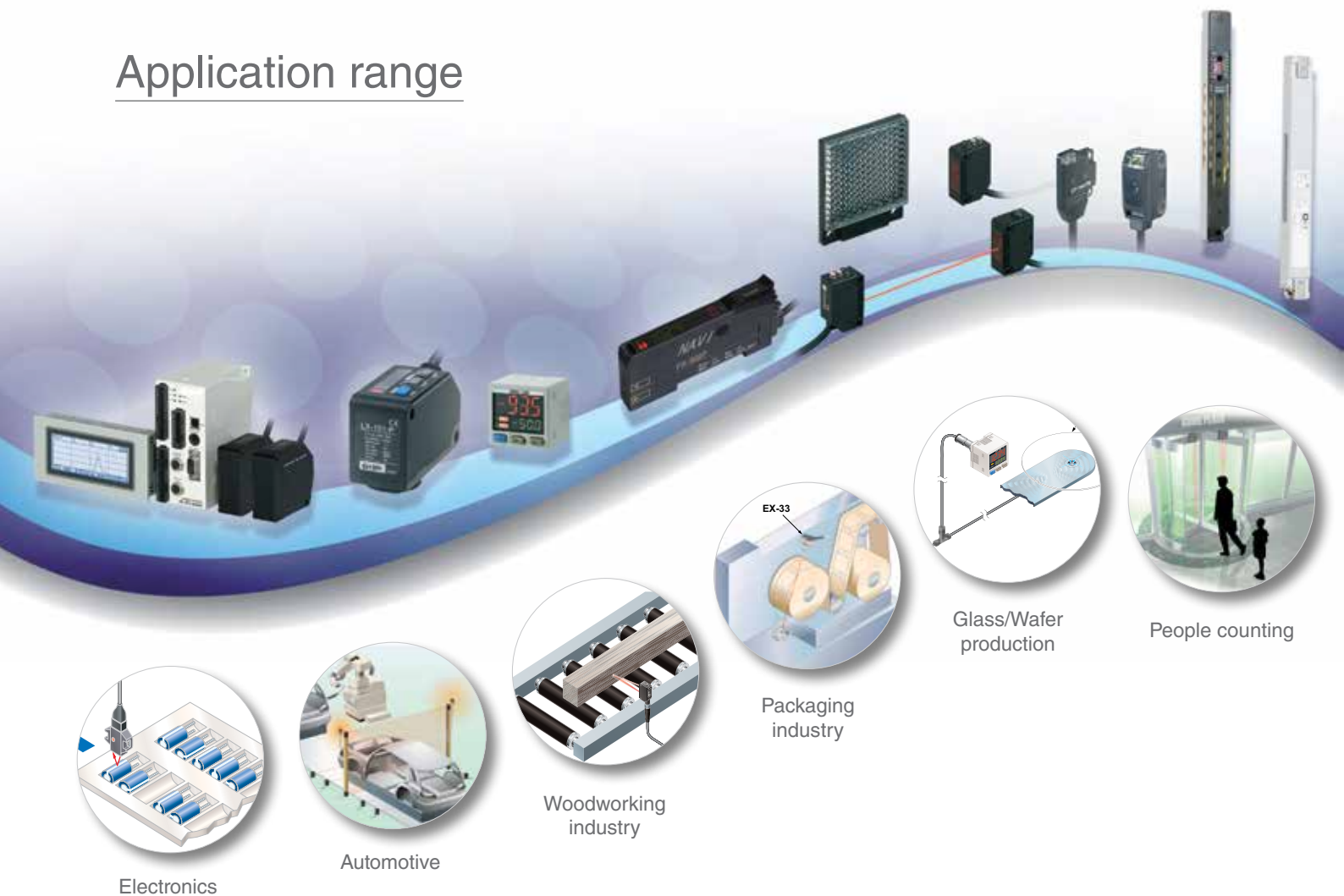# Panasonic

SHORT FORM

SENSORS

A new performance class of innovative sensor technology

The delivery program: innovative and extensive. Besides through-beam and retroreflective types, reflective sensors and optical fiber photoelectric sensors, we also offer laser and eddy current analog sensors that provide precise measurement results even in the most complicated of applications.

Our delivery program also includes safety sensors, photoelectric sensors for special applications, inductive proximity switches and miniature pressure sensors for relative or differential pressure measurement, and ionizers for Electro Static Discharge (ESD) applications.

Application range

EX-33

Glass/Wafer production

People counting

Packaging industry

Woodworking industry

Automotive

Electronics

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 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. Besides the most important technical data, you will find numerous illustrations of possible applications. Of course, detailed data sheets are available for download on our website www.panasonic-electric-works.com. Our product managers, sales and application engineers will be happy to advise you.

Contents

CX-400

A full lineup of world standard photoelectric sensors

Features

■ Great lineup of 170 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
CX-413□ Thru-beam (long sensing range)	30m
CX-412□ Thru-beam	15m
CX-411□ Thru-beam	10m
CX-493□ Retroreflective (long sensing range)	5m
CX-491□ Retroreflective (with polarizing filters)	3m
CX-482□ Retroreflective (transparent object sensing)	0,1 - 2m
CX-483□ Retroreflective (transparent object sensing)	50 - 1000mm
CX-481□ Retroreflective (transparent object sensing)	50 - 500mm
CX-422□ Diffuse reflective type	800mm
CX-421□ Diffuse reflective type	300mm
CX-424□ Diffuse reflective type	100mm
CX-423□ Diffuse reflective (narrow-view)	70 - 200mm
CX-442□ Adjustable range reflective	20 - 300mm
CX-444□ Adjustable range reflective	15 - 100mm
CX-443□ Adjustable range reflective	2 - 50mm
CX-441□ Adjustable range reflective (small spot)	2 - 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 11.2x31x20mm (WxHxD). The mounting pitch is also at the world standard size of 25.4mm.
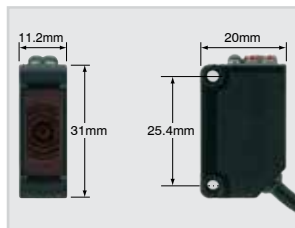
■ Less processing

