|---------------------------------|---|--------------------|-----------|
| Threaded type M6 |  |  |  | ø0.02mm gold wire | | 2m |  | R25mm | FD-B8 |
| | Coaxial M6  |  |  | | | | | | FD-FM2 |
| | Sleeve 90 mm M6  |  |  | | | | | Fiber R25mm Sleeve | FD-FM2S |
| | Sleeve 40mm M6  |  |  | | | | | R10mm | FD-FM2S4 |
| | M6  |  |  | | | | | R1mm | FD-W8 |
| | M6  |  |  | | | | | R4 mm Flexible | FD-P80 |
| | M6 Tough flexible  |  |  | | | | | 1m | R10mm |
| Elbow | M6  |  |  | ø0.02mm gold wire | | 2m | R25mm | FD-R80 | |

- Notes:** 1) The sensing range is specified for white non-glossy paper [400 x 400mm] as the object.
2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
3) The minimum sensing object size is the value for red LED type at maximum sensitivity.
Note that the corresponding setting distance is different from the rated sensing distance.

Optical Fibers for FX 300 Series

Reflective type



The FX-305 and FX-301(-HS) have different sensing modes.
 FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)
 FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type | Shape of fiber head (mm) | Sensing range (mm) (Notes 1, 2) | U-LG LONG STDF STD | FAST H-SP S-D | Min. sensing object (Note 3) | Fiber cable length Free-cut | Bending radius | Model No. |
|---------------|--|---------------------------------|-------------------------------|---------------------|------------------------------|--------------------------------|-------------------------|------------|
| Threaded type | M4 | 370 270 170 110 | 85 45 39 | | ø0.02mm gold wire | 2m | R25mm | FD-T80 |
| | M4 | | | | | | | FD-NFM2 |
| | Sleeve 90 mm M4 ø1.48 | 140 90 60 45 | 35 16 16 | | | | Fiber R25mm Sleeve | FD-NFM2S |
| | Sleeve 40 mm M4 ø1.48 | | | | | | R10mm | FD-NFM2S4 |
| | Sleeve 40mm 1.575 in M4 ø1.48 | 40 30 18 15 | 12 4.5 5 | | | | Fiber R1mm Sleeve R10mm | FD-W44 |
| | M4 | 250 190 110 90 | 60 25 32 | | | | R1mm | FD-WT8 |
| | Minute objects can be detected due to the small spot beam. Coaxial • Lens mountable | 85 65 37 32 | 25 10 11 | | | | R2mm | FD-WG4 |
| | M4 | 150 110 65 55 | 42 15 19 | | | | R25mm | FD-G4 |
| | M4 | 130 90 55 45 | 30 13 16 | | | | R4 mm Flexible | FD-P60 |
| | Small diameter M3 | 140 90 60 45 | 35 16 16 | | | 2m | R25mm | FD-T40 |
| | M3 | 40 30 18 15 | 12 4.5 5 | | | | R1mm | FD-WT4 |
| | M3 | 50 36 20 18 | 14 5.5 6 | | | | R4 mm Flexible | FD-P40 |
| | Lens mountable (FX-MR3, FX-MR6) M3 Coaxial | 150 110 65 55 | 42 15 19 | | | | R25mm | FD-G6 |
| | Lens mountable (FX-MR3, FX-MR6) M3 Coaxial • Tough flexible | 150 90 48 45 | 35 12 20 | | | 1m (Note 4) | R10mm | FD-G6X |
| | Coaxial • Lens mountable (FX-MR3, FX-MR6) M3 | 50 38 25 18 | 14 5 6 | | | | R25mm | FD-EG1 |
| | Coaxial • Lens mountable (FX-MR3, FX-MR6) M3 Light emitting fiber element High precision ø0.175 | 40 25 14 12 | 9 3 5 | | ø0.04mm gold wire | 500mm | R10mm | FD-EG2 |
| | Coaxial • Lens mountable (FX-MR3, FX-MR6) M3 Light emitting fiber element High precision ø0.125 | 20 15 9 8 | 5 2.5 3 | | | | | FD-EG3 |
| | M3 ø0.5 Sleeve part cannot be bent. | 6.5 5 3 3 | 2 Cannot use Cannot use | | | 1m | R25mm | FD-EN500S1 |
| | Coaxial M3 ø0.8 Sleeve part cannot be bent. | 50 38 20 18 | 14 5 6 | | | | | FD-ENM1S1 |

- Notes: 1) The sensing range is specified for white non-glossy paper [200 × 200mm (FD-T80, FD-WT8: 400 × 400mm, FD-W44, FD-WT4, FD-P40, FD-G6, FD-EG1, FD-EG2, FD-EG3, FD-EN500S1, FD-ENM1S1: 100 × 100mm)] as the object.
 2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
 3) The minimum sensing object size is the value for red LED type at maximum sensitivity.
 Note that the corresponding setting distance is different from the rated sensing distance.
 4) The allowable cutting range is 700mm from the end that the amplifier inserted.

Optical Fibers for FX 300 Series

Reflective type



The FX-305 and FX-301(-HS) have different sensing modes.

FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)

FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type | Shape of fiber head (mm) | Sensing range (mm) (Notes 1, 2) | U-LG LONG STDF STD | FAST H-SP S-D | Min. sensing object (Note 3) | Fiber cable length Free-cut | Bending radius | Model No. |
|------------------|--------------------------|---------------------------------|-----------------------------|---------------------|------------------------------|--------------------------------|-------------------|-----------|
| Cylindrical type | | | | | | | R25mm | FD-S80 |
| | | | | | | | R1mm | FD-WS8 |
| | | | | | | | R2mm | FD-WSG4 |
| | | | | | | | R4 mm Flexible | FD-P50 |
| | | | | | | | R25mm | FD-SNFM2 |
| | | | | | | | R4 mm Flexible | FD-P2 |
| | | | | | | | R10mm | FD-E12 |
| | | | | | | | R25mm | FD-E22 |
| | | | | | | | R25mm | FD-V41 |
| | | | | | | | R1mm | FD-WV42 |
| Rectangular | | | | | | | R25mm | FD-L46 |
| | | | | | | | R4 mm | FD-L45 |
| | | | | | | | | FD-L43 |
| | | | | | | | R10mm | FD-L44 |
| | | | | | | | | FD-L44S |
| | | | | | | | R1mm | FD-WL41 |
| | | | | | | | R10mm | FD-L41 |
| | | | | | | | | FD-L4 |
| | | | | | | | R1mm | FD-WL48 |
| | | | | | | | | |

Notes: 1) The sensing range is specified for white non-glossy paper (FD-S80, FD-WS8, 400 × 400mm, FD-WSG4, FD-P50, FD-SNFM2, FD-V41, FD-SFM2SV2: 200 × 200mm, FD-P2, FD-E12, FD-E22, FD-WV42, FD-L4, FD-WL48: 100 × 100mm, FD-L46: 100 × 100 × t 0.7mm R edge of LCD glass substrates, FD-L43, FD-L44 and FD-L45: 100 × 100 × t 0.7mm LCD glass substrates, FD-L44S: silicon wafers polished surface, FD-WL41, FD-L41: 100 × 100 × t 2mm glass substrates) as the object.

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

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

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

Optical Fibers for FX 300 Series

Reflective type



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

The **FX-305** and **FX-301(-HS)** have different sensing modes.
FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)
FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type | Shape of fiber head (mm) | Sensing range (mm) (Notes 1, 2) | U-LG LONG STDF STD | FAST H-SP S-D | Min. sensing object (Note 3) | Fiber cable length Free-cut | Bending radius | Model No. |
|----------------------|---|--|-------------------------------------|---------------------|------------------------------|--------------------------------|---|------------------------------------|
| Rectangular | Front sensing W10 × H7 × D2 | 1 to 50 1.5 to 34 2 to 24 3 to 17 | 3 to 10 Cannot use Cannot use | | ø0.16mm copper wire | 1m | | NEW FD-WZ4 (Note 4) |
| | Fiber bending type W2 × H10 × D10 | 1 to 70 1 to 46 1 to 32.2 2.5 to 23 | 2.5 to 15 3 to 7 3 to 7 | | | | R1mm | NEW FD-WZ4HB (Note 4) |
| | Front sensing W14 × H7 × D3.5 | 200 120 1 to 84 1 to 60 | 1.5 to 35 2.5 to 18 2.5 to 18 | | ø0.03mm gold wire | 2m | | NEW FD-WZ7 (Note 4) |
| | Fiber bending type W3.5 × H14 × D11 | 0.5 to 270 0.5 to 180 1 to 126 1 to 90 | 1 to 70 1 to 35 1 to 35 | | | | | NEW FD-WZ7HB (Note 4) |
| Special | Long sensing range • Rectangular head W5.2 × H9.5 × D15 | 20 to 660 20 to 480 20 to 300 20 to 230 | 20 to 170 25 to 90 25 to 100 | | ø0.3mm copper wire | 2m | R1mm | FD-WKZ1 |
| | Wide beam W7 × H15 × D30 | 230 200 150 150 | 45 100 50 | | ø0.02mm gold wire | 2m | R25mm | FD-A15 |
| | Top sensing W5 × H20 × D20 | 290 220 135 110 | 78 35 39 | | ø0.02mm gold wire | 2m | R25mm | FD-AFM2 |
| | Side sensing W5 × H20 × D20 | | | | | | | FD-AFM2E |
| | Mountable on pipe • Standard W25 × H13 × D20 | Applicable pipe diameter: Outer dia. ø6 to ø26mm transparent pipe [PVC (vinyl chloride), fluorine resin, polycarbonate, acrylic, glass, wall thickness 1 to 3mm] | | | (Liquid) | 2m (Note 5) | Protective tube R40mm Fiber R15mm | FD-F8Y (Note 6) |
| | Mountable on pipe • For PFA, wall thickness 1mm pipe W25 × H13 × D20 | Applicable pipe diameter: Outer dia. ø6 to ø26mm transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1mm] | | | | 2m | R10mm | FD-F41 (Note 6) |
| Liquid level sensing | Mountable on pipe SEMI S2 compliant W23 × H20 × D17 | Applicable pipe diameter: Outer dia. ø3 to ø10mm transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 0.3 to 1mm] | | | (Liquid) | 2m | Protective tube R20mm Fiber R4 mm | FT-F902 (Note 7) |
| | SEMI S2 compliant W20 × H30 × D10 | | | | (Liquid) | 5m (Protective tube: 3m) | Protective tube R20mm Fiber R4 mm | FD-F705 (Note 7) |

- Notes: 1) The sensing range is specified for white non-glossy paper [200 × 200mm (FD-WKZ1, FD-AFM2, FD-AFM2E: 400 × 400mm)] as the object.
2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
3) The minimum sensing object size is the value for red LED type at maximum sensitivity. Note that the corresponding setting distance is different from the rated sensing distance.
4) Refer to p.79~ for details.
5) The allowable cutting range is 1000mm from the end at which the amplifier is inserted.
6) Refer to p.90 for details.
7) The dedicated amplifier **FX-301-F** must be used with **FT-F902** and **FD-F705**.

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

Optical Fibers for FX 300 Series

Reflective type



The FX-305 and FX-301(-HS) have different sensing modes.
 FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)
 FX-301(-HS): S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

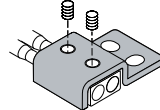
| Type | Shape of fiber head (mm) | Sensing range (mm) (Note 1, 2) | U-LG LONG STDF STD | FAST H-SP S-D | Min. sensing object (Note 3) | Fiber cable length Free-cut | Bending radius | Model No. |
|---------|--|--|---------------------------------------|---------------------|------------------------------|--------------------------------|-----------------------------|------------------------|
| Special | Heat-resistant | | | | | | | |
| | 350°C • Coaxial | | | | | | R25mm | FD-H35-M2 |
| | 350°C • Sleeve 60mm | 300 270 150 140 | 35 47 | 100 | | 2m | Fiber R25mm Sleeve R10mm | FD-H35-M2S6 |
| | 200°C • Coaxial | | | | | | R25mm | FD-H20-M1 |
| | 350°C • Sleeve 90mm | 190 160 80 80 | 57 20 26 | | | 1m | Fiber R25mm Sleeve R10mm | FD-H35-20S |
| | 200°C • Coaxial | 300 270 150 140 | 35 47 | 100 | | | | FD-H20-21 |
| | 300°C • Glass substrate detection Convergent reflective type | 0 to 20 0 to 15 0 to 10 0 to 10 | 1 to 8 Cannot use 2 to 6 | | | 2m | | FD-H30-L32 |
| | 180°C • Glass substrate detection Convergent reflective type | 0 to 20 0 to 15 0 to 10 0 to 10 | 1 to 8 Cannot use 2 to 6 | | | | | FD-H18-L31 |
| | 130°C | 410 310 200 140 | 55 47 | 100 | | 2m | | FD-H13-FM2 |
| | Vacuum-resistant | | | | | | | |
| | 300°C • Rectangular head W9.5 × H5.2 × D15 | 20 to 300 20 to 200 20 to 150 25 to 130 | 30 to 100 Cannot use Cannot use | | | 1m | | FD-H30-KZ1V-S (Note 4) |
| | 300°C • Glass substrate detection Convergent reflective type | 0 to 11 0 to 8 1.5 to 6 1.5 to 5 | 2 to 4 Cannot use Cannot use | | | 3m | | FD-H30-L32V-S (Note 4) |

Notes: 1) The sensing range is specified for white non-glossy paper [400 × 400mm (FD-H30-L32, FD-H18-L31: 50 × 50mm glass substrate, FD-H30-KZ1V-S, FD-H30-L32V-S: 100 × 100 × t 0.7mm transparent glass)] as the object.
 2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
 3) The minimum sensing object size is the value for red LED type at maximum sensitivity. Note that the corresponding setting distance is different from the rated sensing distance.
 4) Sold as a set comprising vacuum type fiber + photo-terminal (FV-BR1) + fiber at atmospheric side (FT-J8). Please refer to p.91- for details.

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

- Vacuum-resistant fiber
- FD-H30-KZ1V
- FD-H30-L32V

- Mounting bracket for FD-H30-KZ1V
- MS-FD-2

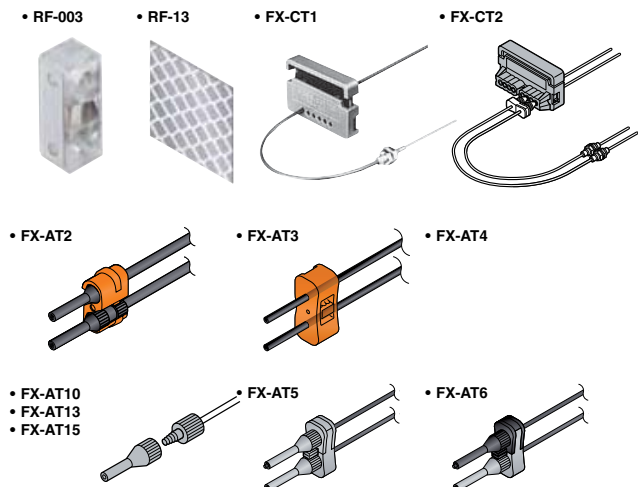


- Photo-terminal
- FV-BR1 (one pair set)

- Fiber at atmospheric side
- FT-J8 (one pair set)

Accessories (attached with fibers)

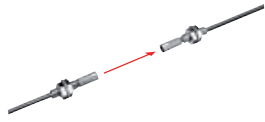
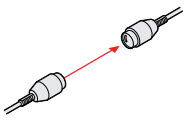

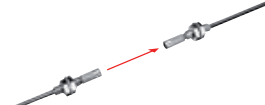
- RF-003 (FR-KZ21/KZ21E exclusive reflector)
- RF-13 (Reflective tape)
- FX-CT1 (Fiber cutter)
- FX-CT2 (Fiber cutter)
- FX-AT2 (Attachment for fixed-length fiber, Orange)
- FX-AT3 (Attachment for ø2.2mm fiber, Clear orange)
- FX-AT4 (Attachment for ø1mm fiber, Black)
- FX-AT5 (Attachment for ø1.3mm fiber, Gray)
- FX-AT6 (• Attachment for ø1mm / ø1.3mm mixed fiber, Black / Gray)



If connecting to the FX2 / FX3 series


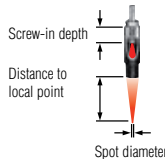
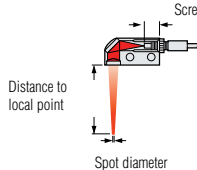
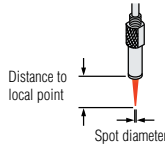
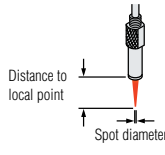
- FX-AT10 (Attachment for ø1mm fiber)
- FX-AT13 (Attachment for ø1.3mm fiber)
- FX-AT15 (• Attachment for ø1mm / ø1.3mm mixed fiber)

Accessories for the FX 300 Series

| Accessories for retroreflective fiber optics | | | | | |
|---|---|----------------------------------|----------------|-----------------|-----------|
| Figure | Description | Effective distance (with FX-301) | | | Model no. |
| | | Fiber optics | Sensing range* | Sensing range** | |
|  | Effective distance expanded 5 times or more; Ambient temperature: -60°C to +350°C | FT-B8 | 2500 | 3500 | FX-LE1 |
| | | FT-FM2 | 3500 | 3500 | |
| | | FT-T80 | 3500 | 3500 | |
| | | FT-R80 | 2300 | 3500 | |
| | | FT-W8 | 2900 | 3500 | |
| | | FT-P80 | 3500 | 3500 | |
| | | FT-P60 | 3500 | 3500 | |
| | | FT-H35M2 | 2000 | 3500 | |
| | | FT-H20WM1 | 1300 | 1600 | |
| | | FT-H20WM2 | 1300 | 3500 | |
| | | FT-H20M1 | 1600 | 1000 | |
|  | Tremendously increases the sensing range with large diameter lenses Ambient temperature: -60°C to +350°C | FT-B8 | 3500 | 3500 | FX-LE2 |
| | | FT-FM2 | 3500 | 3500 | |
| | | FT-T80 | 3500 | 3500 | |
| | | FT-R80 | 3500 | 3500 | |
| | | FT-W8 | 2900 | 3500 | |
| | | FT-P80 | 3500 | 3500 | |
| | | FT-P60 | 3500 | 3500 | |
| | | FT-H35M2 | 3500 | 3500 | |
| | | FT-H20WM1 | 1600 | 1600 | |
| | | FT-H20WM2 | 3500 | 1600 | |
| | | FT-H20M1 | 1600 | 1600 | |
| | | FT-H13 | 3500 | 1600 | |
|  | Beam axis is bent by 90° Ambient temperature: -60°C to +350°C | FT-B8 | 530 | 1100 | FX-SV1 |
| | | FT-FM2 | 600 | 1200 | |
| | | FT-T80 | 600 | 1200 | |
| | | FT-W8 | 450 | 900 | |
| | | FT-P80 | 600 | 1200 | |
| | | FT-P60 | 300 | 650 | |
| | | FT-H35M2 | 280 | 550 | |
| | | FT-H20WM1 | 140 | 310 | |
| | | FT-H20WM2 | 140 | 310 | |
| | | FT-H20M1 | 280 | 550 | |
|  | Sensing range increases by 15 times or more Ambient temperature: -40°C to +120°C | FT-6V | 2700 | 3500 | FV-LE1 |
| | | FT-60V | 1450 | 3500 | |

* The indicated values (red, green, blue infrared) refer to response time "Standard"
 ** Red (max.) refers to response time "Ultralong"

Accessories for the FX Series

| Accessories for retroreflective fiber optics | | | | | | |
|---|---|----------------------------------|----------------|-------------------------|---------------|-----------|
| Figure | Description | Effective distance (with FX-301) | | | Model no. | |
| | | Fiber | Screw-in depth | Spot diameter | | |
|  | Pinpoint spot of Ø 0.5mm enables detection of minute objects or small marks Applicable fibers: FD-WG4 / FD-G4 Ambient temperature: -40°C to +70°C | FD-WG4 | 6mm ± 1mm | Ø 0.5mm | FX-MR1 | |
| | | FD-G4 | 6mm ± 1mm | Ø 0.5mm | | |
| Figure | Description | Fiber | Screw-in depth | Distance to local point | Spot diameter | Model no. |
|  | The spot diameter is adjustable from 0.7mm to Ø2mm according to how far the fiber is screwed in. Ambient temperature: -40°C to +70°C | FD-WG4 | 7mm | approx. 18.5mm | Ø 0.7mm | FX-MR2 |
| | | | 12mm | approx. 27mm | Ø 1.2mm | |
| | | | 14mm | approx. 43mm | Ø 2.0mm | |
| | | FD-G4 | 7mm | approx. 18.5mm | Ø 0.7mm | |
| | | | 12mm | approx. 27mm | Ø 1.2mm | |
| | | | 14mm | approx. 43mm | Ø 2.0mm | |
| Figure | Description | Fiber | Screw-in depth | Distance to local point | Spot diameter | Model no. |
|  | FX-MR2 is converted into a sideview type and can be mounted in a very small space. Ambient temperature: -40°C to +70°C | FD-WG4 | 8mm | approx. 13mm | Ø 0.5mm | FX-MR5 |
| | | | 10mm | approx. 15mm | Ø 0.8mm | |
| | | | 14mm | approx. 30mm | Ø 3.0mm | |
| | | FD-G4 | 8mm | approx. 13mm | Ø 0.5mm | |
| | | | 10mm | approx. 15mm | Ø 0.8mm | |
| | | | 14mm | approx. 30mm | Ø 3.0mm | |
| Figure | Description | Fiber | Screw-in depth | Spot diameter | Model no. | |
|  | Extremely fine spot of approx. Ø 0.3mm achieved Ambient temperature: -40°C to +70°C | FD-WG4 | 7.5mm ± 0.5mm | Ø 0.5mm | FX-MR3 | |
| | | FD-G4 | 7.5mm ± 0.5mm | Ø 0.5mm | | |
| | | FD-EG1 | 7.5mm ± 0.5mm | Ø 0.3mm | | |
| | | FD-EG3 | 7.5mm ± 0.5mm | Ø 0.15mm | | |
| Figure | Description | Fiber | Screw-in depth | Spot diameter | Model no. | |
|  | Extremely fine spot of approx. Ø 0.3mm achieved Ambient temperature: -40°C to +70°C | FD-WG4 | 7mm ± 0.5mm | Ø 0.4mm | FX-MR6 | |
| | | FD-G4 | 7mm ± 0.5mm | Ø 0.4mm | | |
| | | FD-EG1 | 7mm ± 0.5mm | Ø 0.2mm | | |
| | | FD-EG3 | 7mm ± 0.5mm | Ø 0.1mm | | |

FD-L40

FD-L40

Fibers for liquid crystal display industry

Features

Mapping Fiber

FD-L46

Variety of glass substrates

FD-L46

Alignment fiber

FD-L43 / FD-L45

Seating confirmation fiber

FD-L44 / FD-L44S / FD-WL48

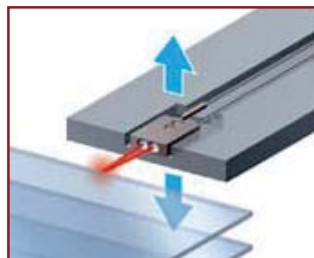
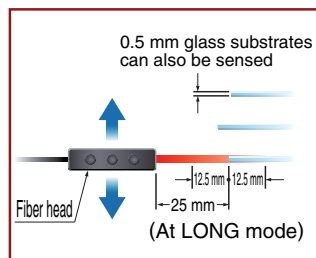
The adoption of a unique large lens allows even thin glass substrates to be sensed directly from the side. In addition, due to the wide sensing range (25 ± 12.5 mm), stable mapping is possible even if glass substrates are in irregular positions.