M8 plug-in connector type and M12 pigtailed type are available. This contributes to less time spent setting up. In addition, cable types are available with the following cable lengths: 0.5m, 2m, and 5m.
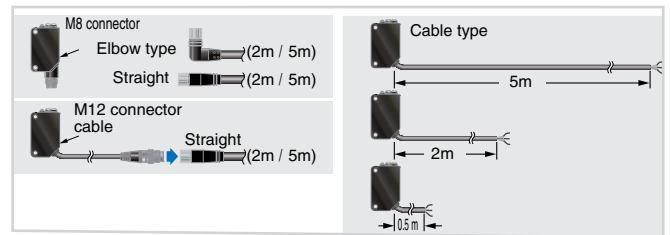
■ Less power consumed

By relentlessly developing our technologies, we have been able to considerably reduce our sensors' power consumption.

60% Reduction

Old **CX-482** 25mA   New **CX-482** 10mA
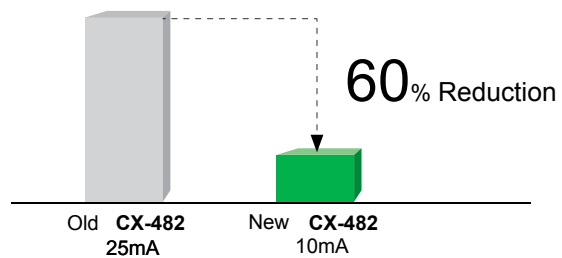
■ Less resources used

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

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

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Index

Standard Sensors

CX-400

■ Strong against oil and coolant liquids

CX-41❏/42❏/49❏

The lens material for the thru-beam type, retroreflective type (excluding the CX-48❏) and the diffuse reflective type is 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 is 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 mounted close together.
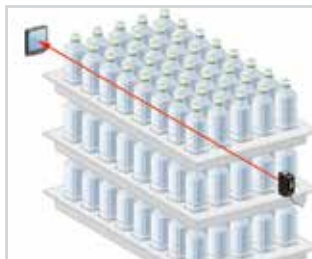
Typical applications

Detecting cars on conveyor lines

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.
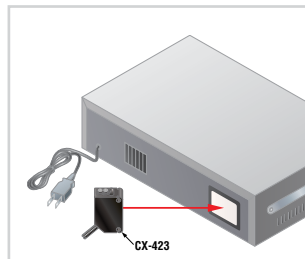
Detecting transparent bottles

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.

Detecting labels

CX-423

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. 2mm, 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.

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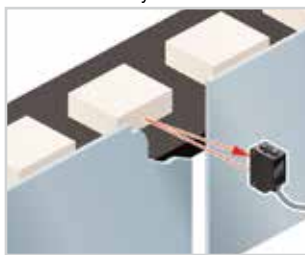
BGS/FGS functions make even the most challenging settings possible!

Background suppression BGS
When object and background are separated.

Foreground suppression FGS
When object and background are close together.
When the object is glossy or uneven.

2.5 times the sensing capability

Height differences of as little as 0.4mm can be detected at a setting distance of 20mm.

0,4mm

30 % higher sensing capability

Technical specifications

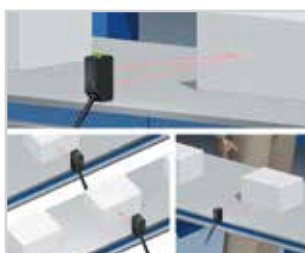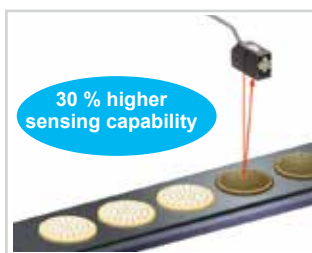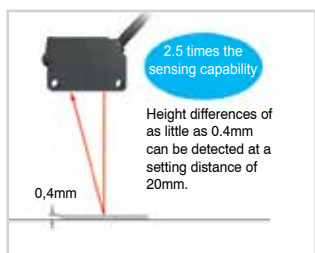| Type		Thru-beam			Retroreflective				
				Long sensing range	With polarizing filter	Long sensing range	For transparent object sensing		
Model no.	NPN	CX-411(-Z) (Note 1)	CX-412(-Z)	CX-413(-Z)	CX-491(-Z)	CX-493(-Z)	CX-481(-Z)	CX-483(-Z)	CX-482(-Z)
	PNP	CX-411-P(-Z)	CX-412-P(-Z)	CX-413-P(-Z)	CX-491-P(-Z)	CX-493-P(-Z)	CX-481-P(-Z)	CX-483-P(-Z)	CX-482-P(-Z)
Sensing range		10m	15m	30m	3m (Note 2)	5m (Note 2)	50 to 500mm (Note 2)	50 to 1.0m (Note 2)	0.1 to 2m (Note 2)
Object to be sensed		Ø 12mm (opaque)			Ø 50mm (opaque, transparent) (Note 2)	Ø 50mm (opaque, transparent or specular) (Note 2)			
Hysteresis		–							
Supply voltage		12 to 24V DC ±10%							
Output		PNP / NPN open-collector transistor, max. 100mA							
Output operation		Switchable either Light-ON or Dark-ON							
Response time		1ms or less		2ms or less	1ms or less				
Emitting element		Red LED	Infrared LED		Red LED			Infrared LED	
Automatic interference prevention function		Two units of sensors can be mounted close together with interference prevention filters. (Sensing range: 5m)	–		Incorporated (two sensor units can be mounted close together.)				
Protection		IP67 (IEC)							
Ambient temperature		−25 to +55°C							
Material		Enclosure: PBT, Lens: Polycarbonate (**CX-48▢**: Polycarbonate), Protection cover: Polycarbonate (**CX-48▢**: Polycarbonate)							
Connection method		2m cable, Suffix - Z: M8 connector (Note 3)							
Dimensions (HxWxD)		31x11.2x20mm (-Z connector type: 35.5x11.2x20mm)							
Accessories		–			Reflector: **RF-230** 1 pc.				

Notes:
1) Suffix -Z = M8 connector type
2) The sensing range is specified for the attached reflector **RF-230**
3) Cable is not included in delivery. Please select under accessories (page 125)

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Index

Standard Sensors

CX-400

Type		Diffuse reflective				Adjustable range reflective (Note 2)			
					Narrow view	Small spot			
Model no.	NPN	CX-424(-Z) (Note 1)	CX-421(-Z)	CX-422(-Z)	CX-423(-Z)	CX-441(-Z)	CX-443(-Z)	CX-444(-Z)	CX-442(-Z)
	PNP	CX-424-P(-Z)	CX-421-P(-Z)	CX-422-P(-Z)	CX-423-P(-Z)	CX-441-P(-Z)	CX-443-P(-Z)	CX-444-P(-Z)	CX-442-P(-Z)
Sensing range		100mm	300mm	800mm	70 to 300mm	2 to 50mm (adjustable range: 20-50mm)		15 to100mm (adjustable range: 20-100mm)	20 to 300mm (adjustable range: 40-300mm)
Object to be sensed		Opaque, transparent				–			
Hysteresis		<15% or less of sensing range				<2% or less of sensing range			<5% or less of sensing range
Supply voltage		12 to 24V DC ±10%							
Output		PNP / NPN open-collector transistor, max. 100mA							
	Output operation	Switchable either Light-ON or Dark-ON							
Response time		1ms or less							
Emitting element		Infrared LED			Red LED	Red LED			
Automatic interference prevention function		Incorporated (two sensor units can be mounted close together.)							
Protection		IP67 (IEC)							
Ambient temperature		−25 to +55°C							
Material		Enclosure: PBT, Lens: Polycarbonate (**CX-48**☐: Polycarbonate), Protection cover: Polycarbonate (**CX-48**☐: Polycarbonate)							
Connection method		2m cable, Suffix - Z: M8 connector (Note 3)							
Dimensions (HxWxD)		31x11.2x20mm (-Z connector type: 35.5x11.2x20mm)							

Notes:
1) Suffix -Z = M8 connector type
2) FGS = Foreground suppression
   BGS = Background suppression
   Selectable by wiring the inputs correspondingly
3) Cable is not included in delivery. Please select under accessories (page 125)

NX5

Sensor usable world-wide

Features

■ **Multi-voltage**

24 to 240V AC and 12 to 240V DC, suitable for supply voltages all over the world.
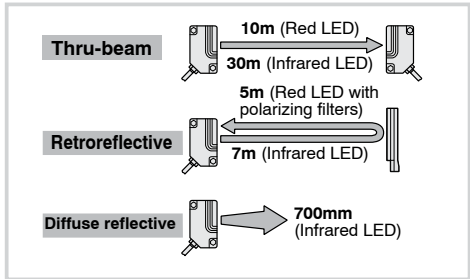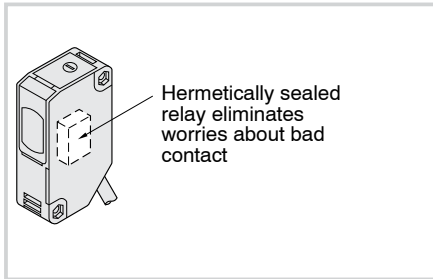
■ **High reliability**

The hermetically sealed output relay significantly increases its reliability.

■ **Interference prevention**

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

■ **Long sensing range**

Suitable for conveyor lines and parking lot applications.

Hermetically sealed relay eliminates worries about bad contact

Thru-beam	10m (Red LED)
	30m (Infrared LED)
Retroreflective	5m (Red LED with polarizing filters)
	7m (Infrared LED)
Diffuse reflective	700mm (Infrared LED)

Typical applications

Multistoried parking

Detects if the car is protruding from the elevator door.