Large light amounts can be obtained for a variety of glass edge shapes such as R surfaces and C surfaces, so that accurate mapping of glass substrates inside cassettes is possible. Glass that has received black or yellow masking can also be sensed in addition to clear glass.

Increases in size of glass substrates mean greater amounts of flexure, but a single fiber can sense glass even if horizontal flexure is within $\pm 8^\circ$ (FD-L45% $\pm 6^\circ$).

A sensing range of 3 to 17mm (FD-L45: 10 to 25mm) and a positioning error of 0.2mm or less makes higher precision sensing possible.

Long sensing range of 0 to 7mm for seating confirmation. Sensing is even possible if absorption pads are present.



Technical Specifications

| | |
|----------------------------------|--|
| Applicable amplifiers: | FX-100/301/305/311/411 series red LED type |
| Sensing range (Note 1): | FD-L46 12.5 to 37.5mm (LONG mode) (Note 2) FD-L43 0 to 23mm (STD mode) FD-L44 0 to 7mm (LONG mode) (Note 3) FD-L44S 0 to 4.5mm (LONG mode) (Note 4) FD-L45 0 to 36mm (LONG mode) (Note 5) FD-WL48 0.5 to 7.5mm (LONG mode) (Note 6) |
| Allowable bending radius: | FD-L46 R25mm or more, FD-L45/FD-L43 R4mm or more FD-L44(S) R10mm or more, FD-WL48 R1mm or more |
| Fiber cable length: | FD-L46 4m (free-cut), FD-L43/44(S) 2m (free-cut) FD-L45 3m (free-cut), FD-WL48 1m (free-cut) |

Notes: 1) The values for the **FD-L46** are for R edge of glass substrate ($100 \times 100 \times 0.7$ mm) for LCDs; the values for the **FD-L43**, **FD-L44** and **FD-L45** are for glass substrate ($100 \times 100 \times 0.7$ mm) for LCD; the values for the **FD-L44S** are for silicon wafer (polished surfaces) and the values for the **FD-WL48** are for white non-glossy paper (100×100 mm).

2) 12 to 50mm for the **FX-411** (U-LG mode).

3) 0 to 8.2mm for the **FX-411** (U-LG mode).

4) 0 to 4.4mm for the **FX-411** (U-LG mode).

5) 0 to 50mm for the **FX-411** (U-LG mode).

6) **FX-411** specifications are in U-LG mode.

FT/FD-V

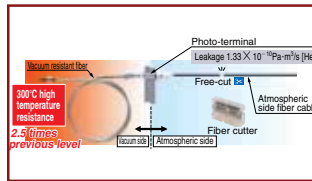


Vacuum resistant fiber

Features

Usable in high temperatures of 300°C and vacuum

Highly reliable sensing of objects is possible even after the high-temperature processing that is used in FPD manufacturing processes.



Compact routing

We have realized an allowable bending radius of R18mm.



Highly resistant to repeated bending

It has a bending durability of over 100,000 times (at R20mm).



Technical Specifications

| | |
|---|---|
| Applicable amplifiers: | FX-100/301/305/311/411 series |
| Sensing range (Note 1) (at LONG mode of red LED type): | FT-H30-M1V 250mm (Note 1) FD-H30-KZ1V 20 to 200mm (Note 2) FD-H30-L32V 0 to 8mm (Note 3) |
| Allowable bending radius: | FD-L46 R25mm or more, FD-L45/FD-L43 R4mm or more FD-L44(S) R10mm or more, FD-WL48 R1mm or more |
| Fiber cable length: | FD-L46 4m (free-cut), FD-L43/44(S) 2m (free-cut) FD-L45 3m (free-cut), FD-WL48 1m (free-cut) |

- Notes: 1) 390mm for the FX-411 (U-LG mode).
2) 20 to 300mm for the FX-411 (U-LG mode).
3) 0 to 11mm for the FX-411 (U-LG mode).
4) Model n°s. having the suffix '-S' are set model n°s. When ordering, be sure to specify the vacuum resistant fiber, photo-terminals and atmospheric fibers set model n°s.

EX-F70/F60



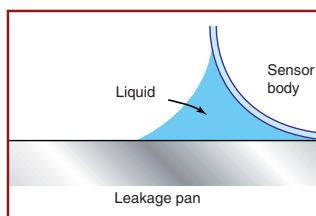
EX-F70/F60

High-speed detection of even small liquid leaks

Features

Reliable detection

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



Safe design

If the sensor is installed incorrectly, or if the cable breaks or a sensor problem occurs, the same output as for a liquid leak occurs. This guards against human error in setup that might occur during maintenance.

Compact, space-saving

The **EX-F70** series is a slim (10mm) side mounting sensor. The **EX-F60** series is compact at 26×19×9mm (W×H×D), so that it can be used even in narrow spaces.

PFA enclosure gives excellent chemical resistance

Accurate sensing can be obtained even if there are leaks of chemicals such as sulfuric acid, hydrochloric acid or ammonia.

Technical Specifications

| | |
|--------------------------|---|
| Sensing object: | EX-F7m Water, Fluorinert™ (Note 1) EX-F6□ Agent, such as sulfuric acid, hydrochloric acid, phosphoric acid or ammonia etc. |
| Supply voltage: | 12 to 24V DC±10% |
| Output: | EX-F7□/F6□ NPN open-collector transistor EX-F7□/F6□ -PNP open-collector transistor |
| Response time: | 50ms or less |
| Emitting element: | Infrared LED (non-modulated) |

Notes: 1) Fluorinert™ is the worldwide TradeMark of 3M.

2) 5m cable length type (standard: EX-F7□ 2m, EX-F6□ 3m) is also available.

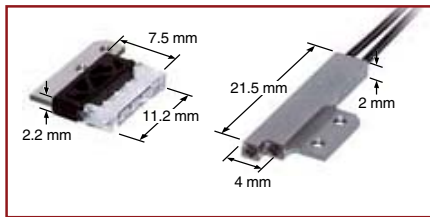
FR-KV1

Wafer mapping fiber

Features

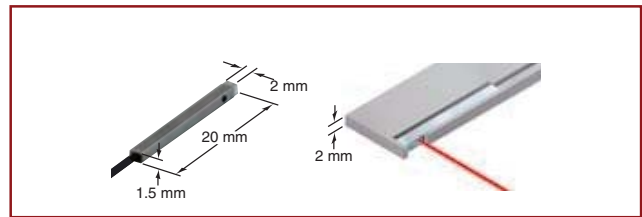
Retroreflective type: new concept

A 2.0mm fiber head and an ultrathin 2.2mm reflector allow these sensors to be mounted even in thin robot hands. Since they are retroreflective type fibers, the amount of wiring needed can be reduced, and the robot hands require less processing and so can be kept strong. A heat-resistant type that can resist heat of +105°C is also available.



Thru-beam type: ultra compact size

The ultra compact size of 2×1.52×20mm (W×H×D) means that mounting is possible even in places such as robot hands where space is limited. Furthermore, a heat-resistant type that can resist heat of +105°C is also available.



With the FT-KV1, the fiber can be embedded into a plate with a thickness of 2mm.

Technical Specifications

| | |
|--|--|
| Applicable amplifiers: | FX-100/301/305/311/411 series |
| Sensing range: (at LONG mode of red LED type) | Retroreflective type 15 to 330mm (Note: thru-beam type 500mm) |
| Allowable bending radius: | R10mm or more |
| Fiber cable length: | 2m (free-cut) |

FD-F705



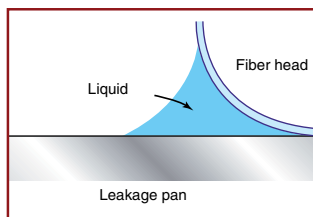
FD-F705

A new slim fiber sensor ideal for sensing chemical leaks

Features

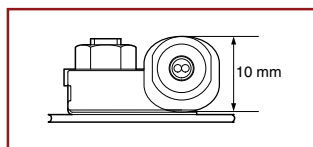
Reliable detection

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



Compact, space-saving

This slim (10mm) side-mounting sensor is especially well suited for use in confined spaces.



Ideal for chemicals and volatile materials

This fiber type sensor is safe to use with volatile materials (SEMI S2 compliant). The PFA (fluorine resin) fiber head makes it ideal for use with chemicals.

Technical Specifications

| | |
|-------------------------|---------------------|
| Applicable amplifiers: | FX-301-F, FX-301P-F |
| Sensing object: | Liquid |
| Fiber cable length: | 5m (free-cut) |
| Protective tube length: | 3m |
| Dimensions (WTHTD): | 20×30×10mm |

Notes: 1) Fluorinert™ is the worldwide TradeMark of 3M.
2) 5m cable length type (standard: EX-F7□ 2m, EX-F6□ 3m) is also available.

FT-F902

Reliably detect liquid in pipe

Features

Safe fiber type sensor

Because it is a fiber sensor, it is safe to use in dangerous areas where there is a risk of fire or explosion. It meets the stringent demands for higher safety levels placed by international standards including SEMI S2.

Easy to use and reliable detection

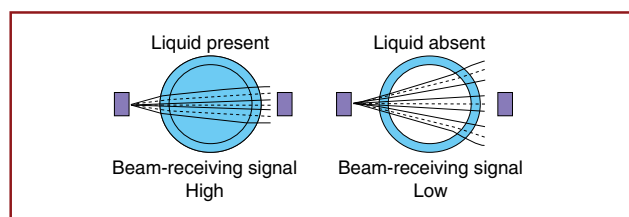
Even when shape and thickness of the pipe vary, this sensor uses a method where the beam axis follows the diameter of the pipe, and so, when compared to conventional methods, the shape and thickness of the pipe have no influence on the performance of this sensor.

Reliable detection not affected by bubbles or droplets

Problems encountered by conventional pipe-mountable sensors, such as bubbles, droplets or liquid leakage, have been solved using the latest optical fiber techniques.

Worry-free design that doesn't overlook liquid-absent condition and sensor malfunction

When liquid is present in the pipe, the lens effect of the liquid condenses the beam, so that the sensor is in beam receiving condition.



Technical Specifications

| | |
|---------------------------|---|
| Applicable amplifiers: | FX-301-F, FX-301P-F |
| Sensing object: | Liquid |
| Applicable pipe diameter: | Outer dia. $\varnothing 3.0$ to $\varnothing 10.0$ mm |
| Fiber cable length: | 2m (free-cut) |
| Protective tube length: | 1m |
| Dimensions (W×H×D): | 23×17×20mm |

M18-L

New



Multifunction optical sensors

M18-L

One for all: M18-L Series

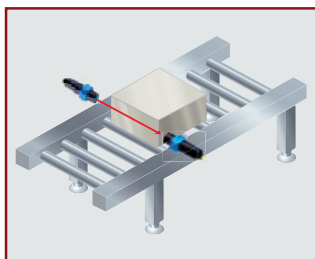
Features

Great lineup of 48 models

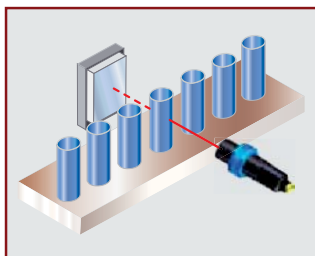
The M18-L series offers all optical functions in an M18 housing. The visible laser light spot makes the sensor simple to align. It is easy to install and requires little space due to its ultra-compact size.

- Available types: Thru-beam laser sensor up to 60m, retroreflective type up to 16m, diffuse reflective type up to 350mm
- Complete range of optic functions, laser class 1
- Flat plastic tubular housing for improved versatility, or metal cylindrical housing
- Cable or M12 connection
- NPN or PNP
- Radial and axial versions

Typical Applications



Packaging



Precise object detection

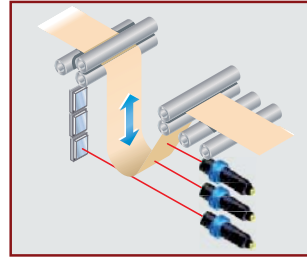
Technical Specifications

| | | | | |
|--|--|--|--|--|
| NPN-Output | M18-LT5000- [R]-[M/P]-[J] | M18-LT6000- [A]-[M/P]-[J] | M18-LP0900- [R]-[M/P]-[J] | M18-LP1600- [A]-[M/P]-[J] |
| PNP-Output | M18-LT5000- [R]-[M/P]- PN-[J] | M18-LT6000- [A]-[M/P]- PN-[J] | M18-LP0900- [R]-[M/P]- PN-[J] | M18-LP1600- [A]-[M/P]- PN-[J] |
| Sensor type | Thru-beam | | Retroreflective | |
| | Radial | Axial | Radial | Axial |
| Maximum operation distance | 50m | 60m | 9m | 16m |
| Sensing range | 0 to 50m | 0 to 60m | 0.1 to 9m | 0.1 to 16m |
| Sensing object | Metal, black | | | |
| | Ø 10mm | | Ø 5mm | |
| Beschaffenheit des Messobjektes | Opaque | | Opaque, translucent | |
| Hysteresis | – | | | |
| Response time | 333µs | | | |
| Output | Max. 100mA | | | |
| Emitting element | Red semiconductor laser, 650nm (class 1) | | | |
| Current consumption without load | Emitter: max. 35mA Receiver: max. 30mA | | Max. 35mA | |
| Material | Metal version: nickel-plated brass Plastic version: PBT Lens: PMMA | | | |
| Protection | IP67 | | | |
| Dimensions (H×W×D) | Cable type: M18×89mm Connector type: M18×93.5mm | Cable type: M18×77mm Connector type: M18×81.5mm | Cable type: M18×89mm Connector type: M18×93.5mm | Cable type: M18×77mm Connector type: M18×81.5mm |
| Connection | Cable 2m or M12 connector | | | |
| Supply voltage | 10 to 30V DC | | | |
| Ambient temperature | Operation: –10 to +50°C, storage: –25 to +70°C | | | |
| Weight | Cable type: Emitter and receiver each approx. 75g Connector type: Emitter and receiver each approx. 25g | | Cable type: approx. 75g (plastic version) or approx. 110g (metal version) Connector type: Approx. 25g (plastic version) or approx. 60g (metal type) | |
| [R] = Radial • [A] = Axial [P] = Plastic [M] = Metal • [PN] = PNP [J] = M12 connector | | | | |

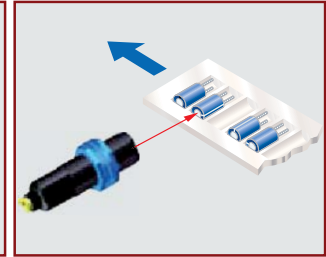


Technical Specifications

| | | |
|----------------------------------|---|---------------------------|
| NPN-output | M18-LD0025-R-[M/P]-[J] | M18-LD0035-A-[M/P]-[J] |
| PNP output | M18-LD0025-R-[M/P]-PN-[J] | M18-LD0035-A-[M/P]-PN-[J] |
| Sensor type | Reflective | |
| | Radial | Axial |
| Maximum operation distance | 250mm | 350mm |
| Sensing range | 0 to 250mm | 0 to 350mm |
| Spot diameter | 0.3mm at 50mm | |
| Sensing object | Paper, white | |
| | 100×100mm | 200×200mm |
| | Opaque, translucent | |
| Hysteresis | <1% | |
| Response time | 333µs | |
| Output | Max. 100mA | |
| Emitting element | Red semiconductor laser, 650nm (class 1) | |
| Current consumption without load | Max. 35mA | |
| Material | Metal version: nickel-plated brass | |
| | Plastic version: PBT | |
| | Lens: PMMA | |
| Protection | IP67 | |
| Dimensions (Ø × L) | M18 × 81.5mm | |
| Connection | Cable 2m or M12 connector | |
| Supply voltage | 10 to 30VDC | |
| Ambient temperature | Operation: -10 to +50°C, storage: -25 to +70°C | |
| Weight | Cable type: approx. 75g (plastic version), approx. 110g (metal version) | |
| | Steckertyp: approx. 25g (plastic version), approx. 60g (metal version) | |



Control of sag



Detection of capacitors

Options

Cables

| UZZ81220 | UZZ81221 | UZZ81250 | UZZ81251 |
|-------------|----------|-------------|----------|
| 2m straight | 2m elbow | 5m straight | 5m elbow |
| | | | |

Mounting brackets

| M18L-ST20 | M18-SPM |
|-----------|---------|
| | |

Reflector

| M18-RF48 |
|----------|
| |

LC-100

New



LC-100

Digital Laser Sensor

Features

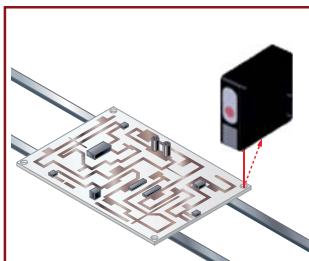
Multifunction Optoelectronic Sensors

The **LC100 series**, standard 50×50×15mm compact housing, offers all the most advanced optic functions, as well as the universal, available with safety class 1 laser emission. This series offers versions with cable or M12 connection that can be rotated for either straight or right-angle positions. All versions have NPN or PNP output and standard configuration conforming to the EN 60947-5-2 standard. There are 16 types of LC100 available.

Typical Applications

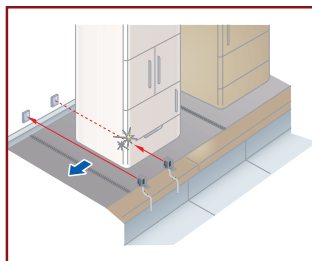
Positioning of printed circuit boards

Electronic industry



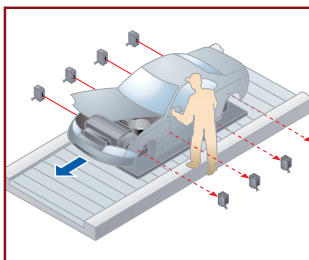
Detection of Refrigerators

Packaging industry



Detection of automobiles on conveyers

Automotive industry



Available in 4 versions

Laser through-beam

- Visible class 1 Laser red light emission (typ. 650nm)
- Operating distance up to 60m with highest excess gain
- Resolution better than 6mm at 0.5m and 10mm over 2m
- Very high switching frequency up to 1.5kHz
- Double NO-NC output with NPN or PNP version
- Text input
- Plastic housing with compact dimensions 50×50×15mm

Laser polarized retroreflective

- Visible class 1 Laser red light emission (typ. 650nm)
- Operating distance up to 20m
- Resolution better than 10mm
- Trimmer setting for fine sensitivity adjustment
- Very high switching frequency up to 2kHz
- Double NO-NC output with NPN or PNP version
- Plastic housing with compact dimensions 50×50×15mm

Diffuse reflective

- Visible class 1 Laser red light emission (typ. 650nm)
- Operating distance 0 to 60cm
- Resolution approx. 0.2mm at 15cm
- Trimmer setting for fine sensitivity adjustment
- Very high switching frequency up to 2kHz
- Double NO-NC output with NPN or PNP version
- Plastic housing with compact dimensions 50×50×15mm

Background suppression

- Visible class 1 Laser red light emission (typ. 650nm)
- Operating distance 5 to 10cm
- Resolution approx. 0.5mm at 6cm
- Teach-in setting
- Double NO-NC output with NPN or PNP version
- External teach-in





Technical Specifications

| | | | | |
|----------------------------------|--|--------------------------|--------------------------|-----------------------------|
| NPN-Output | LC-100-TL6000-A-P-[J] | LC-100-PL2000-A-P-[J] | LC-100-DL0060-A-P-[J] | LC-100-BL0010-A-P-[J] |
| PNP-Output | LC-100-TL6000-A-P-PN-[J] | LC-100-PL2000-A-P-PN-[J] | LC-100-DL0060-A-P-PN-[J] | LC-100-BL0010-A-P-PN-[J] |
| Sensor type | Thru-beam | Retroreflective | Diffuse reflective | Diffuse reflective with BGS |
| Maximum operation distance | 60m | 20m | 600mm | 100mm |
| Sensing range | 0 to 60m | 0.1 to 20m | 0 to 600mm | 50 to 100mm |
| Sensing object | Metal, black | | Paper, white | |
| | Ø 6mm | | 200 x 200mm | 100 x 100mm |
| Detectable target | Opaque | Opaque, translucent | Opaque, transparent | |
| Hysteresis | – | – | <1% | |
| Response time | Approx. 333µs | Approx. 250µs | | 500µs |
| Output | Max. 100mA | | | |
| Emitting element | Red semiconductor laser, 650nm (Class 1) | | | |
| Current consumption without load | Emitter: max. 35mA Receiver: max. 35mA | Max. 35mA | | Max. 60mA |
| Material | Enclosure: Plastic | | | |
| Protection | IP67 | | | |
| Dimensions (H×W×D) | Cable type: approx. 50×50×15mm Connector type: approx. 50×66×15mm | | | |
| Connection | Cable 2m or M12 connector | | | |
| Supply voltage | 10 to 30V DC | | | |
| Ambient temperature | Operation: –10 to +50°C, storage: –25 to +70°C | | | |
| Weight | Cable type: approx. 90g Connector type: approx. 40g | | | |
| [PN] = PNP • [J] = M12 connector | | | | |


*Reflector not included

Options

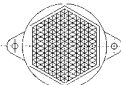
Cables

| UZZ81220 | UZZ81221 | UZZ81250 | UZZ81251 |
|---|---|---|---|
| 2m straight | 2m elbow | 5m straight | 5m elbow |
|  |  |  |  |

Mounting brackets

| LC1-ST60 | LC1-ST26 | LC10-ST62 |
|---|---|---|
|  |  |  |

Reflector

| M18-RF48 |
|---|
|  |

LC-120

New



LC-120

High-performance sensors

Features

Maximum performance in compact housing

The **LC120 series**, developed in the 50×50×18mm compact plastic housing, offers the maximum performance of optic detection functions for industrial automation.

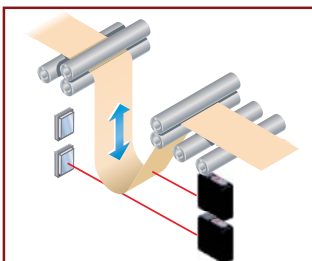
Furthermore, versions with visible red laser emission are available with 5–35cm background suppression and polarized retro-reflex reaching more than 20m.

These laser sensors are characterized by a very small light spot as well as a low response time that guarantee excellent detection repeatability, even of very small objects or movements.