NX5-M10RA
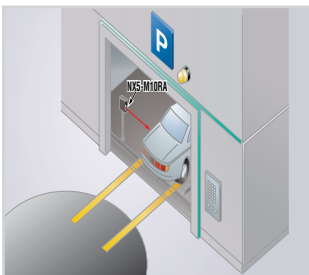
Golf driving range

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

NX5-D700A
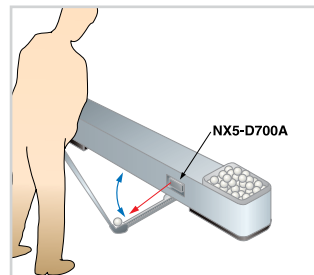
Arresting shutter closing

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

NX5-M
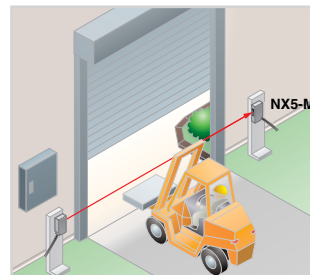
Arresting door closing

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

NX5-PRVM5A

Technical specifications

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

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Standard Sensors

NX5

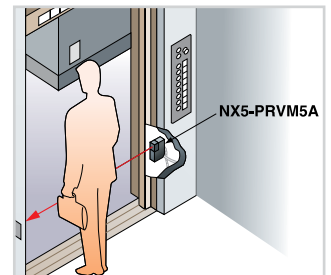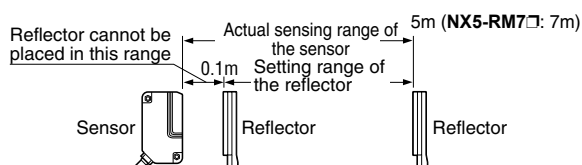| Type			Thru-beam			Retroreflective				Diffuse reflective	
				Long sensing range		With polarizing filters		Long sensing range			
Model no.		NX5-M10RA	NX5-M10RB	NX5-M30A	NX5-M30B	NX5-PRVM5A	NX5-PRVM5B	NX5-RM7A	NX5-RM7B	NX5-D700A	NX5-D700B
Sensing range		10m		30m		0.1 to 5m (Note 1)		0.1 to 7m (Note 1)		700mm (Note 2)	
Object to be sensed		Ø 20mm or more; opaque transparent object (Note 3)				Ø 50mm or more; opaque, semitransparent or transparent object (Note 1, 3)		Ø 50mm or more; opaque or translucent object (Note 1, 3)		Opaque, semitransparent or transparent object (Note 3)	
Hysteresis		—								15% or less of sensing range	
Repeatability (perpendicular to sensing axis)		0.1mm or less		0.2mm or less						0.3mm or less	
Supply voltage		24 to 240V AC ± 10%, or 12 to 240V DC ± 10%									
Power consumption		Emitter: 1VA or less Receiver: 2VA or less		Emitter: 1.5VA or less Receiver: 2VA or less		2VA or less					
Output		Relay contact 1c Switching capacity: 250V AC 1A (resistive load) 30V DC 2A (resistive load) Electrical life: 500,000 or more switching operations (switching frequency 3600 operations/hour) Mechnical 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									
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.)					
Protection		IP66 (IEC)									
Ambient temperature		−20 to +55°C									
Emitting element		Red LED		Infrared LED		Red LED		Infrared LED			
Material		Enclosure: Polycarbonate; lens: polycarbonate; cover: polycarbonate; front cover (retroreflective type sensor only): Acrylic									
Connection method		5-core (thru-beam type emitter: 2 cable) cable, 2m									
Dimensions (HxWxD)		62x18x35mm									
Accessories		Adjusting screwdriver: 1 pc.		—		Reflektor **RF-230**: 1 pc. Adjusting screwdriver: 1 pc.		Reflektor **RF-230**: 1 pc.		Adjusting screwdriver: 1 pc.	

Reflector cannot be placed in this range
0.1m
Sensor
Actual sensing range of the sensor
Setting range of the reflector
5m (**NX5-RM7▢**: 7m)
Reflector
Reflector

Notes:
1) The sensing range and the sensing object of the retroreflective type sensor is specified for the **RF-230**.
   Further, the sensing range is the possible setting range for the reflector.
   The sensor can also detect an object 0.1m, or more, away.
2) The sensing range is specified for white non-glossy paper (200x200m).
3) Check the functionality with a real object.
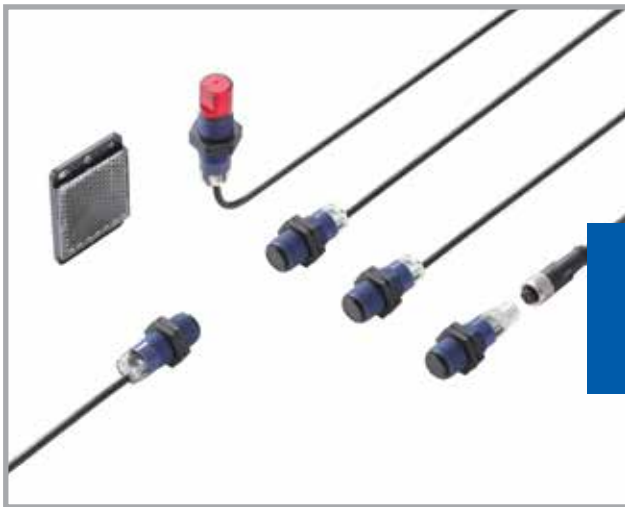
CY-100

Simple mounting with M18 thread

Features

■ Wide product range

The availability of a wide range of models within the series means the **CY-100** sensors can solve relatively complex tasks. Types with integrated polarization filters can even recognize reflective objects. The side view type makes applications possible in cramped spaces.

■ M18 Thread

All models have an M18 male thread for easy and quick mounting. Furthermore the models are also available for the M12 connector type. You can easily replace and add these standard models. The nuts are included in delivery.

■ Long sensing range

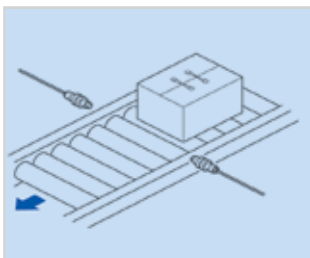The thru-beam and retroreflective types of the CY-100 have a large sensing range of up to 15m.
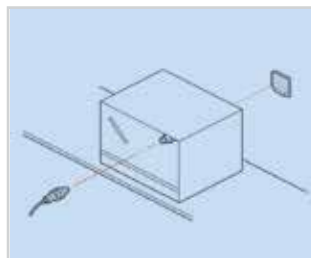
■ Environmentally robust

Thanks to the IP67 (IEC) casing, the sensor is suitable for installation in humid and dusty environments. Integrated status LEDs allow the operator to check the function of the sensor at a glance.
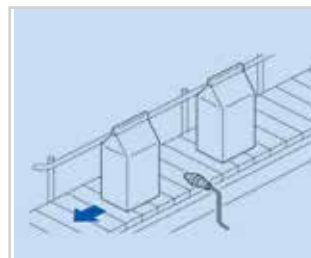
Typical applications