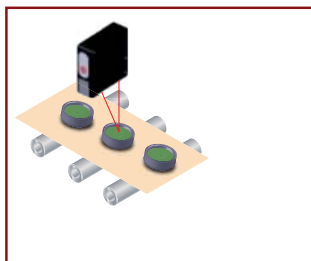
- High-resolution sensors with LED or laser emission
- Background suppression models ranging up to 350mm
- Polarized retroreflex with operating distance of up to 20m
- Plastic housing with compact dimensions of 50×50×18mm
- NPN or PNP double output with standard NO-NC
- Visible class 2 laser red light emission (typ. 658nm)
- Very fast response time less than 200µs
- Very high switching frequency of up to 2.5kHz

Typical Applications

Foil detection



Pharmaceutical industry







Technical Specifications

| | | | |
|----------------------------------|---|------------------------|------------------------|
| NPN-Output | LC-120-PL2000-A-P-J | LC-120-BL0015-A-P-J | LC-120-BL0035-A-P-J |
| PNP-Output | LC-120-PL2000-A-P-PN-J | LC-120-BL0015-A-P-PN-J | LC-120-BL0035-A-P-PN-J |
| Sensor type | Retroreflective | Reflective with BGS | |
| Maximum operation distance | 20m | 150mm | 350mm |
| Sensing range | 0.3 to 20m | 30 to 150mm | 50 to 350mm |
| Spot diameter | Ø 0.5mm (at 0.5m) | 0.2mm (at 60mm) | 0,4mm (at 150mm) |
| Sensing object | Metal, black Opaque, translucent | Paper, white Opaque | |
| | Ø 6mm | 100 x 100mm | |
| Detectable target | Opaque | | |
| Hysteresis | — | <1% | |
| Response time | 200µs | 140µs | 200µs |
| Output | Max. 100mA | | |
| Emitting element | Red semiconductor laser, 645 to 665nm (Class 2) | | |
| Current consumption without load | Max. 30mA | | |
| Material | Enclosure: Plastic | | |
| Proteciton | IP67 | | |
| Dimensions (H×W×D) | Connector type: approx. 50×66×18mm | | |
| Connection | M12 connector | | |
| Supply voltage | 10 to 30V DC | | |
| Ambient temperature | Operation: − 10 to +50°C, storage: −25 to +70°C | | |
| Weight | Approx. 40g | | |
| [PN] = PNP • [J] = M12 connector | | | |

*Reflector not included

Options

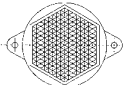
Cables

| UZZ81220 | UZZ81221 | UZZ81250 | UZZ81251 |
|---|---|---|---|
| 2m straight | 2m elbow | 5m straight | 5m elbow |
|  |  |  |  |

Mounting bracket

| LC12-ST50 | LC1-ST60 | LC1-ST26 |
|---|---|---|
|  |  |  |

Reflector

| M18-RF48 |
|---|
|  |

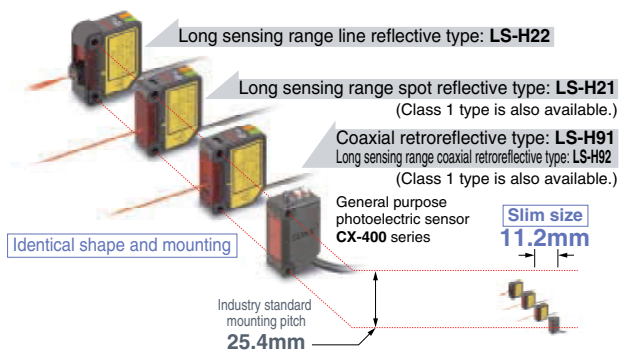


User-friendly, advanced high precision laser sensing!

Features

4 types of identically sized sensor heads available

They are approximately the same size as general purpose photoelectric sensors, and the mounting method is identical.



New coaxial reflective type with a long sensing range of 30m

The introduction of the **LS-H92** long sensing range coaxial reflective type sensor means that even longer sensing ranges are now possible.

Spot size adjustment

The long sensing range spot reflective type and long sensing range line reflective type have a built-in spot-size adjuster that enables spot size adjustment according to the object for optimal setting.



Accurately senses the minutest variations

When sensing at close range or when the target objects are transparent or minute, adjust the sensor receiving sensitivity to one of 3 levels for the optimal setting. In addition, changing the receiving sensitivity will not affect the response time.

Easy setting, dual display

Equipped with 2 large 4-digit digital displays. While checking the current light-receiving amount (red display), the optimal threshold value (green display) can be set easily.



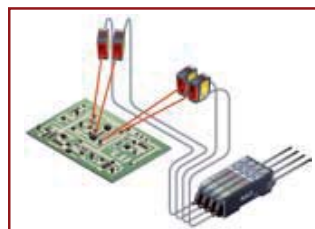
Wiring and space savings

The quick-connection cables enable reductions in wiring (connector type). The connections and man hours for the intermediate terminal block setup can be reduced and valuable space saved. Also, LS series amplifiers can be connected side-by-side with FX-300 series fiber sensors.



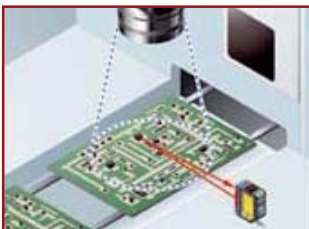
Interference prevention function

The automatic interference prevention function protects against interference among up to 4 sensors.



Emission halt function

Using the emission halt function, the laser beam can be stopped via external input, e.g. when a spot appears within the visual range of an image processor.



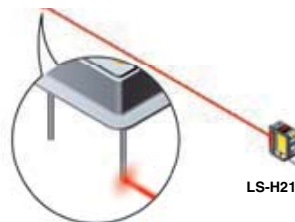
External teaching function

Teaching can be conveniently performed externally for laser sensors installed inside a device.



Typical Applications

IC pin check from remote position



Checking protrusion of glass substrate



Technical Specifications

Sensor heads

| Type | Coaxial retroreflective | | Diffuse reflective | |
|---------------------|---|---|---|---|
| | | Long sensing range type | Long sensing range spot reflective | Long sensing range line reflective |
| Model no. (Note 1) | LS-H91(F) (-A)(Note 2) | LS-H92(F) | LS-H21(F) (-A)(Note 2) | LS-H22(F) (Note 3) |
| Sensing range | 0.1 to 7m (U-LG) 0.1 to 5m (STD) 0.1 to 3m (FAST/H-SP) | 0.2 to 30m (U-LG) 0.2 to 20m (STD) 0.2 to 10m (FAST/H-SP) | 30 to 1000mm (U-LG) 30 to 500mm (STD) 30 to 300mm (FAST/H-SP) | 30 to 1000mm (U-LG) 30 to 500mm (STD) 30 to 300mm (FAST/H-SP) |
| Ambient temperature | -10 to +55°C | | | |
| Emitting element | Red semiconductor laser, Class 2 (LS-HM: IEC/JIS/GB, LS-HMF: FDA/IEC/JIS) [LS-H91(F)-A, LS-H21(F)-A: Class 1] [Max. output: 3mW or less (LS-H91(F)-A, LS-H21(F)-A: 1 mW or less), Peak emission wavelength: 655nm] | | | |
| Dimensions (W×H×D) | 11.2×31×25mm | | | |

Notes: 1) LS-H□□ conforms to IEC/JIS/GB standards.
LS-H□□F conforms to FDA/IEC/JIS standards.
2) LS-H91(F)-A, LS-H21(F)-A: Class 1 type
3) LS-H22(F) is the set model no. for LS-H21(F) long sensing range spot reflective type sensor head combined with the LS-MR1 lens attachment for line reflective.
LS-H21(F) appears on the sensor itself.

Amplifiers

| Type | | Connector (Note) | Cable |
|--|------------|---|------------|
| Model no. | NPN output | LS-401 | LS-401-C2 |
| | PNP output | LS-401P | LS-401P-C2 |
| Supply voltage | | 12 to 24VDC ±10% | |
| Output (Output 1, Output 2) | | NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor | |
| Output operation | | Selectable either Light-ON or Dark-ON, with jog switch | |
| Response time | | 80μs or less (H-SP), 150μs or less (FAST), 500μs or less (STD), 4ms or less (U-LG), selectable with jog switch | |
| Sensitivity setting | | Normal mode: 2-level teaching/limit teaching/full auto teaching/manual adjustment Window comparator mode: teaching (1-level, 2-level, 3-level)/manual adjustment Hysteresis mode: teaching (1-level, 2-level, 3-level)/manual adjustment Differential mode: 5-level settings | |
| Digital display | | 4 digit (green) + 4 digit (red) LED display | |
| Automatic interference prevention function | | Incorporated [up to four sets of sensor heads can be mounted close together (however, disabled when in H-SP mode)] | |
| Ambient temperature | | -10 to +55°C (if 4 to 7 units are mounted close together: -10 to +50°C if 8 to 16 units are mounted close together: -10 to +45°C) | |
| Dimensions (W×H×D) | | 10×30×75mm | |

Notes: The cable for amplifier connection is not supplied as an accessory with the connector type amplifier. Make sure to use the optional quick-connection cable listed below.
Main cable (4-core): **CN-74-C1** (cable length 1m), **CN-74-C2** (cable length 2m)
CN-74-C5 (cable length 5m)
Sub cable (2-core): **CN-72-C1** (cable length 1m), **CN-72-C2** (cable length 2m)
CN-72-C5 (cable length 5m)

LX-100



LX-100

Introducing the 3-LED mark sensor

Features

Equipped with 3 LEDs: red, green and blue

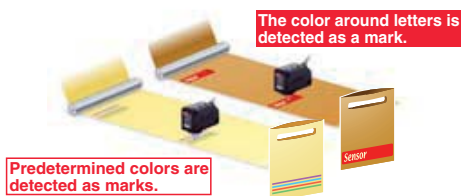
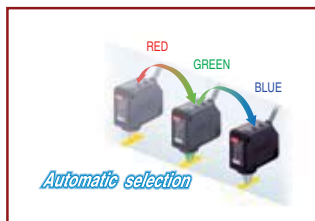
To detect any marking, this sensor is equipped with red, green and blue LED light emitting elements all in one. In addition, it uses a coaxial reflective optics system and realizes high precision sensing when used with a 1/4000 resolution 12-bit A/D converter.



2 selectable sensing modes for any application

Mark mode: This sensing mode automatically selects a single color from the 3 R-G-B LEDs to realize an ultra quick 45μs response time. The automatic optimal LED selection function automatically selects the LED that is most suitable for the sensing. This function is perfect for ultra quick sensing.

Color mode: All 3 R-G-B LEDs light up and high precision mark color discrimination occurs using the R-G-B reflective light ratio. This function enables effective detection of films with patterns around the areas of the mark.



Even beginners can quickly master MODE NAVI operation

The sensor's basic operations are represented by 6 indicator lamps (MODE NAVI). The user can check what mode the sensor is presently in with a quick glance rendering operation simple.

Sensing status digitally controllable

The sensing status, displayed numerically, can be verified at a glance. Also, the sensor settings for each type of packing film can be digitally indicated.

Direct codes enable settings verification at a glance

The settings for the **LX-100** series sensors are displayed using a 4-digit direct code. Direct codes enable easy settings verification and maintenance by phone.

Super simple teaching

Teaching (setting the threshold value) can be effectuated by a super simple operation even in 'Mark Mode' or 'Color Mode'. In addition, because teaching via an operation panel or other external input device is also possible, models can be easily interchanged.

Compact design for significant space savings

High precision sensing and multiple functions are provided in a compact 57×24×38mm (W×D×H) body. Cable and plug-in connector types are available depending on the equipment used. These sensors can be easily integrated into already existing systems.

Typical Applications

Tube positioning

Detects printed marks to align tubes



Mark detection

Mark detection of packaging film



Technical Specifications

| Type | | Cable | Plug-in connector |
|---------------------|------------|---|-------------------|
| Model. no. | NPN output | LX-101 | LX-101-Z (Note) |
| | PNP output | LX-101-P | LX-101-P-Z (Note) |
| Sensing range | | 1053mm | |
| Supply voltage | | 12 to 24VDC $\pm 10\%$ | |
| Output | | NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor | |
| Output operation | | Mark mode: Light-ON/Dark-ON (auto-setting on teaching) Color mode: Consistent-ON/Inconsistent-ON (Setting on teaching) | |
| Response time | | Mark mode: 45 μ s or less; color mode: 150 μ s or less | |
| Sensitivity setting | | Mark mode: 2-level teaching/full-auto teaching; Color mode: 1-level teaching | |
| Protection | | IP67 (IEC) | |
| Ambient temperature | | -10 to +55°C | |
| Emitting element | | Combined Red/Green/Blue LEDs (Peak emission wave length: 640nm/525nm/470nm) | |
| Dimensions (W×H×D) | | 10×30×75mm | |

Note: Mounting cable is not supplied with the plug-in connector type.
Please order separately.

Options

Cables

| UZZ81220 | UZZ81221 | UZZ81250 | UZZ81251 |
|-------------|----------|-------------|----------|
| 2m straight | 2m elbow | 5m straight | 5m elbow |
| | | | |

CX-400



CX-400

A full lineup of world standard photoelectric sensors

Features

Great lineup of 116 models

The **CX-400** series has a high level of basic functionality and excellent cost performance. Moreover, a wide number of variations means that there is sure to be a sensor that fits your needs.

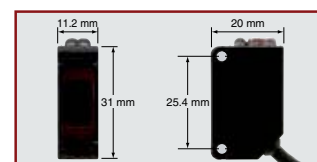
| Type | Sensing range |
|--|---------------|
| Thru-beam (long sensing range) | 15m |
| Thru-beam | 10m |
| Retroreflective (long sensing range) | 5m |
| Retroreflective (with polarizing filters) | 3m |
| Retroreflective (transparent object sensing) | 0.1 to 2m |
| Retroreflective (transparent object sensing) | 50 to 500mm |
| Diffuse reflective (800mm type) | 80mm |
| Diffuse reflective (300mm type) | 300 mm |
| Diffuse reflective (100mm type) | 100mm |
| Diffuse reflective (narrow-view) | 70 to 200mm |
| Adjustable range reflective | 20 to 300mm |
| Adjustable range reflective | 15 to 100mm |
| Adjustable range reflective | 2 to 50mm |
| Adjustable range reflective (small spot) | 2 to 50mm |

| | |
|-------------------------------------|---|
| Output | NPN, PNP |
| Connecting method (Note 1) | Cable type, M8 plug-in connector type, M12 pigtailed type |
| Cable length of cable type (Note 2) | 0.5m, 2m, 5m |

Notes: 1) Only the cable type and M8 plug-in connector type are available for the adjustable range reflective type.
2) Only the 2m cable length type (standard) is available for the adjustable range reflective type.

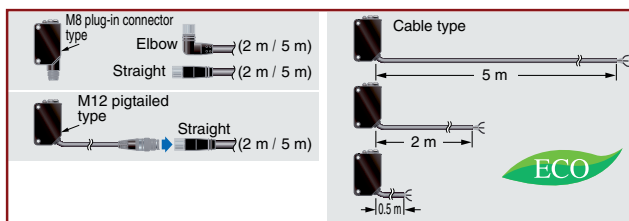
Compact size

The sensors are compact in size at 11.2×31×20mm (W×H×D). The mounting pitch is also at the world standard size of 25.4mm (1in).



Less processing

M8 plug-in connector type and M12 pigtailed type are available. This contributes to less time spent in setting up. In addition, cable types are available with cable lengths of 0.5m, 2m and 5m. This results in less wastage.



Less power consumed

The **CX-400** series sensors achieve a maximum of approx. 55% of the power consumption of conventional sensors. This contributes to preserving the environment.

Less resources used

Based on environmental considerations, simplified packaging is used in order to reduce waste.

In addition, the bag is made from polyethylene which produces no toxic gases even when burned.

Strong against oil and coolant liquids

CX-41□/42□/49□

The lens material for the thru-beam type, retroreflective type (excluding the CX-48M) and the diffuse reflective type are made of a strong acrylic that resists the harmful effects of coolants. These sensors can be used with confidence even around metal processing machinery that disperses oil mists. The protection mechanism also conforms to IP67 (IEC).

Strong against ethanol

CX-44□/48□

A strong, ethanol resistant polycarbonate was used for the front and display covers. Safe even for installing near food processing machinery that disperses ethanol based detergents. The protection mechanism also conforms to IP67 (IEC).

Strong against interference

The interference prevention function allows two sensors to be precisely mounted close together.

Typical Applications

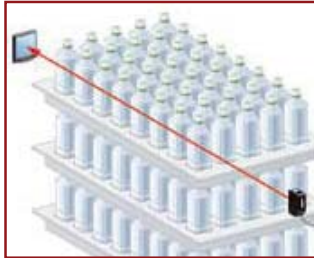
Detecting car on conveyor line

When beams of at least two out of four sensors are interrupted, the presence of a car is confirmed. The system distinguishes a car from a worker even when he is standing on the conveyor line.



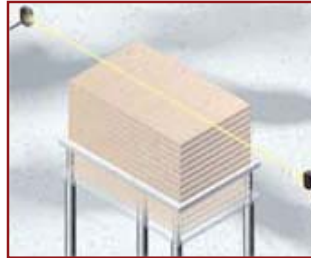
Detecting transparent bottles

The retroreflective sensor reliably detects transparent bottles containing liquid.



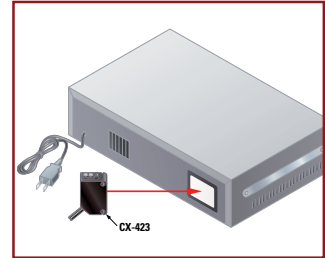
Detecting shiny material

M4-sized FT-B8 thru-beam type fiber offers a long sensing range of 1100mm in combination with long range mode of FX-301. This provides enough span so that large PCBs can also be detected.



Detecting label

The sensor detects the presence or absence of a label by the difference in reflectivity between the label and the base. The sensor projects a visible red spot so that setting is simple.



Thru-beam type CX-412□

Strong infrared beam

It realizes a 15m long-distance sensing range. Remarkable penetrating power enables applications such as package content detection.



Retroreflective type CX-493□

Strongest sensing range in its class

A long 5m sensing range is possible with the red LED type that is easy to align with the beam axis. Can be used for wide automatic door shutters.



Diffuse reflective type CX-423□

Beam axis alignment made easy

These sensors realize a high luminance red LED spot that provides bright visibility enabling the sensing position to be checked at a glance.

Because it has the small spot, approx. Ø2mm, even the minutest object can be accurately detected.



CX-481□/482□

Introducing the transparent object sensing type sensor

Our unique optical system and transparent object sensing circuitry provide stable sensing of even thinner transparent objects than the conventional models.



Technical Specifications

| Type | | Thru-beam | | Retroreflective | | | | Diffuse reflective | | | |
|--|------------------|--|--------------------|--|--------------------|--------------------------------|-----------|--------------------|----------|----------|-------------|
| | | | Long sensing range | With polarizing filters | Long sensing range | For transparent object sensing | | | | | Narrow view |
| Model. no. | NPN | CX-411 | CX-412 | CX-491 | CX-493 | CX-481 | CX-482 | CX-424 | CX-421 | CX-422 | CX-423 |
| | PNP | CX-411-P | CX-412-P | CX-491-P | CX-493-P | CX-481-P | CX-482-P | CX-424-P | CX-421-P | CX-422-P | CX-423-P |
| Sensing range | | 10m | 15m | 3m | 5m | 50 to 500mm | 0.1 to 2m | 100mm | 300mm | 800mm | 70 to 200mm |
| Supply voltage | | 12 to 24V DC±10% | | | | | | | | | |
| Output | | NPN output type: NPN open-collector transistor, PNP output type: PNP open-collector transistor | | | | | | | | | |
| | Output operation | Switchable either Light-ON or Dark-ON | | | | | | | | | |
| Response time | | 1ms or less | | | | | | | | | |
| Automatic interference prevention function | | Two units of sensors can be mounted close together with interference prevention filters. (Sensing range: 5m) | — | Incorporated (two units of sensors can be mounted close together.) | | | | | | | |
| Protection | | IP67 (IEC) | | | | | | | | | |
| Ambient temperature | | −25 to +55°C | | | | | | | | | |
| Emitting element (modulated) | | Red LED | Infrared LED | Red LED | | Infrared LED | | | | | Red LED |

Note: 0.5m/5m cable length type (standard: 2m), M8 plug-in connector type, and M12 pigtailed type are available.

Options

Cables for M8

| UZZ80820 | UZZ80821 | UZZ80850 | UZZ80851 |
|-------------|----------|-------------|----------|
| 2m straight | 2m elbow | 5m straight | 5m elbow |
| | | | |

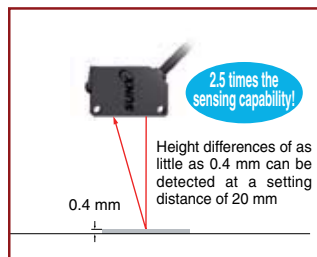
Cables for M12

| UZZ81220 | UZZ81221 | UZZ81250 | UZZ81251 |
|-------------|----------|-------------|----------|
| 2m straight | 2m elbow | 5m straight | 5m elbow |
| | | | |

CX-441/443□

Can sense differences as small as 0.4mm, with hysteresis of 2% or less

An advanced optical system provides sensing performance that is approx. 2.5 times more precise than conventional models. Even ultra small differences of 0.4mm can be detected accurately.

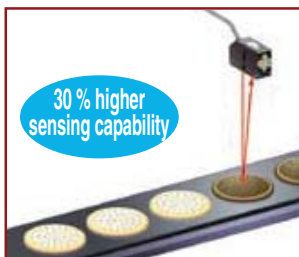


CX-44□

Not affected by color

Both black and white objects can be sensed at almost the same distances. No adjuster control is needed, even when products of different colors are moving along the production line.

Sensing range difference is 1% or less between white non-glossy paper and non-glossy paper (gray) with lightness 5 at a setting distance of 50mm.



BGS/FGS functions make even the most challenging settings possible!

Background not present



When object and background are separated.

Background present



When object and background are close together.

When the object is glossy or uneven.



Technical Specifications

| Type | | Adjustable range reflective | | | |
|---|------------|--|----------|-------------|-------------|
| | | Small spot | | | |
| Model. no. | NPN output | CX-441 | CX-443 | CX-444 | CX-442 |
| | PNP output | CX-441-P | CX-443-P | CX-444-P | CX-442-P |
| Adjustable range (Note 1) | | 20 to 50mm | | 20 to 100mm | 40 to 300mm |
| Sensing range (with white non-glossy paper) | | 2 to 50mm | | 15 to 100mm | 20 to 300mm |
| Supply voltage | | 12 to 24VDC ±10% | | | |
| Output | | NPN output type: NPN open-collector transistor, PNP output type: PNP open-collector transistor | | | |
| Output operation | | Switchable either Detection-ON or Detection-OFF | | | |
| Response time | | 1ms or less | | | |
| Sensing mode | | BGS/FGS functions Switchable with wiring of sensing mode selection input | | | |
| Protection | | IP67 (IEC) | | | |
| Ambient temperature | | -25 to +55°C | | | |
| Emitting element | | Red LED (modulated) | | | |

Notes: 1) The adjustable range stands for the maximum sensing range which can be set with the distance adjuster.
The sensor can detect an object at a distance of 2mm [CX-444(-P): 15mm, CX-442(-P): 20mm] or more.
2) M8 plug-in connector type is also available.