Object detection   **Detecting specular objects**   **Object counting**

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

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Standard Sensors

CY-100

Technical specifications

■ Standard type

Type		Thru-beam		Retroreflective type (Note 4)				Diffuse			
		–		–		With polarizing filter		–		With sensitivity adjuster	
		Light-ON	Dark-ON	Light-ON	Dark-ON	Light-ON	Dark-ON	Light-ON	Dark-ON	Light-ON	Dark-ON
Model no.	NPN	CY-111A (-Z) (Note 1)	CY-111B (-Z)	CY-192A (-Z)	CY-192B (-Z)	CY-191A (-Z)	CY-191B (-Z)	CY-121A (-Z)	CY-121B (-Z)	CY-122A (-Z)	CY-122B (-Z)
	PNP	CY-111A-P (-Z)	CY-111B-P (-Z)	CY-192A-P (-Z)	CY-192B-P (-Z)	CY-191A-P (-Z)	CY-191B-P (-Z)	CY-121A-P (-Z)	CY-121B-P (-Z)	CY-122A-P (-Z)	CY-122B-P (-Z)
Sensing range		15m		4m		2m		100mm (Note 3)		600mm (Note 3)	
Object to be sensed		Ø 18mm (opaque)		Ø 50mm (opaque, transparent) (Note 2)		Ø 50mm (opaque, transparent or specular) (Note 2)		Opaque, transparent			
Supply voltage		12 to 24V DC ±10%									
Output		PNP / NPN open-collector transistor, max. 100mA									
Response time		1ms or less									
Emitting element		Infrared LED				Red LED		Infrared LED			
Protection		IP67 (IEC)									
Ambient temperature		−25 to +55°C									
Material		Enclosure: PBT, Lens: PMMA									
Connection method		2m cable, Suffix - Z: M12 connector (Note 5)									
Dimensions (HxWxD)		M18x46mm, -Z connector type: M18x60mm				M18 x 48mm, -Z connector type: M18x62mm		M18x46mm, -Z connector type: M18x60mm		M18x62mm, -Z connector type: M18x76mm	
Accessories		Nuts 4 pcs.		Nuts 2 pcs.						Nuts 2 pcs. Screwdriver 1pc.	

■ Side sensing

Type		Thru-beam		Retroreflective type (Note 4)				Diffuse			
		–		–		With polarizing filter		–		With sensitivity adjuster	
		Light-ON	Dark-ON	Light-ON	Dark-ON	Light-ON	Dark-ON	Light-ON	Dark-ON	Light-ON	Dark-ON
Model no.	NPN	CY-111VA(-Z) (Note1)	CY-111VB(-Z)	CY-192VA(-Z)	CY-192VB(-Z)	CY-191VA(-Z)	CY-191VB(-Z)	CY-121VA(-Z)	CY-121VB(-Z)	CY-122VA(-Z)	CY-122VB(-Z)
	PNP	CY-111VA-P (-Z)	CY-111VB-P (-Z)	CY-192VA-P(-Z)	CY-192VB-P(-Z)	CY-191VA-P(-Z)	CY-191VB-P(-Z)	CY-121VA-P(-Z)	CY-121VB-P(-Z)	CY-122VA-P(-Z)	CY-122VB-P(-Z)
Sensing range		15m		4m		2m		100mm (Note 3)		600mm (Note 3)	
Object to be sensed		Ø 18mm (opaque)		Ø 50mm (opaque, transparent) (Note 2)		Ø 50mm (opaque, transparent or specular) (Note 2)		Opaque, transparent			
Supply voltage		12 to 24V DC ±10%									
Output		PNP / NPN open-collector transistor, max. 100mA									
Response time		1ms or less									
Emitting element		Infrared LED				Red LED		Infrared LED			
Protection		IP67 (IEC)									
Ambient temperature		−25 to +55°C									
Material		Enclosure: PBT, Lens: PMMA									
Connection method		2m cable, Suffix - Z: M12 connector (Note 5)									
Dimensions (ØxD)		M18x62mm, -Z connector type: M18x76mm						M18x46mm, -Z connector type: M18x60mm		M18x78mm, -Z connector type: M18x92mm	
Accessories		Nuts 4 pcs.		Nuts 2 pcs.						Nuts 2 pcs. Screwdriver 1 pc.	

Notes:
1) Suffix -Z = M12 connector type
2) The sensing range and sensing object of the retroreflective type are specified for the reflector **RF-420** (accessories page 126)
3) The sensing range is specified for white, matt paper
4) The reflector is not included in delivery; please order separately (accessories page 126)
5) Cable not included in delivery, please order separately (accessories page 125)
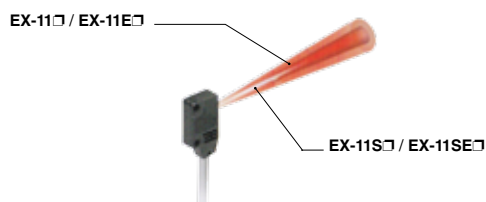
EX-10

The slimmest: 3.5mm thick

Features

■ Optimized precision optics

The enhanced EX-10 series offers a more precise light beam compared with the other standard models. Now you can realize an even more space saving installation, because no additional tools like slit masks are needed to prevent interferences. It is no problem to detect smallest objects with a diameter of 0,5mm.

EX-11☐ / EX-11E☐

EX-11S☐ / EX-11SE☐

■ Sensing range 1m: EX-19☐

■ High-speed response time: 0.5ms

The sensor **EX-10** with a response time of only 0.5ms is especially suitable for detecting small and high-speed traveling objects.

■ Flexible setup

The EX-10 sensor is available as front sensing or side sensing type, allowing for flexible mounting in the narrowest of spaces.