EQ-500



EQ-500

**Long range sensing capability
up to 2.5m**

Features

1m sensing range type EQ-502(T)/512(T)

Impervious to variations in color or angle

Due to its advanced optical system, the sensor is not affected by variations in the object's angle or gloss as compared to conventional sensors. Moreover, sensing can be performed at a somewhat constant distance even if the sensing object is black or white.



Note: Sensing range difference is 5% or less between white non-glossy paper and non-glossy paper (gray) with lightness 5 at a setting distance of 2m. [EQ-5M1(T)]

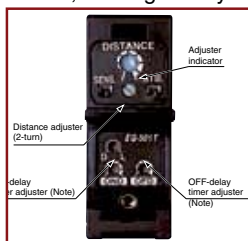
Not affected by background objects

Due to the 2-segment photodiode adjustable range system, the sensor does not detect objects outside the preset sensing field; it will not malfunction even if someone walks behind the sensing object, or machines or conveyors are in the background.

An easy-to-set adjuster with indicator

Equipped with a 2-turn adjuster with indicator, making it easy to set for short or long distances.

It can function with 24 to 240VAC and 12 to 240VDC. Therefore, almost any power supply anywhere in the world will work.



Multi-voltage type EQ-501(T)/502(T)

Equipped with BGS/FGS function

We have added a DC-voltage type with NPN and PNP transistor outputs, all in one sensor. Its BGS/FGS function controls any background effects for more stable sensing.

New DC-voltage type EQ-511(T)/512(T)

Convenient timer function models

Types with an ON-delay/OFF-delay timer available. (EQ-5□T) OFF-delay, e.g. useful when the response of the connected device is slow, ON-delay, e.g. useful to detect objects that take a long time to move.

- Operation: ON-delay
OFF-delay
- Timer period: 0.1 to 5sec.
(individual setting possible)

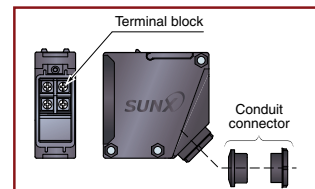


Little affected by contamination on lens

Even if the lens surface gets somewhat dirty from dust particles, there is very little change in the operation field, rendering stable and consistent detection even for objects appearing close to the front surface of the unit.

Convenient terminal block type

Cabling is enabled by way of a terminal block that eliminates waste.



Technical Specifications

| Type | Multi-voltage | | | | DC-voltage | | | |
|---|--|--|-------------|--|---|--|-------------|--|
| | | With timer | | With timer | | With timer | | With timer |
| Model. no. | EQ-501 | EQ-501T | EQ-502 | EQ-502T | EQ-511 | EQ-511T | EQ-512 | EQ-512T |
| Adjustable range (Note) | 0.2 to 2.5m | | 0.2 to 1.0m | | 0.2 to 2.5m | | 0.2 to 1.0m | |
| Sensing range (at maximum setting distance) | 0.1 to 2.5m | | 0.1 to 1.0m | | 0.1 to 2.5m | | 0.1 to 1.0m | |
| Supply voltage | 24 to 240VAC ±10% or 12 to 24VDC ±10% | | | | 12 to 24VDC ±10% | | | |
| Output | Relay contact 1a | | | | NPN open-collector transistor and PNP open-collector transistor 2 outputs | | | |
| Output operation | Switchable either Detection-ON or Detection-OFF | | | | | | | |
| Response time | 20ms or less (for EQ-50MT dependent on the setting timer period) | | | | 2ms or less (for EQ-51MT dependent on the setting timer) | | | |
| Timer function | — | Incorporated with variable (0.1 to 5sec.) ON-delay / OFF-delay timer | — | Incorporated with variable (0.1 to 5sec.) ON-delay / OFF-delay timer | — | Incorporated with variable (0.1 to 5sec.) ON-delay / OFF-delay timer | — | Incorporated with variable (0.1 to 5sec.) ON-delay / OFF-delay timer |
| Protection | IP67 (IEC) | | | | | | | |
| Ambient temperature | −20 to +55°C | | | | | | | |
| Emitting element (modulated) | Infrared LED (modulated) | | | | | | | |
| Dimensions (W×H×D) | 26×68×68mm | | | | | | | |

Note: The adjustable range stands for the maximum sensing rang which can be set with the distance adjuster.
The sensor can also detect an object 0.1m, or more, away.

EQ-30



Adjustable Range Reflective Type

EQ-30

Unaffected by color or material,
2m distance adjustable fixed-focus
sensing

Features

Not affected by object color or background

Long sensing range 2m

Compact size

The EQ-30 saves space, since a miniaturized housing of 20×68×40mm (W×H×D) has been designed for the fixed-focus sensing sensor.

Two setting distances are possible: EQ-34W

With **EQ-34W**, two sensing distances, Far (Main) and Near (Sub), can be set. Hence, one sensor can suffice where previously two were required.

Plug-in connector type (excluding EQ-34W)

Plug-in connector type of the **EQ-30** series can be easily disconnected for replacement. Should a problem occur, anyone would be able to replace the sensor in a minute.

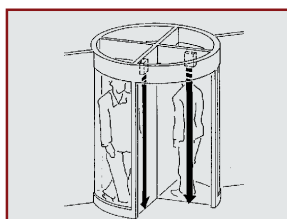
| | |
|----------------------------|--|
| Adjustable range: | EQ-34(-PN): 0.2 to 2m EQ-34W: Far 0.2 to 2m, Near 1 to 2m |
| Sensing range: | EQ-34(-PN): 0.1 to 2m EQ-34W: Far 0.1 to 2m, Near 0.2 to 2m |
| Supply voltage: | 10 to 30V DC |
| Output: | EQ-34(W) NPN open-collector transistor EQ-34-PN PNP open-collector transistor |
| Dimensions (W×H×D): | 20×68×40mm |

Note: Plug-in connector type (EQ-34-J, EQ-34-PN-J) and 5m cable length type (EQ-34-C5, EQ-34W-C5)(standard: 2m) are also available

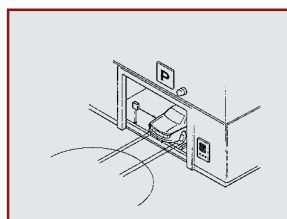
Technical Specifications

| NPN output | EQ-34 (J) | EQ-34W |
|---|----------------------------------|---------------------------------|
| PNP output | EQ-34PN (J) | |
| Sensor type | Diffuse | Diffuse/double output |
| Rated sensing distance | 200cm | |
| Sensing range | 10–200cm | Near: 10–200cm Far: 20–200cm |
| Standard detectable object | White drawing paper 20×20cm | |
| Detectable target | Transparent and opaque material | |
| Hysteresis | ≤10% of measurement | |
| Response time | Max. 2ms | |
| Outputs | Transistor max. 100mA | |
| Emitting diode | Infrared LED 880nm | |
| Rated current consumption without load | NPN type: 50mA PNP type: 55mA | NPN type: 90mA |
| Housing material | Plastic | |
| Protection | IP67 | |
| Physical size (H×W×D) | 68×20×40mm | |
| Connection method | 2m cable or M12 connector (J) | |
| Operating voltage | 10 to 30VDC (±10%) | |
| Usable ambient temperature. | –20°C to +55°C | |
| Weight | Approx. 150g | |

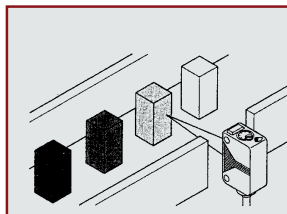
Typical Applications



Long distance sensing



Object detection



Color independent presence sensing

Triple beam trigonometric area reflective photoelectric sensor

MQ-W

MQ-W



Very accurate detection by triple beam triangulation sensing method in a compact package

Features

Accurate detection

Regardless of color, material, or shape of objects. Area reflective type sensor can detect white or black objects at the same distance. In case of diffuse reflective type, it is difficult to detect objects of various color with the same sensitivity setting. MQ-W area reflective type sensor is useful in these instances.

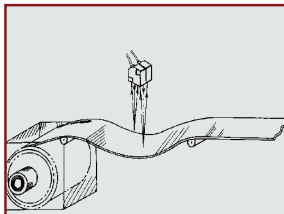
No-miss operation regardless of backgrounds

Area reflective type sensor does not detect objects beyond the set range.

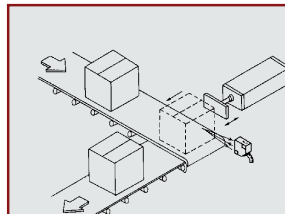
Resistant to lens surface soiling

Area reflective type sensor detects the distance by the angle, not the intensity of received light. Even if the lens surface is soiled by dust or any powdery material, there is little variation in sensing range.

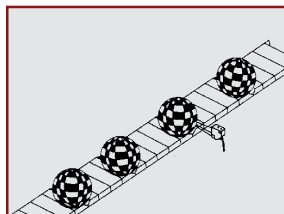
Typical Applications



Distance detection



Position detection



Color independent detection

Technical Specifications

| | | | |
|------------------------------|---------------------------------|------------|---------------------------|
| NPN output | MQ-W3A(R) | MQ-W20A(R) | MQ-W70A |
| PNP output | MQ-W3C(R) | MQ-W20C(R) | MQ-W70C |
| Sensor type | Diffuse | | |
| Rated sensing distance | 3cm | 20cm | 70cm |
| Sensing range | 2–4cm | 4–20cm | 20–70cm |
| Standard detectable object | White drawing paper | | |
| | 1×1cm | 2×2cm | 7.5×7.5cm |
| Detectable target | Transparent and opaque material | | |
| Hysteresis | ≤10% of measurement range | | ≤20% of measurement range |
| Detection frequency | 250Hz | | |
| Response time | 2ms | | |
| Output relay | – | | |
| Output transistor | Max. 100mA, NPN/PNP | | |
| Wavelength of emitting diode | Type R: 660nm | | 880nm |
| | 910nm | | |
| Rated current consumption | Max. 30mA | | |
| Housing material | Zinc die cast | | |
| Protection | IP67 | | |
| Physical size (H×W×L) | 32×12.6×32mm | | 52×18.6×52mm |
| | | | |
| Connection method | 2m cable | | |
| Operating voltage | 12 to 24VDC (–20% / +25%) | | |
| Usable ambient temperature | –25°C to +55°C | | |
| Weight | Approx. 126g | | Approx. 235g |
| | | | |

NX5



NX5

World-wide usable sensor

Features

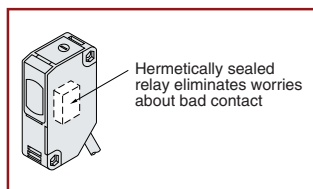
Multi-voltage

24 to 240VAC and 12 to 240VDC, suitable for supply voltages all over the world.

High reliability

The **NX5** has IP66 protection. Moderate dust or water splashes do not affect it.

The new hermetically sealed output relay significantly increases its reliability.



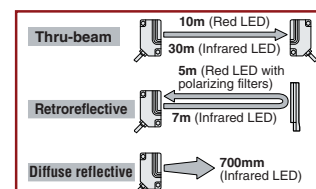
| | |
|-----------------------------|---|
| Supply voltage: | 24 to 240VAC \pm 10% or 12 to 240VDC \pm 10% |
| Output: | Relay contact 1c |
| Response time: | 10ms or less |
| Protection: | IP66 (IEC) |
| Ambient temperature: | -20 to +55°C |
| Dimensions (W×H×D): | 18×62×35mm |

Interference prevention

Two sensors operate quite normally even when mounted close together (excluding the 30m thru-beam type sensor).

Long sensing range

Most suitable for conveyor lines and parking lot applications.



Typical Applications

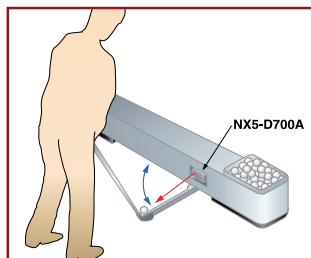
Multistoried parking

Detects if the car is protruding from the elevator door.



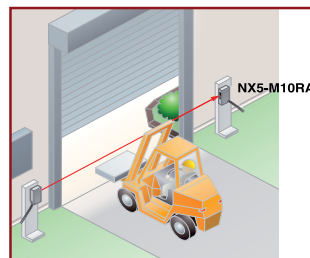
Golf driving range

The sensor detects the presence of a golf ball. The sensor is multi-voltage type, so that no DC power supply is needed.



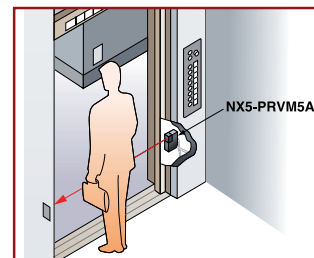
Arresting shutter closing

The long sensing range sensor with a visible red beam can be used to control the shutter operation at the gate of a factory.

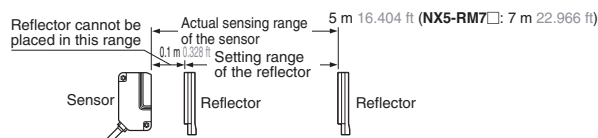


Arresting door closing

The sensor detects a person or an object and prevents the door from closing as long as its beam is interrupted.



| Type | | Thru-beam | | | | Retroreflective | | | | Diffuse reflective | | |
|---|--------------------------|--|-----------|--|----------|--|------------|---|----------|---|-----------|-----------------------------------|
| | | | | Long sensing range | | With polarizing filters | | Long sensing range | | | | |
| Item | Model no. | NX5-M10RA | NX5-M10RB | NX5-M30A | NX5-M30B | NX5-PRVM5A | NX5-PRVM5B | NX5-RM7A | NX5-RM7B | NX5-D700A | NX5-D700B | |
| Sensing range | | 10m | | 30m | | 0.1 to 5 m (Note 1) | | 0.1 to 7m (Note 1) | | 700mm (Note 2) | | |
| Sensing object | | Ø20mm or more opaque object (Note 3) | | | | Ø50mm or more opaque, translucent or specular object (Note 1) | | Ø50mm or more opaque or translucent object (Note 1) | | Opaque, translucent or transparent object | | |
| Hysteresis | | — | | | | | | | | | | 15% or less of operation distance |
| Repeatability (perpendicular to sensing axis) | | 0.1mm or less | | 0.2mm or less | | | | 0.3mm or less | | | | |
| Supply voltage | | 24 to 240VAC ±10%, or 12 to 240VDC ±10% Ripple P-P 10% or less | | | | | | | | | | |
| Power consumption | | Emitter: 1 VA or less Receiver: 2 VA or less | | Emitter: 1.5VA or less Receiver: 2 VA or less | | 2VA or less | | | | | | |
| Output | | Relay contact 1c | | | | | | | | | | |
| | | • Switching capacity: 250VAC 1A (resistive load) 30V DC 2A (resistive load) • Electrical life: 500,000 or more switching operations (switching frequency 3600 operations/hour) • Mechanical life: 100 million or more switching operations (switching frequency 36,000 operations/hour) | | | | | | | | | | |
| | Output operation | Light-ON | Dark-ON | Light-ON | Dark-ON | Light-ON | Dark-ON | Light-ON | Dark-ON | Light-ON | Dark-ON | |
| Response time | | 10ms or less | | | | | | | | | | |
| Operation indicator | | Red LED (lights up when the output is ON) | | | | | | | | | | |
| Stability indicator | | Green LED (lights up under stable light received condition or stable dark condition) | | | | | | | | | | |
| Power indicator | | — | | Red LED (lights up when the power is ON) | | — | | | | | | |
| Sensitivity adjuster | | Continuously variable adjuster | | — | | Continuously variable adjuster | | — | | Continuously variable adjuster | | |
| Automatic interference prevention function | | Use optional interference prevention filters | | — | | Incorporated (two sensor units can be mounted close together.) | | | | | | |
| Environmental resistance | Pollution degree | 3 (industrial environment) | | | | | | | | | | |
| | Protection | IP66 (IEC) | | | | | | | | | | |
| | Ambient temperature | −20 to +55°C (no dew condensation or icing allowed)(Note 4); storage: −30 to +70°C | | | | | | | | | | |
| | Ambient humidity | 35 to 85% RH; storage: 35 to 85% RH | | | | | | | | | | |
| | Ambient illuminance | Sunlight: 11,000 lx at the light-receiving face; incandescent light: 3500 lx at the light-receiving face | | | | | | | | | | |
| | EMC | EN 50081-2, EN 50082-2, EN 61000-6-2 | | | | | | | | | | |
| | Voltage withstandability | 1500VAC for one min. between power supply and output terminals; 1000VAC for one min. between relay contact terminals | | | | | | | | | | |
| | Insulation resistance | 20MΩ, or more, with 500V DC megger between power supply and output terminals, and between relay contact terminals | | | | | | | | | | |
| | Vibration resistance | 10 to 55Hz frequency, 1.5mm amplitude in X, Y and Z directions for two hours each | | | | | | | | | | |
| | Shock resistance | 500m/s² (50G approx.) in X, Y and Z directions for three times each | | | | | | | | | | |
| Emitting element (modulated) | | Red LED (modulated) | | Infrared LED (modulated) | | Red LED (modulated) | | Infrared LED (modulated) | | | | |
| Material | | Enclosure: Polycarbonate; lens: polycarbonate; cover: polycarbonate; front cover (retroreflective type sensor only): acrylic | | | | | | | | | | |
| Cable | | 0.3mm² 5-core (thru-beam type emitter: 2-core) cable, 2m long | | | | | | | | | | |
| Cable extension | | Extension up to total 100m is possible with 0.3mm², or more, cable (thru-beam type: both emitter and receiver) | | | | | | | | | | |
| Weight | | Emitter: 100g approx. Receiver: 140g approx. | | Emitter: 125g approx. Receiver: 140g approx. | | 140g approx. | | | | | | |
| Accessory | | Adjusting screwdriver: 1 pc | | — | | RF-230 (reflector): 1 pc. Adjusting screwdriver: 1 pc. | | RF-230 (reflector): 1 pc. | | Adjusting screwdriver: 1 pc. | | |



- Notes:**
- 1) The sensing range and the sensing object of the retroreflective type sensor is specified for the **RF-230** reflector. Further, the sensing range is the possible setting range for the reflector. The sensor can detect an object less than 0.1m away.
 - 2) The sensing range of the diffuse reflective type sensor is specified for white non-glossy paper (200×200m) as the object.
 - 3) If slit masks (optional) are fitted, an object as small as 3×6mm can be detected.
 - 4) In the event that the sensor is to be used at an ambient temperature of -15°C, or less, please contact our office.

CY

CY



Simple mounting with M18 thread

Features

M18 thread

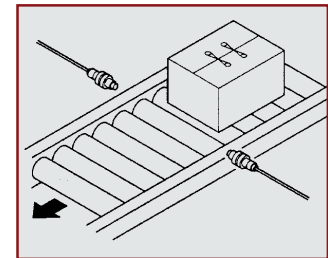
This sensor has an M18 thread on the enclosure, which is convenient for mounting.

Easy to replace

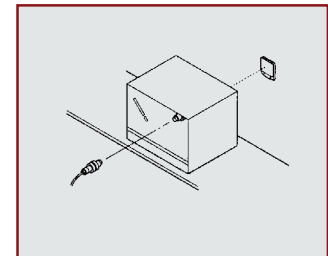
A pigtailed type sensor with connector (CY-I-J) is easy to replace.

| | |
|--------------------------------------|--|
| Supply voltage: | AC supply type 24 to 240VAC \pm 10% DC supply type 10 to 30V DC |
| Response time: | AC supply type 20ms or less DC supply type 2ms or less |
| Test input (emission halt) function: | Incorporated in DC supply type only |
| Protection: | IP67 (IEC) |
| Ambient temperature: | -25 to +55°C |

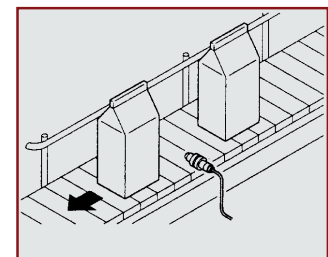
Typical Applications



Object detection



Position detection



Object detection

Technical Specifications

| Type | Appearance | Sensing range | Model No. | Supply voltage | Output |
|----------------|-------------------------|---------------|-----------|-----------------------------|-----------------------------------|
| DC supply type | Thru-beam | 12m | CY-21 | 10 to 30 V DC | NPN open-collector transistor |
| | | | CY-21-PN | | PNP open-collector transistor |
| | Retroreflective | 3m | CY-27 | | NPN open-collector transistor |
| | | | CY-27-PN | | PNP open-collector transistor |
| | With polarizing filters | 1.5m | CY-29 | | NPN open-collector transistor |
| | | | CY-29-PN | | PNP open-collector transistor |
| | Diffuse reflective | 120mm | CY-22 | | NPN open-collector transistor |
| | | | CY-22-PN | | |
| AC supply type | Thru-beam | 12m | CY-11A | 24 to 240 V AC \pm 10% | AC non-contact (thyristor) output |
| | | | CY-11B | | |
| | Retroreflective | 3m | CY-17A | | |
| | | | CY-17B | | |
| | With polarizing filters | 1.5m | CY-19A | | |
| | | | CY-19B | | |
| | Diffuse reflective | 120mm | CY-12A | | |
| | | | CY-12B | | |

M18



Photoelectric sensor basic line

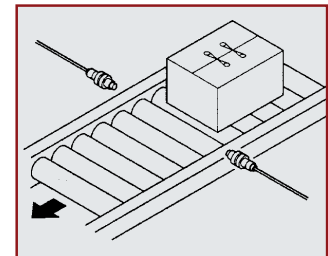
Features

- Basic models available with axial or radial optics
- Versions with NPN or PNP output, cable or M12 connector
- Standard 3-wire connection configuration
- Selectable dark or light output
- Plastic or metal housing

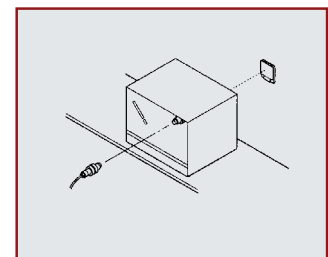
Technical Specifications

| | | | | |
|----------------------------------|---|---|--|--|
| Plastic PNP | M18-T120P-PN(-J) | M18-R020P-PN(-J) | M18-P015P-PN(-J) | M18-D003P-PN(-J) |
| Plastic NPN | M18-T120P(-J) | M18-R020P(-J) | M18-P015P(-J) | M18-D003P(-J) |
| Metal PNP | M18-T120M-PN(-J) | M18-R020M-PN(-J) | M18-P015M-PN(-J) | M18-D003M-PN(-J) |
| Metal NPN | M18-T120M(-J) | M18-R020M(-J) | M18-P015M(-J) | M18-D003M(-J) |
| Sensor type | Through-beam | Retroreflective | Retroreflective with polarizing filter | Reflective |
| Rated sensing distance | 12m | 2m | 1.5m | 30cm |
| Standard detectable object | Metal, black matt finish | | | |
| Detectable target | Ø5mm or more, opaque object | Ø35mm or more, opaque or transparent object | Ø7.5mm or more, opaque or transparent object | Ø5mm or more, opaque or transparent object |
| Hysteresis | — | — | — | ≤ 15% of the measurement range |
| Response time | Max. 2ms | Max. 1ms | | |
| Output transistor | Max. 100mA | | | |
| Emitting diode | Infrared LED | | Red LED | Infrared LED |
| Current consumption without load | Emitter: max. 20mA Receiver: max. 25mA | Max. 30mA | | |
| Housing material | Plastic/nickel-plated brass | | | |
| Protection | IP67 | | | |
| Physical size (Ø x L) | M18×57mm | | | |
| Connection method | Cable 2m; plug connection (J) | | | |
| Operating voltage | 10 to 30VDC (±10%) | | | |
| Usable ambient temperature | −25°C to +55°C | | | |
| Weight | Max. 210g | Max. 110g | | |

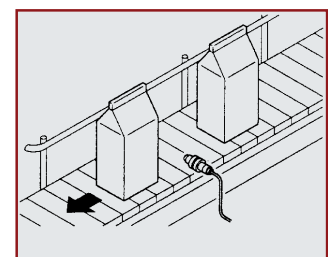
Typical Applications



Object detection



Position detection



Object detection

EX-10



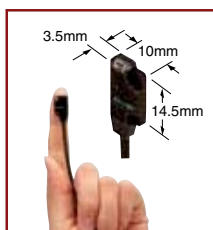
EX-10

The smallest: 3.5mm thick

Features

Freely mountable fingertip size

Freely mountable 10×14.5×3.5mm (W×H×D) size (thru-beam, front sensing type). Moreover, easy alignment is possible with the visible red LED beam source.



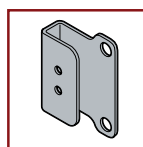
Long sensing range 1m: EX-19□

Operation mode switch type: EX-15□/17□

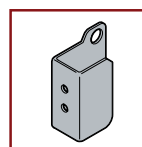
Ten times as durable: EX-□-R

Flexible cable on EX-□-R is 10 times as durable as conventional models. It is best suited for moving parts, such as robot arm, etc.

Slit mask available for EX-13□/17□/19□



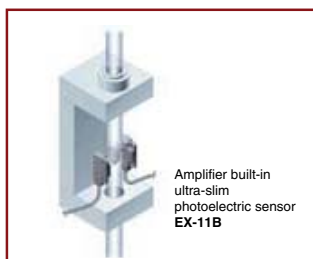
OS-EX10-12
OS-EX10-15



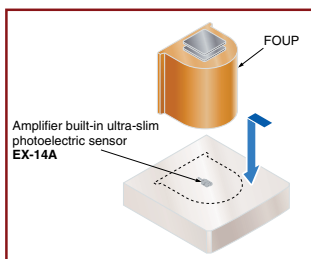
OS-EX10E-12

Typical Applications

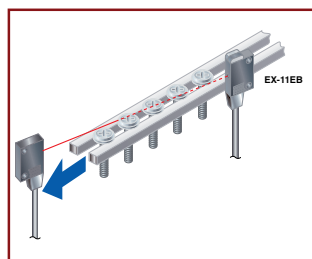
Detecting the float for a flow meter



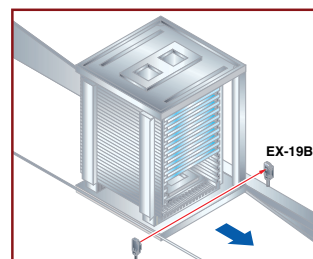
Seating confirmation of FOUF



Detecting end of screw supply



Sensing PCB rack



Technical Specifications

| Type | Thru-beam | | | | | | Thru-beam with operation mode switch on bifurcation | | Convergent reflective | |
|---------------------|--|------------|--------------------|------------|------------|------------|---|--------------------|--|------------|
| Model. no. (Note 1) | EX-11A(-R) | EX-11B(-R) | EX-13A(-R) | EX-13B(-R) | EX-19A(-R) | EX-19B(-R) | EX-15 | EX-17 | EX-14A(-R) | EX-14B(-R) |
| Sensing range | 150mm | | 500mm | | 1m | | 150mm | 500mm | 2 to 25mm (conv. point: 10mm) | |
| Min. sensing object | ∅1mm opaque object | | ∅2mm opaque object | | | | ∅1mm opaque object | ∅2mm opaque object | ∅0.1mm copper wire (Setting distance: 10mm) | |
| Supply voltage | 12 to 24VDC±10% | | | | | | | | | |
| Output | NPN open-collector transistor (Note 2) | | | | | | | | | |
| Output operation | Light-ON | Dark-ON | Light-ON | Dark-ON | Light-ON | Dark-ON | Switchable either Light-ON or Dark-ON | | Light-ON | Dark-ON |
| Response time | 0.5ms or less | | | | | | | | | |
| Protection | IP67 (IEC) | | | | | | | | | |
| Ambient temperature | -25 to +55°C | | | | | | | | | |
| Dimensions (W×H×D) | 10×14.5×3.5mm | | | | | | 10×14.5×3.5mm (sensor head) | | 13×14.5×3.5mm | |

Notes: 1) EX-□-R is flexible cable type.

2) PNP output type is also available. (Excluding flexible cable type, EX-15 and EX-17)

EX-20



EX-20

Miniature-sized and still mountable with M3 screws

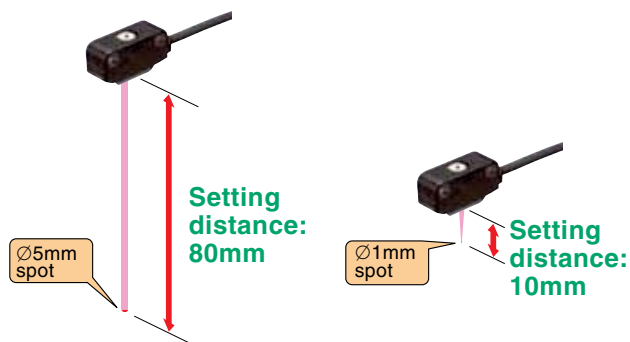
Features

Long sensing range

The **EX-20** series achieves long distance sensing [thru-beam type: 2m, retroreflective type: 200mm (when using the attached reflector), diffuse reflective type: 160mm], despite its miniature size. Hence, it is usable even on a wide conveyor.

Clear beam spot using red LED dot light source

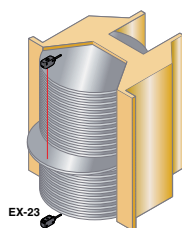
The emission area of a dot light source is smaller than that of a conventional LED flat light source, and it is possible to design a high power, narrow beam. Since a red LED dot light source is used, the red beam spot is clearly visible even at a long distance, so that alignment and confirmation of sensing position is easy.



Typical Applications

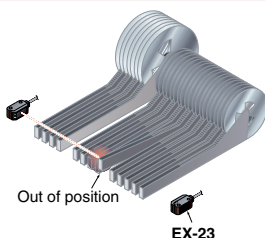
Checking protrusion of wafer

The ultra compact photoelectric sensor EX-23 has a sufficiently long sensing range of 2m. Further, its visible red LED beam makes beam alignment very easy.



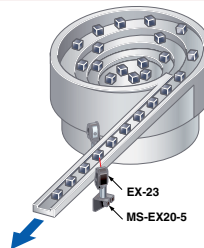
Detecting out of position tape feeder cassette

Ultra compact in size with an ample sensing range of 2m, ideal for monitoring tape feeder cassettes that are out of position.



Detecting fill-up of parts in feeder

The sensor setting can be finely adjusted since a universal sensor mounting bracket, with which the height and the angle of the sensor can be freely adjusted, is available.

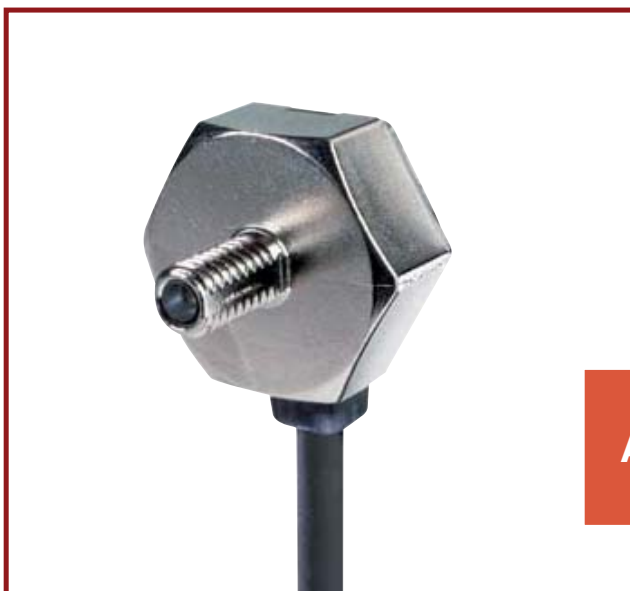


Technical Specifications

| Type | | Thru-beam | | Retroreflective | Diffuse reflective | Convergent reflective | | Narrow-view reflective |
|------------------------|----------|--|--------------------------------------|---|---|--|----------------------------------|--|
| | | | | | | Diffuse beam | Small spot beam | Long distance spot beam |
| | | Front sensing | Side sensing | Side sensing | Side sensing | Front sensing | Side sensing | Side sensing |
| Model. no. (Note 1) | Light-ON | EX-21A(-PN) | EX-23(-PN) | EX-29A(-PN) | EX-22A(-PN) | EX-24A(-PN) | EX-26A(-PN) | EX-28A(-PN) |
| | Dark-ON | EX-21B(-PN) | | EX-29B(-PN) | EX-22B(-PN) | EX-24B(-PN) | EX-26B(-PN) | EX-28B(-PN) |
| Sensing range | | 1m | 2m | 30 to 200mm | 5 to 160mm | 2 to 25mm (Conv. point: 10mm) | 6 to 14mm (Conv. point: 10mm) | 45 to 115mm |
| Sensing object | | Min. \varnothing 2.6mm opaque object | Min. \varnothing 3mm opaque object | \varnothing 15mm or more opaque or translucent object | Opaque, translucent or transparent object | Min. \varnothing 0.1mm copper wire (Setting distance: 10mm) | | Opaque,translucent or transparent object |
| Supply voltage | | 12 to 24VDC \pm 10% | | | | | | |
| Output | | NPN output type: NPN open-collector transistor; PNP output type: PNP open-collector transistor | | | | | | |
| Response time | | 0.5ms or less | | | | | | |
| Protection | | IP67 (IEC) | | | | | | |
| Ambient temperature | | -25 to +55°C | | | | | | |
| Dimensions (W×H×D) | | 8.2×22×12.3mm | | | | | | 10×14.5×3.5mm (sensor head) |

Notes: 1) EX-□-PN is PNP output type.

EX-30



EX-30

A new alternative to fiber sensors

Features

Can be installed in the same way as standard fibers

The **EX-30** series can be screw-mounted (M4 for thru-beam type, M6 for reflective type) in the same way as standard fiber sensors. This means that they can be inserted into production lines in exactly the same way as conventional high-priced fiber sensors.

New design solves all weak points of fiber sensors

The **EX-30** series solves all of the difficulties associated with fiber sensors, such as 'Difficulty finding a suitable place for the amplifier', 'Fragility of the fiber', 'Extra space needed because of difficulty in bending the fiber', 'The nuisance of having to use a protective tube to prevent fiber breakages'.

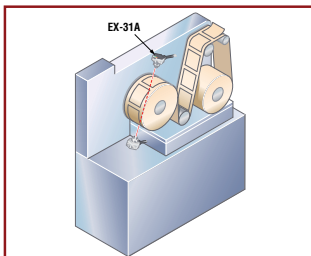
800mm thru-beam type available

The sensing range is 1.5 times greater than previous models! It also has a sensitivity adjuster to enable compatibility with a wide range of applications.

Typical Applications

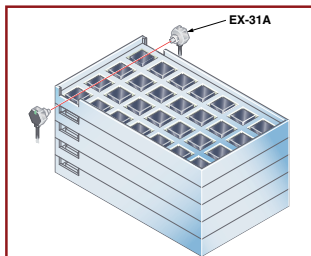
Detecting quantity of labels in label magazine

Detects the remaining amount of labels by the thickness of the roll.



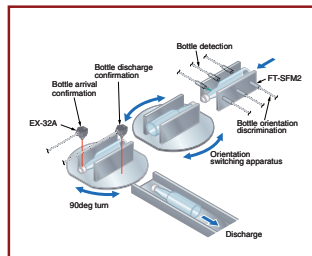
Detecting IC height

Detects whether ICs are accurately placed in IC trays.



Resin bottle detection

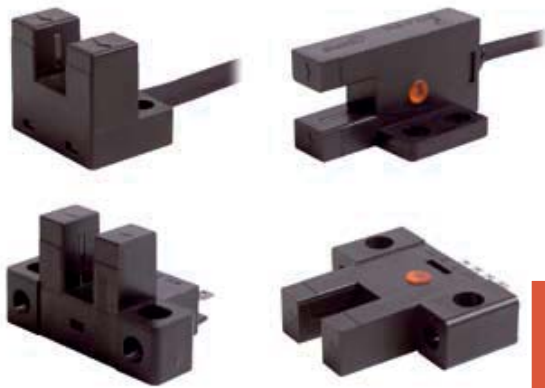
The **EX-32A** threaded photoelectric sensor confirms the arrival of bottles.



Technical Specifications

| Type | | Thru-beam | | | Diffuse reflective | |
|---------------------|------------------|--|-----------|-----------------------------|---|-----------|
| Model no. | NPN output | EX-31A | EX-31B | EX-33 | EX-32A | EX-32B |
| | PNP output | EX-31A-PN | EX-31B-PN | EX-33-PN | EX-32A-PN | EX-32B-PN |
| Sensing range | | 500mm | | 800mm | 5mm | |
| Sensing object | | Min. \varnothing 2mm or more opaque object | | | Opaque, translucent or transparent object | |
| Supply voltage | | 12 to 24V DC \pm 10% | | | | |
| Output | | NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor | | | | |
| | Output operation | Light-ON | Dark-ON | Variable (switching method) | Light-ON | Dark-ON |
| Response time | | 0.5ms or less | | | | |
| Protection | | IP67 (IEC) | | | | |
| Ambient temperature | | −25 to +55°C | | | | |

Note: 5m cable length type (standard: 2m) is also available [excluding EX-33(-PN)].



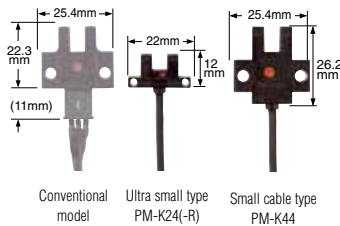
Enables equipment miniaturization and quick construction

Features

Extremely compact

Ultra small type

PM-□24(-R) achieves an extremely compact size and can contribute to the miniaturization of your equipment.



Quick fitting hook-up connector

Easy to maintain connector type models are available. Their exclusive connector is the hook-up connector.

Since only crimping with exclusive pliers needs to be done, cumbersome soldering or insulation is not required.

Further, a connector attached cable (CN-14H-C1/C3) is also available.

Equipped with two independent outputs

All models are equipped with two independent outputs—Light-ON and Dark-ON. Hence, one model suffices even if the output is to be used differently, depending upon the location of use.

Flexible cable type

Flexible cable is used, which allows repeated bending. It is suitable for use in the moving part of a robot arm.

Quick-connector connections with commercially-available connectors

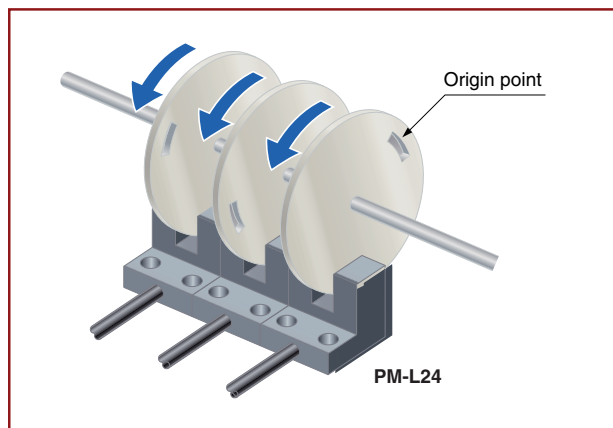
The connector is built-in, allowing greater space savings.

Commercially available general-purpose connectors can be used with some types for improved reliability.

Typical Applications

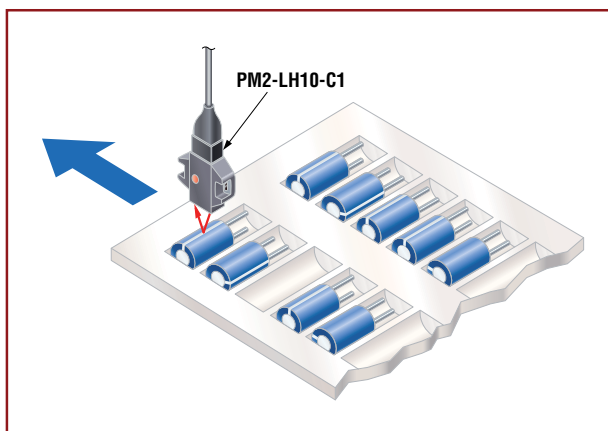
Sensing rotating bodies

By incorporating a slit in the rotating body, the origin point can be sensed.



Detecting capacitors in tray

The convergent reflective type sensor reliably detects capacitors in a tray without being affected by their color, characters, marks or glossiness.



Technical Specifications

| Type | | Ultra small type | Small type | | |
|---------------------|------------|--|------------|----------------|--------------------|
| | | With cable | With cable | With connector | Built-in connector |
| Model no. | NPN output | PM-□24(-R) (Note) | PM-□44 | PM-□54 | PM-□64 |
| | PNP output | PM-□24P | PM-□44P | PM-□54P | PM-□64P |
| Sensing range | | 5mm (fixed) | | | |
| Min. sensing object | | 0.821 × 1.8mm opaque object | | | |
| Repeatability | | 0.03mm or less | | 0.01mm or less | |
| Supply voltage | | 5 to 24VDC ±10% | | | |
| Output | | NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor | | | |
| Output operation | | Incorporated with 2 outputs: Light-ON / Dark-ON | | | |
| Response time | | Under light incident condition: 20μs or less Under light interrupted condition: 100μs or less (Response frequency: 1kHz or more) | | | |
| Emitting element | | Infrared LED (non-modulated) | | | |

Note: PM-□24-R is flexible cable type.
3m cable length type (standard: 1m) is also available (excluding flexible cable type and PNP output type).

Example: PM-K44

K = K-Type
L = L-Type
F = F-Type
R = R-Type
U = U-Type

PM2



PM2

Convergent reflection sensing ensures stable detection

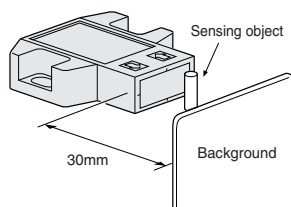
Features

Stable detection by convergent reflective mode

Stable detection characteristics are obtained since it is a convergent reflective type and senses a limited area.

Not affected by background

Even a specular background does not affect the sensing performance if the sensor is located 30mm away from it (when directly opposite).



Dark object detectable

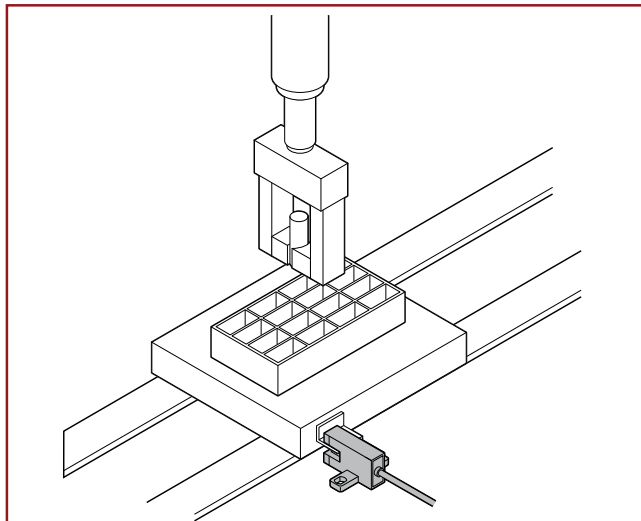
Since the sensor is very sensitive, it can detect even a dark object of low reflectivity.

Minute object detectable

A $\varnothing 0.05\text{mm}$ copper wire can be detected at a distance of 5mm.

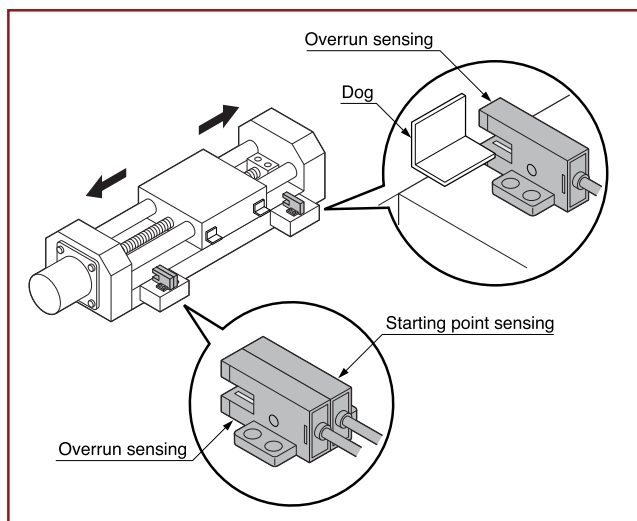
Determining the pallet position

Pallet is stopped by sensing the dog.



Sensing the starting point and overrun of a moving body

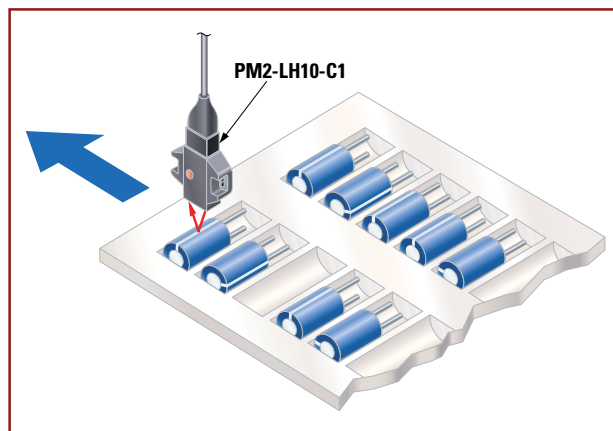
Starting point and overrun is sensed using the dog on the base.



Typical Applications

Detecting capacitors in tray

The convergent reflective type sensor reliably detects capacitors in a tray without being affected by their color, characters, marks, or glossiness.