■ 2-color indicator

A convenient bright, 2-color indicator has been incorporated in the miniature body. You can check the available power supply and current output operation at a glance.
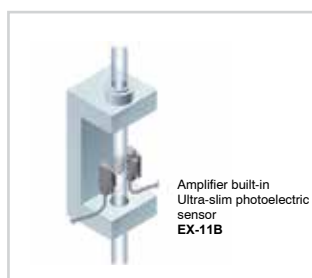
2-colored status LEDs
Orange: Operation
Green: Stability

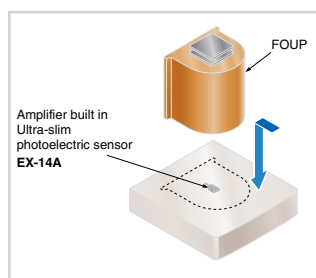### ■ Freely mountable fingertip size
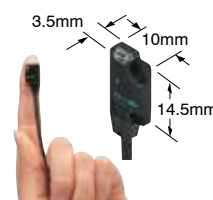
3.5mm
10mm
14.5mm

Freely mountable; dimensions 10x14.5x3.5mm (WxHxD) (Thru-beam type, front sensing). Moreover, easy alignment is possible with the visible red LED beam source.

Typical applications

Detecting the float for a flow meter
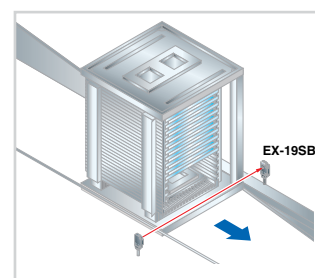
Amplifier built-in Ultra-slim photoelectric sensor **EX-11B**

Seating confirmation fiber

FOUP

Amplifier built in Ultra-slim photoelectric sensor **EX-14A**

Detecting small parts such as screws

EX-11EB

Sensing PCB rack

EX-19SB

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Index

Miniature sensors

EX-10
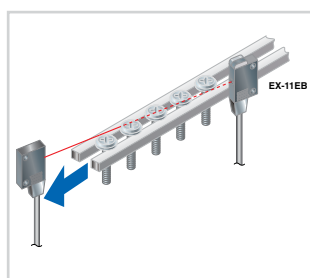
Technical specifications

Type		Thru-beam						Convergent reflective	
Model no.	Front sensing	EX-11A(-PN) (Note)	EX-11B(-PN)	EX-13A(-PN)	EX-13B(-PN)	EX-19A(-PN)	EX-19B(-PN)	EX-14A(-PN)	EX-14B(-PN)
	Side sensing	EX-11EA(-PN)	EX-11EB(-PN)	EX-13EA(-PN)	EX-13EB(-PN)	EX-19EA(-PN)	EX-19EB(-PN)	–	–
Sensing range		150mm		500mm		1m		2 to 25mm (conv. point: 10mm)	
Minimum sensing object		Ø 1mm; opaque object		Ø 2mm; opaque object				Ø 0.1mm copper wire (Setting distance: 10mm)	
Supply voltage		12 to 24V DC ±10 %							
Output		PNP/NPN open-collector transistor, max. 50mA							
Output operation		Light-ON	Dark-ON	Light-ON	Dark-ON	Light-ON	Dark-ON	Light-ON	Dark-ON
Response time		Max. 0.5ms							
Protection		IP67 (IEC)							
Ambient temperature		−25 to +55°C							
Connection method		2m cable							
Dimensions (HxWxD)		14.5x10x3.5mm						13x14.5x3.5mm	
Accessories		Mounting screws, 1 set							

Note:
Suffix -PN = PNP type
No suffix = NPN type

■ Narrow-view reflective type

Type		Thru-beam				
		Front sensing	Side sensing	Front sensing	Side sensing	Front sensing
Model no.	Light-ON	EX-11SA(-PN) (Note)	EX-11SEA(-PN)	EX-13SA(-PN)	EX-13SEA(-PN)	EX-19SA(-PN)
	Dark-ON	EX-11SB(-PN)	EX-11SEB(-PN)	EX-13SB(-PN)	EX-13SEB(-PN)	EX-19SB(-PN)
Sensing range		150mm		500mm		1m
Minimum sensing object		Ø 0.5mm opaque object	Ø 1.0mm opaque object	Ø 1.0mm opaque object	Ø 2.0mm opaque object	Ø 2.0mm opaque object
Supply voltage		12 to 24V DC ±10%				
Output		PNP/NPN open-collector transistor, max. 50mA				
Response time		Max. 0.5ms				
Protection		IP67 (IEC)				
Ambient temperature		−25 to +55°C				
Connection method		2m cable				
Dimensions (HxWxD)		14.5x10x3.5mm				
Accessories		Mounting screws, 1 set				

Note:
Suffix -PN = PNP type
No suffix = NPN type

EX-20

Miniature-sized and still mountable with M3 screws

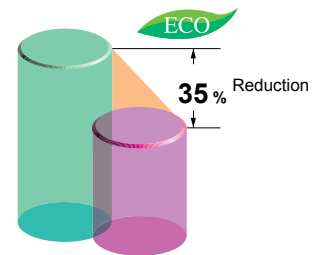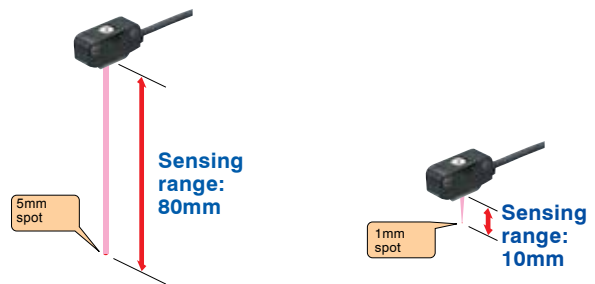## Features

■ 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. 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 the alignment and confirmation of the sensing position is easy.

■ Less power consumed!