Technical Specifications

| Type | | Connector | | | Cable | | |
|--|----------|---|---------------|-------------------------|--------------|---------------|-------------------------|
| | | Top sensing | Front sensing | L type (Top sensing) | Top sensing | Front sensing | L type (Top sensing) |
| Model no. | Light-ON | PM2-LH10 | PM2-LF10 | PM2-LL10 | PM2-LH10-C1 | PM2-LF10-C1 | PM2-LL10-C1 |
| | Dark-ON | PM2-LH10B | PM2-LF10B | PM2-LL10B | PM2-LH10B-C1 | PM2-LF10B-C1 | PM2-LL10B-C1 |
| Sensing range | | 2.5 to 8mm (conv. point: 5mm) with white non-glossy paper (15×15mm) | | | | | |
| Min. sensing object | | Ø0.05mm copper wire (setting distance: 5mm) | | | | | |
| Repeatability (perpendicular to sensing axis) | | 0.08mm | | | | | |
| Supply voltage | | 5 to 24VDC±10% | | | | | |
| Output | | NPN open-collector transistor | | | | | |
| Response time | | 0.8ms or less | | | | | |
| Emitting element | | Infrared LED (modulated) | | | | | |

NA1-11

NA1-11

Cross-beam scanning system to detect slim objects

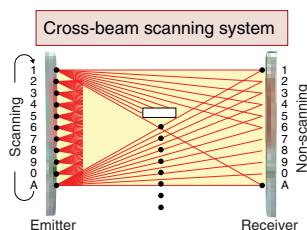
Features

Letter or visiting card detectable

Thin objects can be detected by using the cross-beam scanning system.

Emitting and receiving element pitch: 10mm

A minimum sensing object size of $\varnothing 13.5\text{mm}$ is realized by using an emitting and receiving element pitch of 10mm.

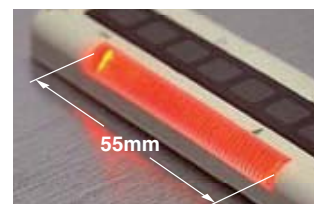


Wide area

Though being very slim, it realizes a wide sensing area of 1m length and 100mm width. It is most suitable for object detection on a wide assembly line, or for detecting the dropping of, or incursion by, small objects whose travel path is uncertain.

Clearly visible large indicator

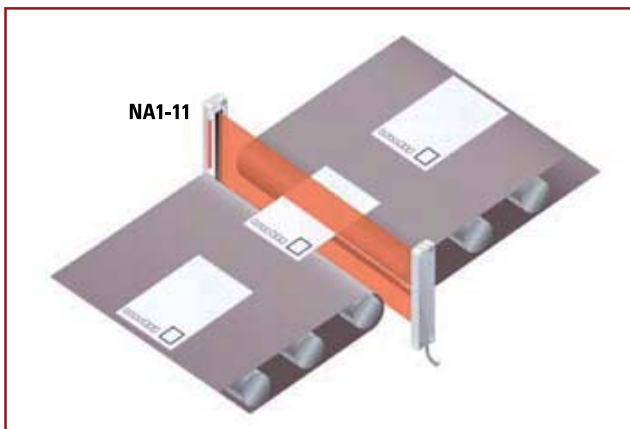
A clearly visible large indicator, having a 55mm width, is incorporated on both the emitter and the receiver.



Typical Applications

Detecting postcards

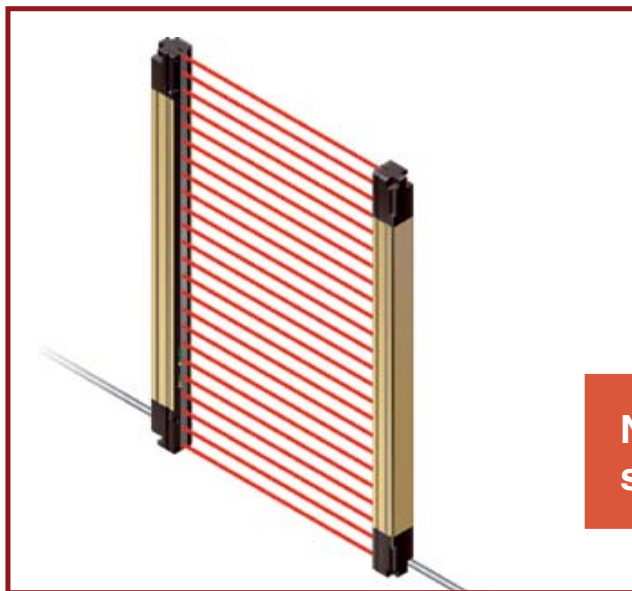
NA1-11 can detect thin postcards due to its crossbeam scanning system.



Technical Specifications

| Model no. | NA1-11 | NA1-11-PN |
|---|---|-------------------------------|
| Sensing height/ Sensing range | 100mm/0.17 to 1m (Note 1) | |
| Element pitch | 10mm | |
| Number of emitting/ receiving elements | 11 each on the emitter and the receiver, respectively | |
| Sensing object | Ø13.5mm or more opaque object (Note 2) | |
| Supply voltage | 12 to 24VDC ±10% | |
| Output | NPN open-collector transistor | PNP open-collector transistor |
| Ambient temperature | -10 to +55°C | |
| Dimensions | W30×H140×D10mm | |

Notes: 1) The sensing range is the possible setting distance between the emitter and the receiver.
The sensor can detect an object less than 0.17m away.
2) Although this product can detect slim objects by using the cross-beam scanning system, the size of the slim object which can be stably detected differs with the setting distance. When this sensor is used to detect slim objects, make sure to confirm stable detection using the actual objects.



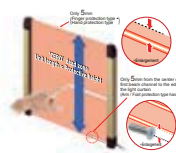
SF4B

New concepts combining greater safety and higher productivity!

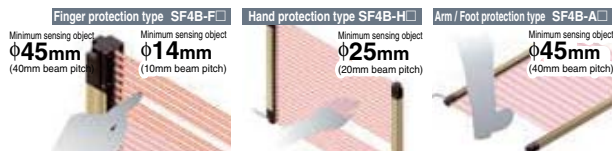
Features

'ZERO' dead zone

The length of the main unit equals the protective height, so that installation is possible in places where space is limited, with no wastage. No dead zone occurs at the joints between light curtains when light curtains are connected in series.



3 types available for different workplace conditions

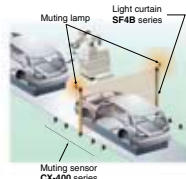


Same response time of 14ms and constant safety distance

A fast response time of 14ms has been achieved regardless of the number of beam channels, the beam axis pitches and the number of units connected in series. This reduces calculation work required for the safety distances.

A muting control function is provided to increase both safety and productivity.

The light curtain is equipped with a muting control function that causes the line to stop only when a human body passes through the light curtain, and does not stop the line when a workpiece passes through.



The safety relay unit capability is built into the light curtain, so component costs can be reduced

The light curtain has a built-in external device monitoring function (such as for fused relay monitoring) and an interlock function. The safety circuit is constructed so that a separate safety relay unit is not needed, and the control board is also more compact, both of which contribute to lower costs.

Reduces malfunction due to mutual interference and extraneous light

The advanced ELCA function used in the SF4-A that has been widely acclaimed by the marketplace has also been adopted into the SF4B in order to suppress mutual interference. In addition, the unique double scanning method and retry processing developed by SUNX greatly reduce malfunctions due to extraneous light.

Equipped with a digital error indicator

If an error occurs, details of the error appear on the digital display, so that maintenance can be carried out more quickly.



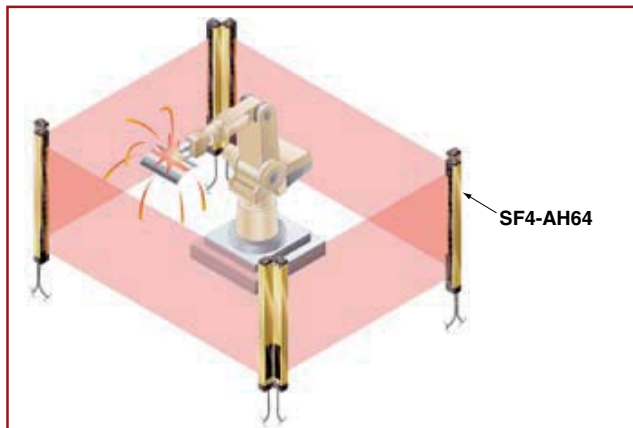
Universal design that can be used anywhere in the world

The SF4B series combines PNP transistor output and NPN transistor output in a single model. Overseas equipment that uses PNP, replacement with NPN sensors, factories that are positively grounded, and transfer of equipment overseas are all situations where the control circuits for a single model are suitable for use worldwide.

Typical Applications

Guarding space around welding robot

The spatter protection hood type perfect for welding devices is also available.



Technical Specifications

| Type | Finger protection type | Hand protection type | Arm / Foot protection type |
|---------------------|---|---|---|
| Beam pitch | 10mm | 20mm | 40mm |
| Operating range | 0.3 to 7m | 0.3 to 9m (72 beam channels or more: 0.3 to 7m) | 0.3 to 9m (36 beam channels or more: 0.3 to 7m) |
| Protective height | 230 to 1270mm | 230 to 1910mm | 230 to 1910mm |
| Min. sensing object | 14mm or more in opaque object | 25mm or more in opaque object | 45mm or more in opaque |
| Supply voltage | 24VDC \pm 10% | | |
| Control output | PNP open collector transistor / NPN open collector transistor (selectable using wiring) | | |
| Response time | OFF response: 14ms or less, ON response: 80 to 90ms | | |
| Dimensions | W282 \times protective height \times D30mm | | |

Notes: 1) The sensing range is the possible setting distance between the emitter and the receiver.
The sensor can detect an object less than 0.17m away.

SF2B



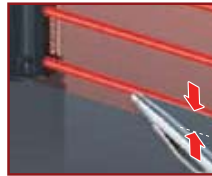
SF2B

Excellent basic functions at a reasonable price

Features

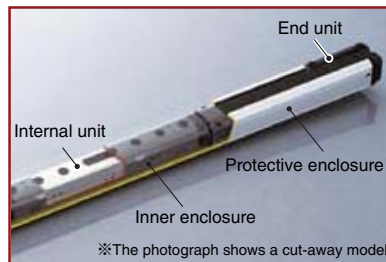
Unit length = Protective height, 'ZERO' dead zone

Non-wasteful installation is possible, with no dead corners in the sensing width.



Seamless structure using an inner enclosure

The internal unit fits into an inner enclosure, so that seams (joints) can be completely eliminated inside the product.



Also suppresses mutual interference and effects of extraneous light

The tried and proven ELCA function suppresses operating errors resulting from mutual interference and the effects of extraneous light, and prevents drops in line efficiency rates from occurring.

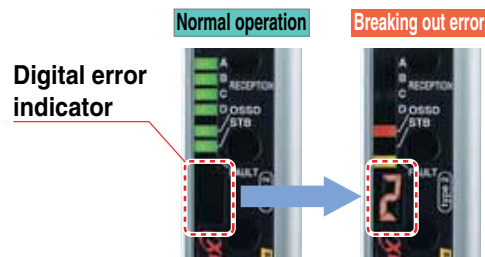


Supports resolution of electrical problems when starting up lines

Equipped with a digital error indicator so that error details can be understood at a glance!

Technical Specifications

| Type | Hand protection type | | Arm / Foot protection | |
|---------------------|--|------------|-----------------------|------------|
| | NPN output | PNP output | NPN output | PNP output |
| Model no. | SF2B-H□-N | SF2B-H□-P | SF2B-A□-N | SF2B-A□-P |
| Beam pitch | 20mm | | 40mm | |
| Operating range | 0.2 to 13m | | | |
| Protective height | 168 to 1912mm | | 168 to 1912mm | |
| Min. sensing object | Ø27mm opaque object | | Ø47mm opaque object | |
| Supply voltage | 24V DC ±10% | | | |
| Control output | NPN output type: NPN open collector transistor PNP output type: PNP open collector transistor | | | |
| Response time | OFF response: 15ms or less, ON response: 40 to 60ms | | | |
| Ambient temperature | -10 to +55°C | | | |
| Dimensions | W28×H protective height×D24mm | | | |



SF-C10



Less setup time for safety curtains

Features

Supports both PNP and NPN polarities

A single unit can be used for PNP / NPN input switching, reducing the number of parts that need to be registered.

Removable terminal blocks reduce maintenance time

Removable terminal blocks are used. This reduces the work required for re-connecting wiring during maintenance.

SF-C11, SF-C14EX(-01)

Removable!
Uses a spring
method



Metal enclosure with an IP65 protective structure

The strong metal enclosure has a built-in safety relay. It has an IP65 protective structure, so that it can be set up individually without needing to be inserted into a control panel.

SF-C12

Slim design

22.5mm thickness, so can be inserted even into narrow spaces inside panels.

SF-C13

Three safety circuit systems packaged into a single unit!

SF-C14EX(-01)

Three safety circuit systems, light curtain output circuit, muting control circuit, and emergency stop circuit, are packaged into a single unit. This allows safety to be maintained for different sections of the equipment.

| | |
|-----------------|---|
| Supply voltage: | 24VDC $\pm 10\%$ |
| Enabling path: | NO contact 23 (SF-C12: NO contact 22) |
| Dimensions: | SF-C11 W46×H130×D100mm SF-C12 W127×H67.5×D130mm SF-C13 W22.5×H130×D80.8mm SF-C14EX(-01) W46×H130×D99mm |

DP-100

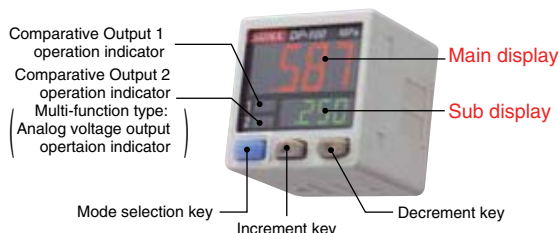


DP-100

A new global standard, dual display

Features

'Current value' and 'threshold value' can be checked at the same time!



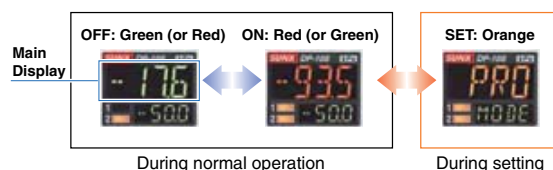
Dual display allows direct setting of threshold value

Equipped with a 30mm square compact-sized dual display. Because the current value and the threshold value can be checked at the same time, the threshold value can be set and checked smoothly without having to switch screen modes.



3-color display (Red, Green, Orange)

The main display changes color according to changes in the status of output ON/OFF operation, and it also changes color while setting is in progress. The sensor status can therefore be understood easily, and operating errors can be reduced.



Readable digital display!

12 segments are used and an alphanumeric display has been adopted. This improves visual checking of letters and numbers.



Realizes high performance

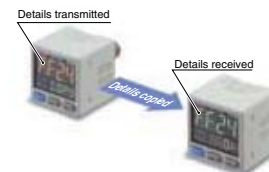
Low pressure type

The low pressure type displays measurements in 0.1kPa at a resolution of 1/2000 and has a response time of 2.5ms (variable up to 5000ms), $\pm 0.5\%$ F.S. temperature characteristics and $\pm 0.1\%$ F.S. repeatability, giving it high performance.

Copy function reduces man hours and human error

Sensors can be connected to a master sensor one by one, and a copy of the setting details for the master sensor can be transmitted as data to the other sensors.

If making the same settings for multiple sensors, this prevents setting errors from occurring with the other sensors and also reduces the number of changes required to instruction manuals when equipment designs are changed.



Equipped with auto-reference/remote zero-adjustment functions

More precise pressure management is possible with a minimum of effort

Multi-function type

If the reference pressure of the device changes, the auto-reference function partially shifts the comparative output judgment level by the amount that the reference pressure shifts, and the remote zero-adjustment function can reset the display value to zero via external input. These functions are ideal for places where the reference pressure fluctuates wildly, or where fine settings are desired.

Typical Applications

Confirming suction of electronic component



Confirming reference pressure



Air-leak test for PET bottles



Technical Specifications

Cable types

| Type | | Compound pressure | | | |
|----------------------|----------------|--|---------------------|---------------------|---------------------|
| | | Multi-function | | | |
| | | For low pressure | For high pressure | For low pressure | For high pressure |
| Model no. | Asian | DP-101 | DP-102 | DP-101A | DP-102A |
| | European | DP-101-E-P | DP-102-E-P | DP-101A-E-P | DP-102-E-P |
| | North American | DP-101-N(-P) | DP-102-N(-P) | DP-101A-N(-P) | DP-102A-N(-P) |
| Rated pressure range | | −100.0 to +100.0kPa | −0.100 to +1.000kPa | −100.0 to +100.0kPa | −0.100 to +100.0kPa |
| Applicable fluid | | Non-corrosive gas | | | |
| Supply voltage | | 12 to 24VDC ±10% | | | |
| Output | | NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor | | | |
| Response time | | 2.5ms, 5ms, 10ms, 25ms, 50ms, 100ms, 250ms, 500ms, 1,000ms, 5000ms, selectable by key operation | | | |
| Display | | 4 digits + 4 digits 3-color LCD display | | | |
| Pressure port | | Asian: M5 female thread + R (PT) 1/8 male thread, European: M5 female thread + G 1/8 male thread, North American: M5 female thread + NPT 1/8 male thread | | | |
| Connecting method | | Connector | | | |
| Accessories | | CN-14A-C2 (Connector attached cable 2m): 1pc. | | | |
| Dimensions (W×H×D) | | 30×30×42.5mm | | | |

Note: Types without connector attached cable are also available.

M8 connector types

| Type | Standard | | Multi-function | |
|---|---|----------------------|----------------------|----------------------|
| | For low pressure | For high pressure | For low pressure | EX-13B(-R) |
| Model. no. | DP-111-E-P-J | DP-112-E-P-J | DP-111A-E-P-J | DP-112A-E-P-J |
| Rated pressure range | −100.0 to +100.0kPa | −0.100 to +1.000 MPa | −100.0 to +100.0 kPa | −0.100 to +1.000 MPa |
| Applicable fluid | Non-corrosive gas | | | |
| Supply voltage | 12 to 24VDC ±10%; Ripple P-P 10% or less | | | |
| Comparative output | PNP open-collector transistor | | | |
| Response time | 2.5ms, 5ms, 10ms, 25ms, 50ms, 100ms, 250ms, 500ms, 1000ms, 5000ms, selectable by key operation | | | |
| Auto-reference function / Remote zero-adjustment function | — | | Incorporated | |
| Analog voltage output | — | | Incorporated | |
| Ambient temperature | −10 to +50°C, Storage: −10 to 60°C | | | |
| Pressure port | G1/8 male thread + M5 female thread | | | |
| Material | Enclosure: PBT (glass fiber reinforced); LCD display: acrylic; pressure port: stainless steel (SUS303); mounting threaded part: brass (nickel plated); switch part: silicone rubber, M8 connector part: brass • nickel plated (shell)/brass • gold plated (contact) | | | |
| Accessories | Unit selection plate: 1 | | | |

Note: Where measurement conditions have not been specified precisely, the conditions used were ambient temperature +20°C.



DP2

High-performance Digital Pressure Sensors

Features

High accuracy, high resolution, high speed

The DP2 series achieves a 2.5ms, or less, response time at a high resolution of 1/1,000. It enables highly accurate sensing with its excellent repeatability and temperature characteristics.

Clearly visible LED display with 3,5 digits

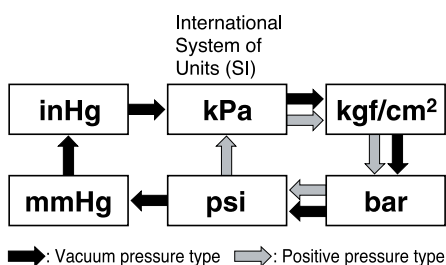
Bright red LED 7-segment display having 3,5 digits, 10mm high. The displayed figures are remarkably noticeable not only in a dark area, but also in a well-lit place.

Setting with easy key operation

Initialization and threshold value settings are easily done by key operation while seeing the values on the display.

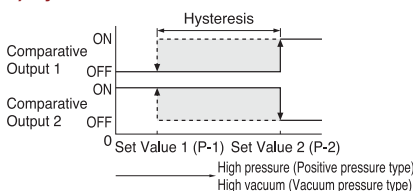
Seletion from six pressure units

The pressure unit can be selected from six different systems to suit your requirement

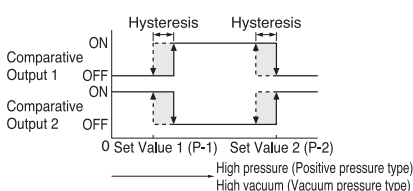


Four output modes enable versatile pressure level control

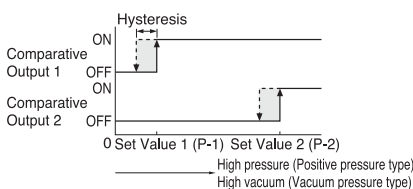
1) Hysteresis mode



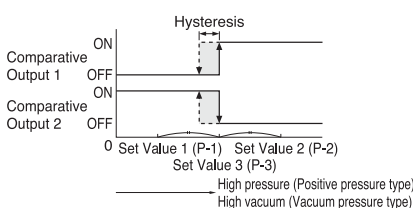
2) Window comparator mode



3) Dual output mode



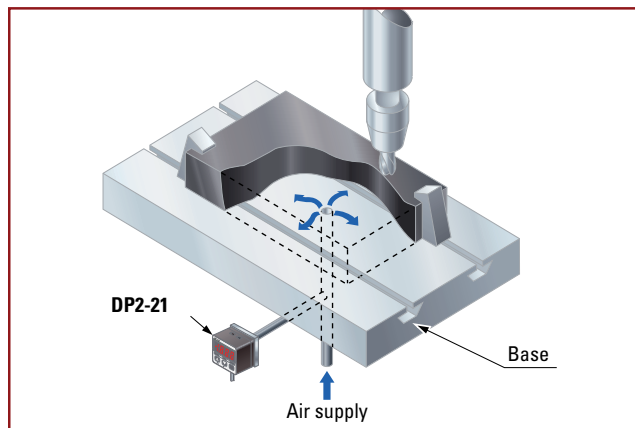
4) Automatic sensitivity setting mode



Typical Applications

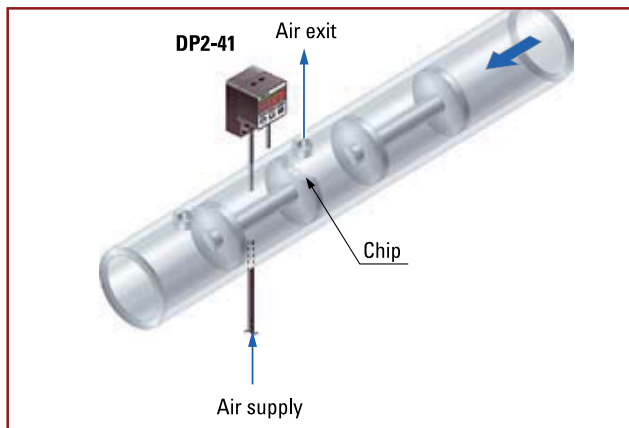
Verifying proper workpiece seating

Air is supplied from under the base, and the pressure sensor checks for air leakage from any gap between the base and the workpiece. If there is no leakage, the workpiece is sealed perfectly, but if the air leaks, the seating is improper.



Detecting broken spool

The pressure sensor detects if a spool is chipped by sensing air leakage in the air-supply system shown below. The DP2 series, providing high accuracy and high resolution, detects even a slight air leakage.



DP4

DP4

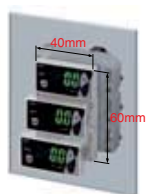
**Suitable for panel installation
due to new shape**

Features

Lightweight, compact design

A compact form specifically designed for mounting on an equipment panel.

It uses only half the space of our conventional product and boasts the lightest weight of just 30g (cable excluded).



Supplied with a simple-to-mount panel mounting bracket

A panel mounting bracket (**MS-DP-1**) is enclosed to enable simple mounting of the sensor onto the panel surface, thus contributing to the total cost reduction.

Bright, easy to view 2-color digital display

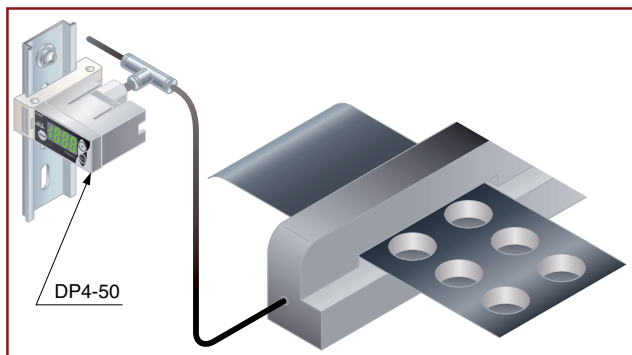
The digital display is a large, easy-to-view, and 2-color digital display. It is also functions as an output indicator as it changes from green to red color when the output turns ON, enabling you to confirm the output status at a glance.

| | |
|------------------------------|--|
| Rated pressure range: | DP4-50/50P 0 to -101.3kPa DP4-52/52P 0 to 1.000MPa DP4-57/57P -100.0 to 100.0kPa |
| Applicable gas: | Non-corrosive gas |
| Supply voltage: | 12 to 24 V DC% |
| Output: | DP4-5□ NPN open-collector transistor DP4-5□P PNP open-collector transistor |

Typical Applications

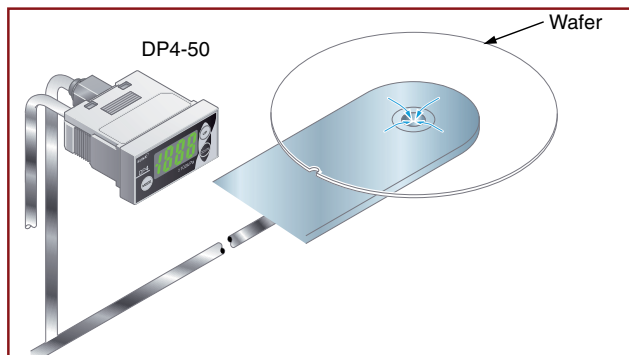
Vacuum level confirmation for vacuum moulding

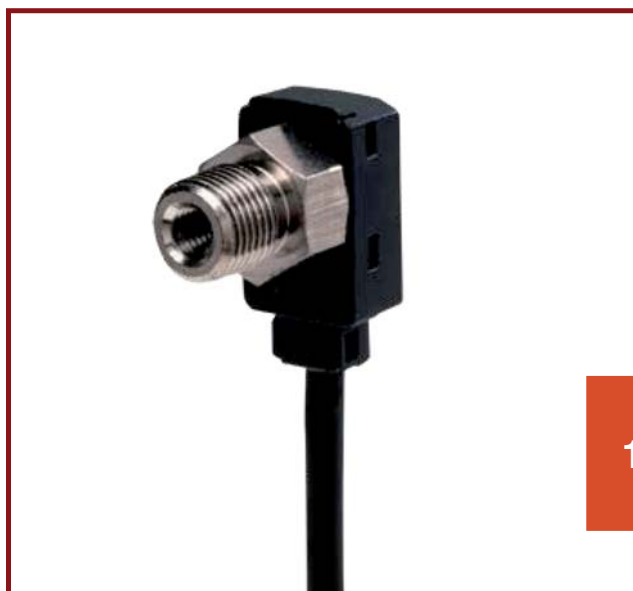
Detects the smallest air leaks from pinholes and other minute imperfections.



Confirming suction of wafer

While a wafer is being carried, the pressure sensor checks the vacuum level in the vacuum pad to verify that the wafer is being securely gripped.





DP5/DPH

1/1000 second high-speed response

Features

Response time 1ms

Mounting the detachable head close to the detecting section minimizes piping and enables response time of 1ms, as well as greatly decreasing tact time delay. In addition, the ultra small and lightweight design of the head means it can easily be mounted on moving sections.

Sensor head with operation indicator

The sensor head is also equipped with an operation indicator. Output ON / OFF can be checked on the sensor head, so that it is suitable for checking operation at the suction head.

Independent use of sensor head possible

Lightweight, compact design

The controller inherits its lightweight, compact design from the popular **DP4** series of digital pressure sensors. Control panel setup is low cost and requires minimal space.

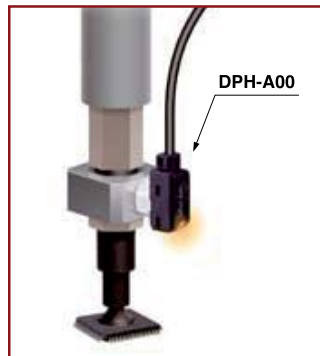
Convenient intermediate cable with connector

Intermediate cable with connectors for connecting the sensor head and the controller makes operation and maintenance easier.

Typical Applications

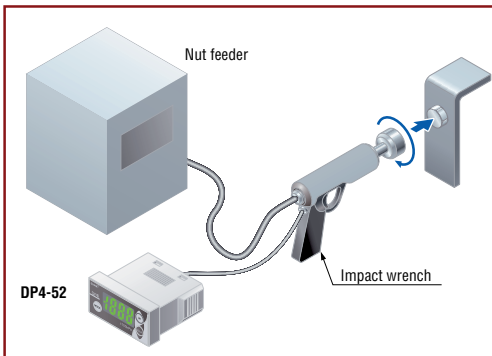
IC suction confirmation

With a light 6g head and a 1ms high-speed response time, it can be used with a high-speed mounter.



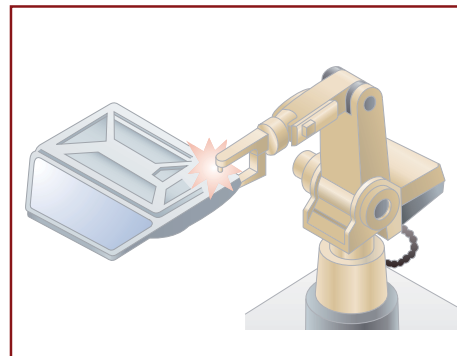
Verifying tightening of nut by impact wrench

The pressure sensor senses the back pressure of the impact wrench to verify that the nut is securely tightened.



Verifying clamping pressure of welding hand

Since the pressure sensor incorporates two outputs, the clamping pressure can be classified into three levels: low, OK and high.





DP-M

Precisely detects minute differences in pressure levels

Features

High accuracy and resolution

Due to differential pressure sensing, the pressure can be set with a high resolution of 0.01kPa.D (1mm H₂O.D) over a pressure range of 0 to 2.00kPa.D (0 to 204mm H₂O.D) and, moreover, the detection accuracy is within 51% F.S.

Bright digital display

Three bright red 7-segment LEDs, 12mm high, are incorporated in the compact body.

Simple key setting

Initialization or pressure settings can be easily done with key operation while looking at the display.

Analogue current output (4 to 20mA) incorporated DP-M2A is also available

Intermediate cable with connectors for connecting the sensor head and the controller makes operation and maintenance easier.

| | |
|-----------------------|-------------------|
| Rated pressure range: | 0 to 2.00kPa.D |
| Applicable fluid: | Non-corrosive gas |
| Supply voltage: | 12 to 24VDC |
| Pressure port: | ∅4.8mm resin pipe |
| Dimensions: | W40×H40×D42.3mm |



GX-F/H

Industry No. 1* in stable sensing

* Based on a research conducted by SUNX as of August 2007 among equivalent rectangular inductive sensors

Features

ENVIRONMENTAL RESISTANCE

10 times the durability! (Compared to previous models)

This sensor has the longest stable sensing range among the same level of rectangular inductive proximity sensors in the industry. It is easy to install the sensor.

- Highly resistant to water or oil!
- Can be installed with ample space
- IP68g* protective construction

The new integrated construction method used improves environmental resistance performance.

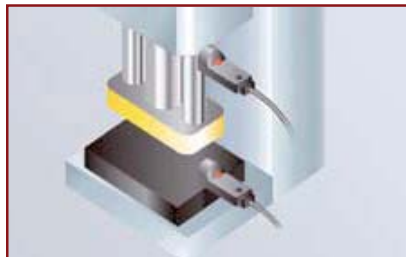
*The IP68g prevents damage to the sensor by stopping water and oil from getting inside.

Indicators are easy to see over a wide field of view

A prism with a wide field of view has been developed, thereby greatly improving the visibility of the operation indicators.

Typical Applications

Checking up/down operation of compact molding equipment



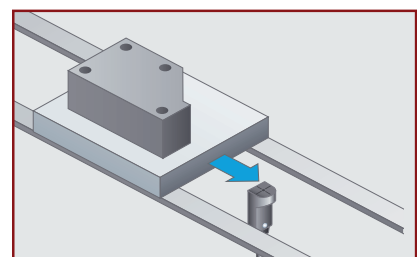
Shock resistance: 5000G

Sensing presence of metallic objects



Vibration resistance: 500Hz

Positioning metal



Technical Specifications

| Model no. | GX-F8A(I) | GX-F8B(I) | GX-F8A(I)-P | GX-F8B(I)-P |
|-------------------------------------|---|------------|---|--------------|
| | GX-H8A(I) | GX-H8B(I) | GX-H8A(I)-P | GX-H8B(I)-P |
| | GX-F12A(I) | GX-F12B(I) | GX-F12A(I)-P | GX-F12B(I)-P |
| | GX-H12A(I) | GX-H12B(I) | GX-H12A(I)-P | GX-H12B(I)-P |
| Maximum operation distance (Note 1) | 2.5mm ±8% GX-□8 | | | |
| Max. operation distance (Note1) | 4.0mm ±8% GX-□12 | | | |
| Supply voltage | 12 to 24VDC ±15% Ripple P-P 10% or less | | | |
| Current consumption | 15mA or less | | | |
| Output | NPN open-collector transistor <ul style="list-style-type: none">• Maximum sink current: 100mA• Applied voltage: 30VDC or less (between output and 0V)• Residual voltage: 1V or less (at 100mA sink current) 0.4V or less (at 16mA sink current) | | PNP open-collector transistor <ul style="list-style-type: none">• Maximum source current: 100mA• Applied voltage: 30VDC or less (between output and 0V)• Residual voltage: 1V or less (at 100mA source current) 0.4V or less (at 16mA source current) | |
| Protection | IP68 (IEC), IP68g (JEM) (Note 2, 3) | | | |
| Temperature characteristics | Over ambient temperature range -25 to +70°C: Within ±8% of sensing range at 23°C | | | |
| Net weight | Front sensing type: 15g approx., top sensing type: 20g approx. | | | |
| Material | Enclosure: PBT, Indicator part: polyester | | | |

Notes: 1) The maximum operation distance stands for the maximum distance for which the sensor can detect the standard sensing object. The stable sensing range stands for the sensing range for which the sensor can stably detect the standard sensing object even if there is an ambient temperature drift and/or supply voltage fluctuation.

2) SUNX's IP68 test method

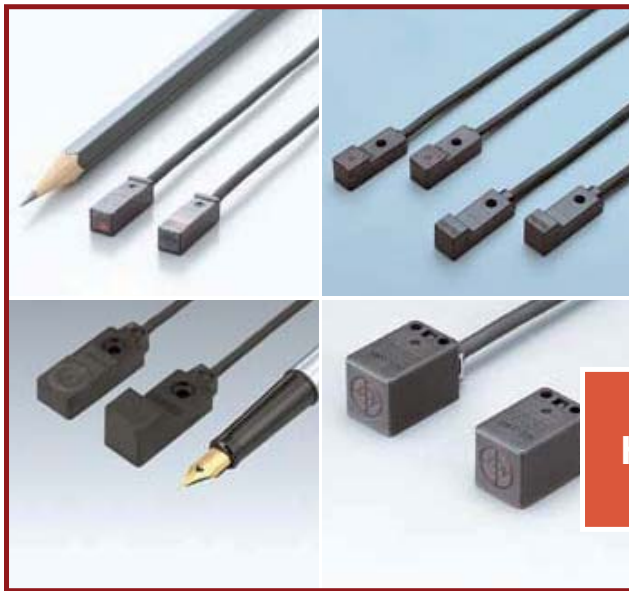
a) Immerse at 0m below 0°C water surface and leave for 30min. Then, immerse at 0m below $+70^{\circ}\text{C}$ water surface and leave for 30min.

b) Regard the heat shock test in a) as one cycle and perform 20 cycles.

c) Leave in water at a depth of 1m for 500 hours.

d) After tests a) to c), insulation resistance, voltage withstandability, current consumption, and sensing ranges must meet the standard values.

3) If using the sensor in an environment where cutting oil droplets splatter, the sensor may deteriorate due to added substances in the oil.



GL

High performance at a low price

Features

Low price

The GL series satisfy the need for a low price inductive proximity sensor. It is recommended to large volume users for cost reduction.

Extremely small

GL-6□

Mountable in a tight space as the sensor is just 6×6×19mm in size. It is suitable for being integrated into a machine.

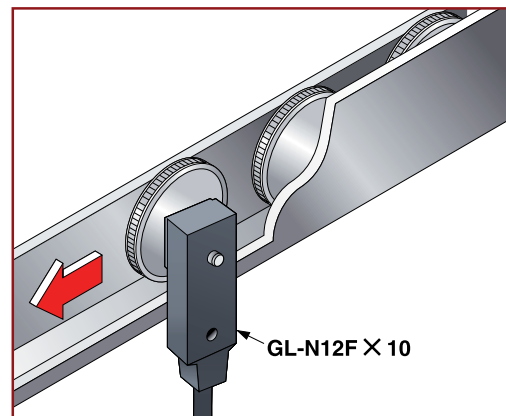
Wide variety

DC 3-wire type (NPN, PNP)/DC 2-wire type, front sensing type/top sensing type, normally open type/normally closed type, as well as different frequency type which allows close mounting of sensors, etc., are available.

Typical Applications

Detecting passing coins in game machine

The inductive proximity sensor detects coins passing by. Since there is no contact, it features high reliability and long life.



Technical Specifications

| Model no. | GL-6□ | GL-8/8U□ | GL-N12□ | GL-18H□ | GL-18HL□ |
|----------------------------|--|---|---|-------------|---------------|
| Maximum operation distance | 1.6mm ± 15% | 2.5mm ± 20% | 4 ± 0.5mm | 5mm ± 10% | 12mm ± 10% |
| Supply voltage | 12 to 24VDC | | | 10 to 30VDC | |
| Output (Note 2) | NPN open-collector transistor (GL-8U□ Non-contact DC 2-wire type) | | | | |
| Protection | IP67 (IEC), IP67g (JEM) (except GL-8/8U□ and GL-N12□) | | | | |
| Dimensions | □6×19mm | Front sensing type: W8×H24× D7.4mm Top sensing type: □8×D26mm | Front sensing type: W12×H27.4 ×D7.1mm Top sensing type: W12×H13× D14.4mm | □18×D28mm | |

Notes: 1): 5m cable length type (standard: 1m) is also available (except GL-8H/18HL□).
2): PNP output type is also available for GL-N12□.

GP-X



GP-X

High-speed sampling 25 μ s and high resolution 0.02%

Features

We have realized a 25 μ s (40,000 times/sec.) ultra high sampling speed

These devices boast 0.07% F.S./7C temperature characteristics

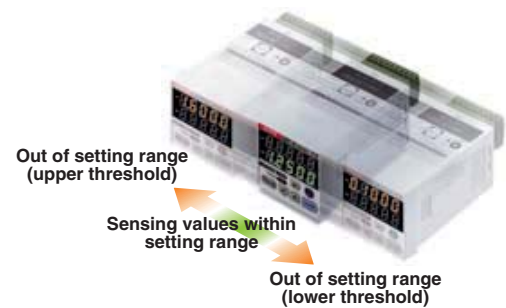
They perform with a $\pm 0.3\%$ F.S. linearity for stainless steel and iron

Because they perform with a $\pm 0.3\%$ F.S. linearity, they can be used for sensing stainless steel and iron, enabling precise measurements not affected by the workpiece's material.

Intelligent monitor GP-XAiM (optional) optimal for collecting and analyzing measurement data

The 5-digit, dual, 2-color digital display offers great visibility

If the measurement results fall within the setting range (GO), they will appear on the lower digital display in green. If they are out of range (HI, LO), they will be displayed in the upper digital display in orange. The display position and color change permit accurate visibility even for momentary changes.



Technical Specifications

Sensor heads

| Model no. | GP-X3SE | GP-X5SE | GP-X8S | GP-X10M | GP-X12ML | GP-X22KL |
|--------------------------|---|----------|----------|----------|----------|-----------|
| Sensing range | 0 to 0.8mm | 0 to 1mm | 0 to 2mm | 0 to 2mm | 0 to 5mm | 0 to 10mm |
| Standard sensing object: | Stainless steel (SUS304)/iron sheet 60×60×1mm | | | | | |
| Ambient temperature | -10 to +55°C | | | | | |
| Dimensions (mm) | ∅3.8×17 | ∅5.4×17 | ∅8×17 | M10×17 | M12×21 | ∅22×35 |

Controller

| Set model No. | NPN output type GP-XC□, PNP output type GP-XC□-P |
|----------------------------------|--|
| Supply voltage | 24VDC $\pm 10\%$ |
| Resolution | (64 times average processing): GP-XC3SE/XC5SE 0.04% F.S. GP-XC8S/XC10M/XC12ML/XC22KL 0.02% F.S. |
| Analog voltage output: | Output voltage 15 to +5V |
| Comparative outputs (HI, GO, LO) | GP-XC□ NPN open-collector transistor GP-XC□-P PNP open-collector transistor |
| Dimensions (mm) | W48×H48×D83mm |

Laser Displacement sensor

HL-C1

HL-C1



Ultra high-speed & stable measurement for a variety of measurement objects

Features

100μs of sampling rate is now available

The most amazing, ultra high-speed sampling in the industry has now been achieved for displacement sensors utilizing linear image sensors, thus enabling ultra high-speed measurement of rotating, vibrating and moving objects.

Resolution of 1μm, linearity of ±0.1% F.S.

Now available with ultra-precise 1μm resolution measurement capability (HL-C105B-BK, HL-C105F-BK, HL-C105B, HL-C105F) and a linearity of ±0.1% F.S. (for all models).

Touch panel operation, easy and compact

A variety of setting and measurement data can be displayed easily (optional).



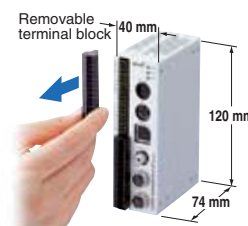
High accuracy measurement is now possible, unaffected by the surface condition of the detected object

All deficiencies inherent in the conventional PSD sensing method have now been completely solved. Whereas the PSD method measures position information from the center of gravity of the total light quantity distribution of the light spots connected along each light element, the linear image sensing method measures the peak position values for the light spots themselves. This advance now makes high-precision measurement possible, regardless of the surface condition of the object, whether for metal hairline surface cracks or for non-reflective surfaces, e.g. black rubber.

Two sensor heads can be connected! Reduces costs and saves space

Controller compact and front connection reduces setup space

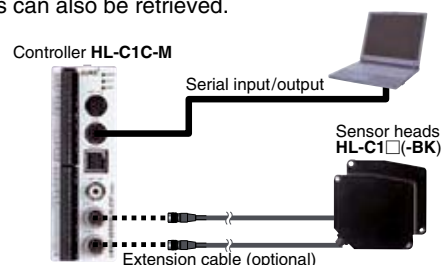
The ultra compact controller with dimensions of W40×H120×D74mm requires extremely little space for installation. Adhesive installation is also possible. Furthermore, the cables can be connected directly or to a removable terminal block, so that all connections come from the same direction in order to further save space.



Equipped with serial input/output

An RS-232C interface for serial input and output is provided so that settings can be retrieved and saved.

Measurement values can also be retrieved.



FDA standards conforming types are available

Special version for measurement of raw and completed rubber tire

The HL-C1 series has added a new line of tire measuring specialized versions for tire making processes.

The high-powered 5mW type enables high accuracy and stable measurement of raw tires and completed tires which were previously considered difficult to measure.

HL-C1 Typical Applications

Measuring glass substrate thickness

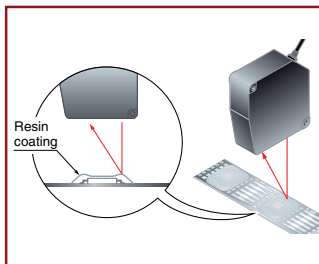
The HL-C1 series specular reflective type realizes stable distance measurements even for specular and transparent objects.

Detecting the presence of the resin coating

The HL-C1 series detects translucent resin coating.

Measuring the eccentricity of metal shaft

By using the filter function, it can quickly and stably measure even workpieces with tiny scratches.



Technical Specifications

Sensor heads

| Type | Diffuse reflective | | Specular reflective | |
|-----------------------------|--|------------------|---------------------|------------------|
| | General propose | High accuracy | General propose | High accuracy |
| Model no. (Note 1) | HL-C108B(F)-BK | HL-C105B(F)-BK | HL-C108B(F) | HL-C105B(F) |
| Measurement center distance | 85mm | 50mm | 81.4mm | 46mm |
| Measuring range | ±20mm | ±5mm | ±16mm | ±4mm |
| Resolution (Note 2) | 2μm | 1μm | 2μm | 1μm |
| Linearity | ±0.1%F.S. | | | |
| Emitting element | Red semiconductor laser, Class 2 (class II for FDA standards conforming type)(IEC/JIS standards conforming type: IEC / JIS, FDA standards conforming type: JIS / IEC / FDA)(Max. output: 1 mW, Peak emission wavelength: 685 nm) | | | |
| Beam diameter | 100×140μm approx. | 70×120μm approx. | 100×140μm approx. | 70×120μm approx. |
| Protection | IP67 (excluding connector) | | | |
| Ambient temperature | 0 to +45°C | | | |
| Dimensions (W×H×D) | 26.6×82×87mm | | | |

Notes: 1) HL-C10□B(-BK) is IEC/JIS standards conforming type.
HL-C10□F(-BK) is FDA standards conforming type.