By relentlessly developing our technologies, we have been able to considerably reduce our sensors' power consumption.
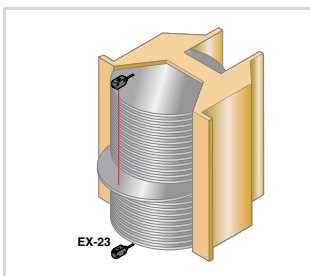
5mm spot

Sensing range: 80mm

1mm spot

Sensing range: 10mm

ECO

35 % Reduction

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.
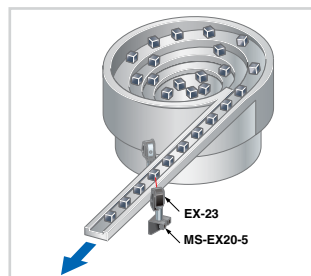
Detecting tape feeder cassette out of position

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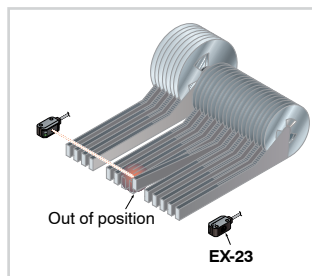
Detecting fill-up of parts in feeder

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

EX-23

Out of position

EX-23

EX-23

MS-EX20-5

Technical specifications

Type		Thru-beam		Retroreflective	Diffuse reflective type			
					Standard type	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.	Light-ON	EX-21A(-PN) (Note)	EX-23(-PN) Light-ON/Dark-ON switchable	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
Object to be sensed		Min. Ø 2.6mm; opaque object	Min. Ø 3mm; opaque object	Min. Ø 15mm opaque or translucent object	Opaque, translucent or transparent object	Min. Ø 0.1mm copper wire (Setting distance: 10mm)		Opaque, translucent or transparent object
Supply voltage		12 to 24V DC ± 10%						
Output		PNP / NPN open-collector transistor, max. 50mA						
Response time		0.5ms or less						
Protection		IP67 (IEC)						
Ambient temperature		−25 to +55°C						
Connection method		Cable 2m						
Dimensions (HxWxD)		18x16x4.5mm	8.2x22x10.5mm	8.2x25x12.3mm		16x18x4.5mm	8.2x25x12.3mm	10x14.5x3.5mm
Accessories		–	Screwdriver, 1 pc.	Reflector **RF-200**, 1 pc. Screwdriver, 1 pc.	Screwdriver, 1 pc.	–	Screwdriver, 1 pc.	

Note:
Suffix -PN = PNP type
No suffix = NPN type

Photoelectric Sensors / Miniature Sensors

EX-30

An alternative to fiber sensors

Features

### ■ An alternative to fiber sensors

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

■ 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.
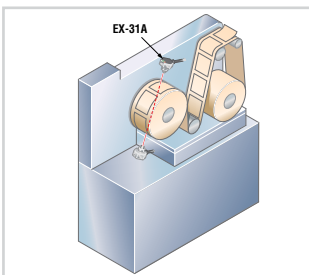
■ Less power consumed!

By relentlessly developing our technologies, we have been able to considerably reduce our sensors' power consumption.

ECO

35 % Reduction
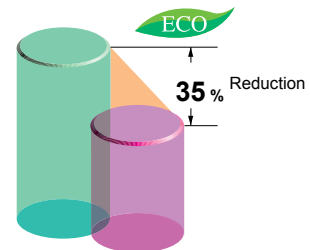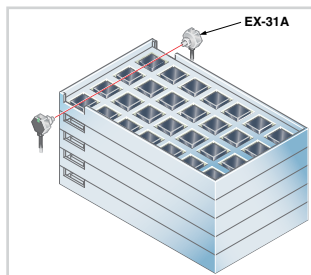
Typical applications

Detecting quantity of labels in label magazine

Detects the remaining amount of labels by the thickness of the roll.
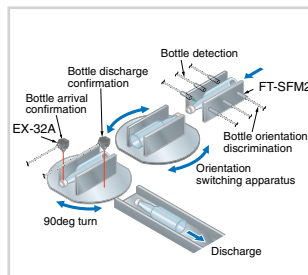
EX-31A

Detecting ICs

Detects whether ICs are accurately placed in IC trays.

EX-31A

Resin bottle detection

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

Bottle detection

Bottle discharge confirmation

Bottle arrival confirmation

EX-32A

FT-SFM2

Bottle orientation discrimination

Orientation switching apparatus

90deg turn

Discharge

Technical specifications

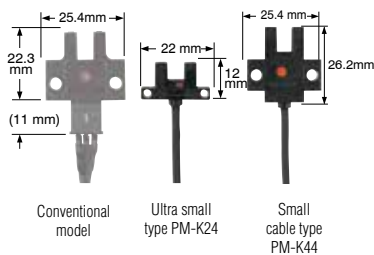| Type		Thru-beam			Diffuse reflective	
Model no. NPN	EX-31A	EX-31B	EX-33	EX-32A	EX-32B
PNP	EX-31A-PN	EX-31B-PN	EX-33-PN	EX-32A-PN	EX-32B-PN
Sensing range		500mm		800mm	50mm	
Object to be sensed		Min. 2mm or opaque object			Opaque, translucent or transparent object	
Supply voltage		12 to 24V DC ± 10%				
Output		PNP / NPN open-collector transistor, max. 50mA				
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				
Connection method		Cable 2m				
Dimensions (HxWxD)		14x15.6x18mm				
Accessories		Nuts, 2 pcs.; washers, 2 pcs.			Nut, 1 pc.; washer, 1 pc.	

PM

Enables equipment miniaturization and quick construction

Features

■ Compact size

Ultra small type

The **PM** sensors achieve an extremely compact size and can contribute to the miniaturization of your equipment.