2) Where measurement conditions have not been specified precisely, the conditions used were as follows: supply voltage 24V DC, ambient temperature +20°C, sampling rate 100μs, average number of samples: 256, measurement center distance, object measured is made of white ceramic (an aluminum vapor deposition surface reflection mirror was used with specular reflective type). Linearity also depends upon the characteristics of the object being measured.

Controller

| Model no. | | HL-C1C-M |
|---------------------------|--------------|--|
| Connectable sensor head | | Max. 2 sensor heads |
| Supply voltage | | 24VDC±10% |
| Sampling rate | | Selectable from 100μs/144μs/200μs/255μs/332μs/498μs/1000μs |
| Analog output | Voltage | Output voltage ±5 V/V.S, Output current: Max. 2mA Output impedance: 50Ω |
| | Current | Output current: 4 to 20mA/F.S., Load resistance: 250Ω or less |
| | Output range | Voltage: 110.9 to +10.9V, Current: 0 to 29.5mA |
| Judgment outputs (O1, O2) | | Photo-MOS relay |
| Average number of samples | | OFF, 2 to 32,768 cycles (switching in 16 steps) |
| Ambient temperature | | 0 to +50°C |
| Dimensions (mm) | | W40×H120×D74 |



HL-C135C-BK10 HL-C1C-M-WL

**Superlative wide-range
measurement with the small head**

Features

Measures wide changes over long ranges

The long-range and wide-range capabilities over **350mm** $\pm 200\text{mm}$ allow large changes to be measured. Even if the object's position changes, there is no need to change the sensor head settings or position.

High speed and high precision even over long and wide ranges

High-speed and high-precision measurement is possible with high-speed sampling of **100 μs** at a resolution of **10 μm** and a linearity of $\pm 0.1\%$ F.S.



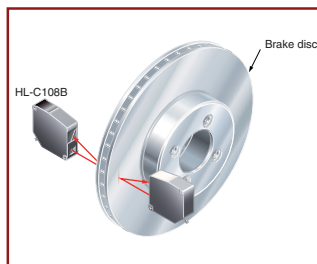
Sensor heads

| | |
|-----------------------------|--|
| Measurement center distance | 350mm |
| Measuring range | $\pm 200\text{mm}$ |
| Emitting element: | Red semiconductor laser, Class 3B (IEC/JIS) |
| Beam diameter: | 400 \times 200 μm approx. |
| Dimensions (mm) | W48 \times H48 \times D83mm |
| Controller | Specifications are the same as for the HL-C1C-M controller on the previous page. |

Typical Applications

Measuring brake disk thickness

Ultra high speed and high precision measurements of brake disk thickness.



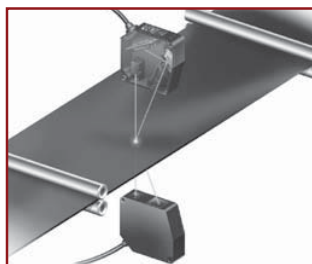
Inspecting tire form

High precision measurement of object surface irregularities on black rubber or other low reflected light intensity sensing object.



Measuring the thickness of rubber sheet

By using the filter function, it can quickly and stably measure even workpieces with tiny scratches.



Measuring glass substrate thickness

The HL-C1 series specular reflective type realizes stable distance measurements for even specular and transparent objects.



HL-T1



HL-T1

A high-functionality intelligent controller

The small sensor head

The most compact size and yet the highest level of performance in their class. These sensors save space.

Resolution of 4μm

A high resolution of 4μm (at an average 64 cycles) allows high-precision positioning and size judgment.

High-precision measurement even of minute differences in light intensity

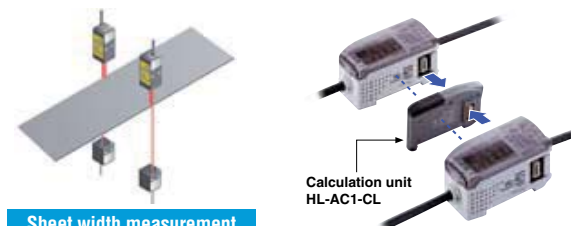
The sensors are sensitive to minute differences in light intensity, so that they can judge even the opacity of glass and turbidity of liquids. In addition, the amount of light received can be displayed as a percentage to allow you to determine permeation rates.



Distinguishing opacity of glass

Calculations for 2 sensors are possible

The calculation unit (optional) just needs to be connected between the two controllers to enable calculations (addition and subtraction) to be carried out for two sensors. No digital panel controller is needed.



Sheet width measurement

FDA standards conforming types are available

FDA standards conforming types, most suitable for equipment used in the USA, are now available (FDA: class II, IEC/JIS: class 1).

Technical Specifications

Sensor heads

| Type | Beam diameter Ø1mm type | | Sensing width 5mm | Sensing width 10mm type |
|---|------------------------------|--|-----------------------|-------------------------|
| Model no. (Note 1) | HL-T1001A(F) | | HL-T1005A(F) | HL-T1010A(F) |
| Sensing range | 0 to 500mm | 500 to 2000mm | 500mm | |
| Sensing width | Ø1mm | Ø1 to Ø2.5mm | 5mm | 10mm |
| Min. sensing object | Ø8µm opaque object | Ø50µm opaque object | Ø0.05mm opaque object | Ø0.1mm opaque object |
| Repeatability (during the state in which light is half blocked) | 4µm (Note 2) | — | 4µm (Note 2) | |
| Linear output resolution | 4µm (Note 2) | — | 4µm (Note 2) | |
| Ambient temperature | 0 to +50°C | | | |
| Emitting element | IEC/JIS standards | Red semiconductor laser, Class 1 (IEC/JIS) [modulated, max. output 0.35mW (HL-T1001A(F): 0.2mW), emission peak wavelength: 650nm] | | |
| | FD standards conforming type | Red semiconductor laser, Class 2 (FDA) [modulated, max. output 0.35mW (HL-T1001A(F): 0.2 mW), emission peak wavelength: 650nm] (IEC/JIS: class 1) | | |

Notes: 1) HL-T10MA is IEC/JIS standards conforming type.
HL-T10MF is FDA standards conforming type.
2) With an average sampling rate of 64 times.

Controllers

| Type | NPN output | PNP output |
|-----------------------------------|--|-------------------------------|
| Model no. | HL-AC1 | HL-AC1P |
| Supply voltage | 12 to 24VDC ±10% | |
| Measuring cycle | 150μs | |
| Linear output | Current / voltage output switchable | |
| | <ul style="list-style-type: none"> During current output: 4 to 20mA/F.S., max. load resistance 300Ω During voltage output: 54V/F.S., output impedance 100Ω (In the monitor focus function, it can also be set at 55V, 0 to 5V, etc.) | |
| Temperature characteristics | ±0.2% F.S./°C | |
| Settable average sampling rate | 1 / 2 / 4 / 8 / 16 / 32 / 64 / 128 / 256 / 512 / 1024 / 2048 / 4096 | |
| Judgment output (HIGH, PASS, LOW) | NPN open-collector transistor | PNP open-collector transistor |
| Ambient temperature | 0 to +50°C | |
| Dimensions (mm) | W30×H34.3×D64.3mm | |

Ultrathin Type Ionizer

ER-VW

ER-VW



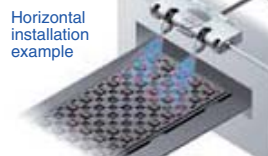
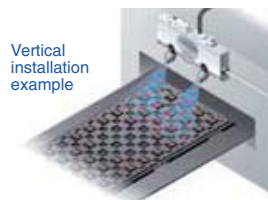
Nozzle angle adjustment and joint layout can be selected as desired

Features

Nozzle angle adjustment mechanism

The angles of the two nozzles can be adjusted within a range of approximately 190° by screwing down the ends of the nozzles. After adjusting the angle, turn the ends of the nozzles to tighten them and secure them at that angle. This allows the nozzle angles of the ER-VW to be adjusted easily after installation.

Installation examples



Includes angle adjustment scale

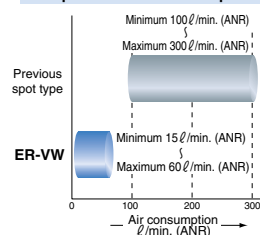
Compact and ultrathin design

The thickness of the unit is 18.9mm. Even so, the nozzle angles can be adjusted, so that they can still be installed in places where there are space restrictions, such as inside other equipment or along several adjacent production lines.

Minimum air consumption 15ℓ/min. (ANR)

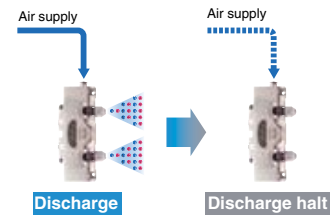
ER-VW can utilize air flow levels starting from a minimum of 15ℓ/min. Because the amount of air consumed is so low, the loads placed on air supply equipment can be reduced and costly clean air can be used much more economically.

Comparison of air consumption



Air supply monitoring function

This function causes discharging to stop automatically if the supply of air drops below a certain pressure. Notification of this is given when the AIR indicator lights up and the discharge output (DSC) turns off. This prevents objects which are not charged from being overlooked when the air supply has been stopped.

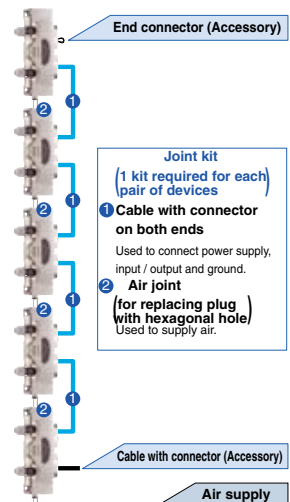


Easy connection possible

The joint kit (optional) can be used to connect up to a maximum of 5 ER-VW units. The air supply part is connected via quick connection joints, and the power supply and input/output signals can also be connected easily using connection cables with connectors at both ends.

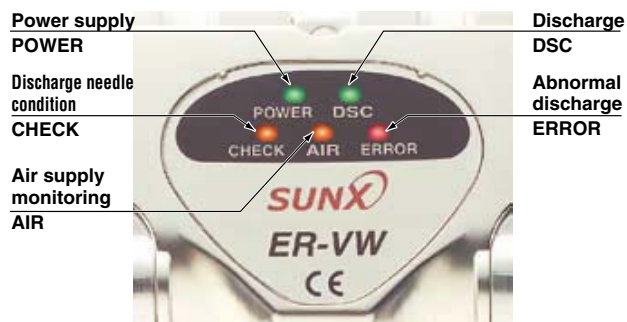
Multiple ER-VW units can be connected to provide charge removal layouts that suit the target equipment.

Connection application example



ER-V Functions to support accurate charge removal

In addition to the air supply monitoring function, the ER-VW is equipped with the following functions to ensure accurate charge removal.



Discharge halt function: Uses external input to forcibly stop discharge.

Check function: Uses the CHECK indicator and output to notify the operator when it is time to clean or replace the discharge needle.

Abnormal discharge monitoring function: Uses the ERROR indicator and output to notify the operator when a problem with discharge occurs, and stops discharge. It can be canceled by means of reset input.

Discharge output: Output is ON during discharging. This lets you check when discharging is being carried out.

Check output: Output turns ON when the discharge needle is dirty.

Error output: Output turns OFF when there is a problem with discharging (normally it is ON). It also allows you to check the power supply to the ionizer.

Typical Applications

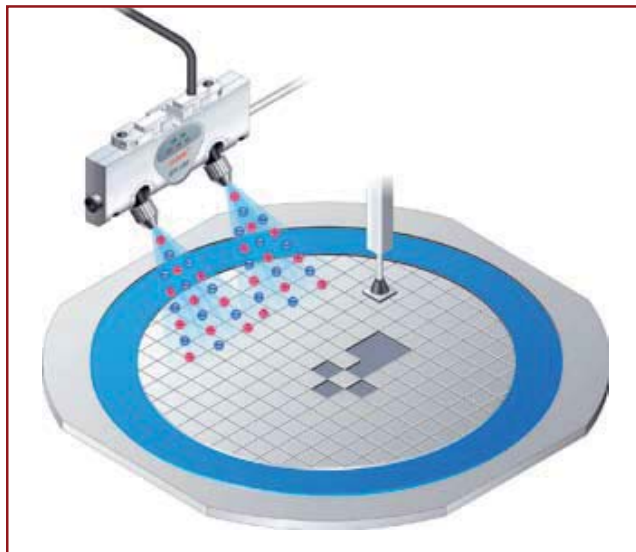
Removing charge during pickup from dicing type

Ideal for preventing damage to devices from static electricity.



Removing charges from surfaces of CDs / DVDs

Adjustment of the nozzle angle allows the charge removal area to be laid out in accordance with the position of the object.



Technical Specifications

| Type | Spot type |
|---|---|
| Model no. | ER-VW |
| Charge removal time ($\pm 1,000V \rightarrow \pm 5100V$) | 1 sec. or less (Note 1) |
| Ion balance | Within $\pm 15V$ (Note 1) |
| Supply voltage | 24VDC $\pm 10\%$ |
| Output | Check (CHECK) Error (ERROR) Discharge (DSC)(Note 2) |
| | NPN open-collector transistor |
| Ambient temperature | 0 to $+55^{\circ}C$ |

Notes: 1) A typical sample applied with a supply voltage of 24V, a distance of 100mm from the front surface of the air flow outlet and a pressure of 0.25MPa (measured on a sample left in the atmosphere at a relative humidity of 65% RH or less for 24 hours or more).

2) 'DSC' is the abbreviated symbol for 'DISCHARGE'.

ER-V



Ultra compact high-performance ionizer

Features

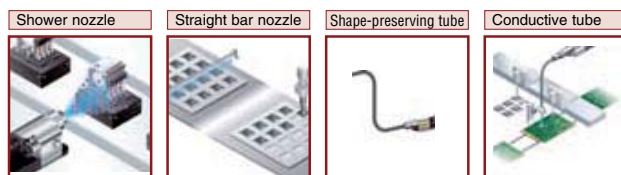
Produces excellent ion balance

The adoption of high-frequency AC method allows extremely stable ion balance to be achieved. Because the ion balance is not affected by the pressure of air supplied or by the setup distance, no troublesome adjustments are required after setup.

High performance with no controller needed

A full range of functions have been provided with full consideration given to ease of use in the workplace. No separate controller is needed.

Nozzle variations can be selected to suit the application



Ultra compact design accurately removes charges of objects even from narrow spaces

The main unit is merely 109×27×28mm, so it can easily be combined with other devices and also be installed as an add-on. Furthermore, the high-voltage power supply is built-in, so no extra space is required except for the ionizer itself.



It can be installed in places where the conventional bar type cannot, so it can be placed closer to the object for more accurate charge removal.

| Type | Spot type |
|--|--------------------------------|
| Model no. | ER-VS01 |
| Charge removal time (±1000V→±5100V) | 1 sec. or less (Note 1) |
| Ion balance | Within ±15V (Note 1) |
| Supply voltage | 24VDC ±10% |
| Output | Check (CHECK) Error (ERROR) |
| | NPN open-collector transistor |
| Ambient temperature | 0 to +55°C |

Note: A typical sample applied with a supply voltage of 24V, a distance of 100mm from the front surface of the air flow outlet and a pressure of 0.25MPa while the shower nozzle is in use (measured on a sample left in the atmosphere at a relative humidity of 65% RH or less for 24 hours or more).

Typical Applications

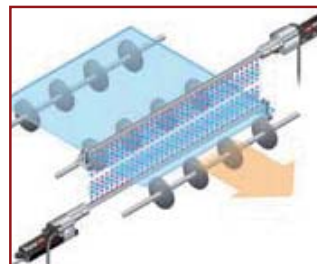
Change removal and dust removal of lenses



Prevent discharge damage in circuit board LEDs



Charge removal of FPD glass surfaces



EF-S1



EF-S1

Constantly checks static electricity in process lines

Maintains and regulates product quality by eliminating static electric damage

The static electricity that can build up in various places in a process line can be monitored constantly, so that abnormalities can be prevented before they occur. This makes it possible to determine if damage or malfunctions are being caused by static electricity, so that stable product quality can be maintained.

Reduces man hours for ionizer inspections

The de-ionizing effectiveness of ionizers can be understood in real-time, so that things such as ionizer damage and the replacement period for worn components can be checked objectively, reducing the number of man hours required for inspection and testing.

Sensor head

| Type. | Spot type |
|---------------|---|
| Model no. | EF-S1HS |
| Sensing range | 8.0 to 20.5mm (51kV range) 21.0 to 40.5mm (52kV range) |

Controller

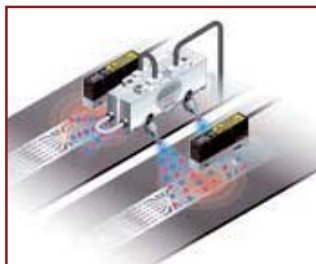
| Type | Spot type |
|-----------------------------------|---|
| Model no. | EF-S1C |
| Supply voltage | 24VDC $\pm 10\%$ |
| Display range (Measurement range) | 11,000 to 1000 (51kV range) 12,000 to 2000 (52kV range) |
| Judgment output | NPN open-collector transistor |
| Analog output | Output voltage 1 to 5V Output impedance 100 Ω approx. |

Typical Applications

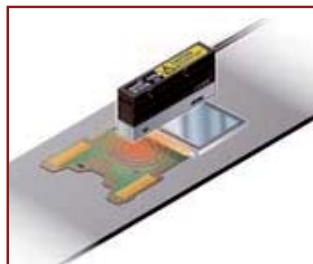
Measuring surface potential when removing BG sheets



Measuring static electric charges in lead frames



Measuring frictional electrification of LCD modules



North America

Europe

Asia Pacific

China

Japan

Panasonic Electric Works

Please contact our Global Sales Companies in:

| Europe | | |
|---------------------------|--|---|
| ▶ Headquarters | Panasonic Electric Works Europe AG | Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. (08024) 648-0, Fax (08024) 648-111, www.panasonic-electric-works.com |
| ▶ Austria | Panasonic Electric Works Austria GmbH | Rep. of PEWDE, Josef Madersperger Str. 2, 2362 Biedermannsdorf, Tel. (02236) 26846, Fax (02236) 46133, www.panasonic-electric-works.at |
| | PEW Electronic Materials Europe GmbH | Ennshafenstraße 30, 4470 Enns, Tel. (07223) 883, Fax (07223) 88333, www.panasonic-electronic-materials.com |
| ▶ Benelux | Panasonic Electric Works | De Rijn 4, (Postbus 211), 5684 PJ Best, (5680 AE Best), Netherlands, Tel. (0499) 372727, Fax (0499) 372185, www.panasonic-electric-works.nl |
| | Sales Western Europe B.V. | |
| ▶ Czech Republic | Panasonic Electric Works Czech s.r.o. | Průmyslová 1, 34815 Planá, Tel. 374 799 990, Fax 374 799 999, www.panasonic-electric-works.cz |
| ▶ France | Panasonic Electric Works | Succursale Française, 10, rue des petits ruisseaux, 91370 Verrières le Buisson, Tél. 01 60135757, Fax 01 60135758, www.panasonic-electric-works.fr |
| | Sales Western Europe B.V. | |
| ▶ Germany | Panasonic Electric Works Deutschland GmbH | Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. (08024) 648-0, Fax (08024) 648-555, www.panasonic-electric-works.de |
| ▶ Hungary | Panasonic Electric Works Europe AG | Magyarországi Közvetlen Kereskedelmi Képviselete, 1117 Budapest, Neumann János u. 1., Tel. 06 1 482 9258, Fax 06 1 482 9259, www.panasonic-electric-works.hu |
| | | Dublin, Tel. (01) 4600969, Fax (01) 4601131, www.panasonic-electric-works.co.uk |
| ▶ Ireland | Panasonic Electric Works UK Ltd. | Via del Commercio 3-5 (Z.I. Ferlina), 37012 Bussolengo (VR), Tel. (045) 6752711, Fax (045) 6700444, www.panasonic-electric-works.it |
| ▶ Italy | Panasonic Electric Works Italia s.r.l. | Building Materials Division, Piazza della Repubblica 24, 20154 Milano (MI), Tel. (02) 29005391, Fax (02) 29003466 |
| | Panasonic Electric Works Italia s.r.l. | Sjöängsvägen 10, 19272 Sollentuna, Sweden, Tel. (08) 59476680, Fax (08) 59476690, www.panasonic-electric-works.se |
| ▶ Nordic Countries | Panasonic Electric Works Nordic AB | Citadellsvägen 23, 21118 Malmö, Tel. (040) 6977000, Fax (040) 6977099, www.panasonic-fire-security.com |
| | PEW Fire & Security Technology Europe AB | Al. Krakowska 4/6, 02-284 Warszawa, Tel. 22 338-11-33, Fax 22 338-12-00, www.panasonic-electric-works.pl |
| ▶ Poland | Panasonic Electric Works Polska sp. z o.o. | Portuguese Branch Office, Avda Adelino Amaro da Costa 728 R/C J, 2750-277 Cascais, Tel. (21) 4812520, Fax (21) 4812529 |
| ▶ Portugal | Panasonic Electric Works España S.A. | Barajas Park, San Severo 20, 28042 Madrid, Tel. (91) 3293875, Fax (91) 3292976, www.panasonic-electric-works.es |
| ▶ Spain | Panasonic Electric Works España S.A. | Grundstrasse 8, 6343 Rotkreuz, Tel. (041) 7997050, Fax (041) 7997055, www.panasonic-electric-works.ch |
| ▶ Switzerland | Panasonic Electric Works Schweiz AG | Sunrise Parkway, Linford Wood, Milton Keynes, MK14 6 LF, Tel. (01908) 231555, Fax (01908) 231599, www.panasonic-electric-works.co.uk |
| ▶ United Kingdom | Panasonic Electric Works UK Ltd. | |
| North & South America | | |
| ▶ USA | PEW Corporation of America | 629 Central Avenue, New Providence, N.J. 07974, Tel. 1-908-464-3550, Fax 1-908-464-8513, www.pewa.panasonic.com |
| Asia Pacific/China/Japan | | |
| ▶ China | Panasonic Electric Works (China) Co., Ltd. | Level 2, Tower W3, The Towers Oriental Plaza, No. 2, East Chang An Ave., Dong Cheng District, Beijing 100738, Tel. (010) 8518-5988, Fax (010) 8518-1297 |
| ▶ Hong Kong | Panasonic Electric Works (Hong Kong) Co., Ltd. | RM1205-9, 12/F, Tower 2, The Gateway, 25 Canton Road, Tsimshatsui, Kowloon, Hong Kong, Tel. (0852) 2956-3118, Fax (0852) 2956-0398 |
| ▶ Japan | Matsushita Electric Works, Ltd. | 1048 Kadoma, Kadoma-shi, Osaka 571-8686, Japan, Tel. (06) 6908-1050, Fax (06) 6908-5781, www.mew.co.jp/e-acg/ |
| ▶ Singapore | Panasonic Electric Works Asia Pacific Pte. Ltd. | 101 Thomson Road, #25-03/05, United Square, Singapore 307591, Tel. (06255) 5473, Fax (06253) 5689 |