25.4mm

22.3 mm

(11 mm)

22 mm

25.4 mm

12 mm

26.2mm

Conventional model

Ultra small type PM-K24

Small cable type PM-K44

■ Quick fitting hook-up connector

Easy to maintain hook-up connector type models are available. A connector attached cable 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.
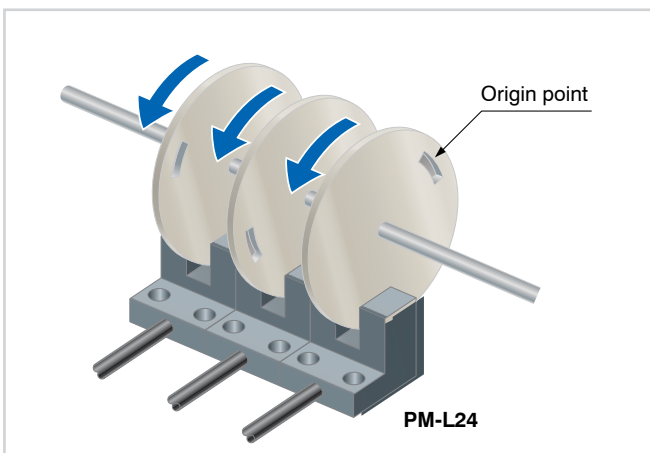
■ Flexible cable type

A flexible cable is used, which allows repeated bending. It is suitable for use in the moving part of a robot arm.
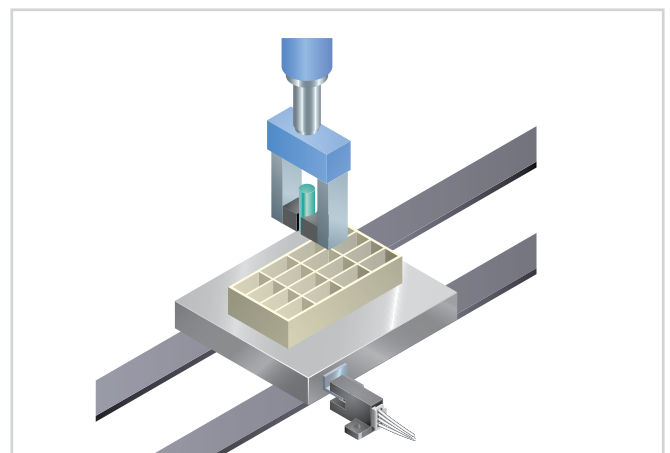
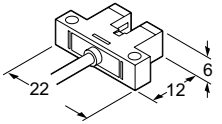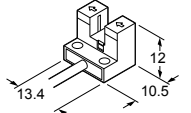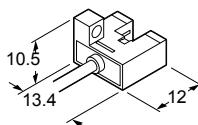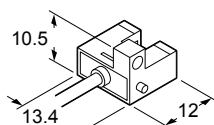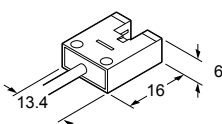## Typical applications

Sensing rotating bodies

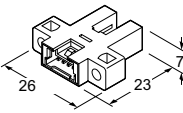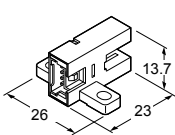By incorporating a slit in the rotating body, the origin point can be sensed.

Origin point
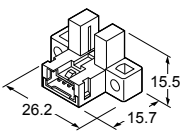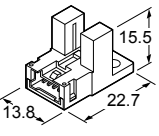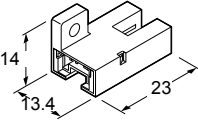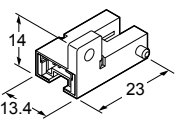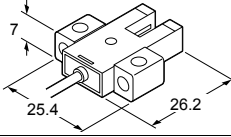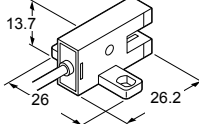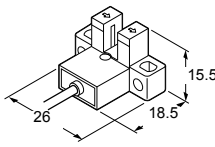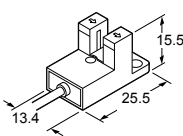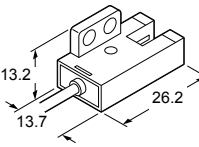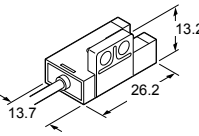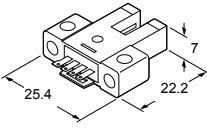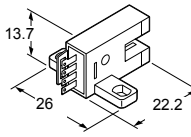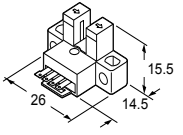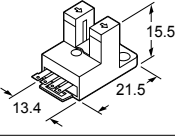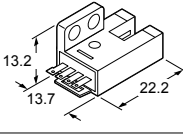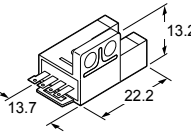
PM-L24

Determine the pallet position

Order guide

Type		Appearance (mm)	Model no.
Ultrasmall	K type		PM-K24
			PM-K24P
	L type		PM-L24
			PM-L24P
	F type		PM-F24
			PM-F24P
	R type		PM-R24
			PM-R24P
	U type		PM-U24
			PM-U24P

Type		Appearance (mm)	Model no.
Small and built-in connector type	K type		PM-K64
			PM-K64P
	T type		PM-T64
			PM-T64P
	L type		PM-L64
			PM-L64P
	Y type		PM-Y64
			PM-Y64P
	F type		PM-F64
			PM-F64P
	R type		PM-R64
			PM-R64P

Type			Appearance (mm)	Model no.
Small	With cable	K type		PM-K44
				PM-K44P
		T type		PM-T44
				PM-T44P
		L type		PM-L44
				PM-L44P
		Y type		PM-Y44
				PM-Y44P
		F type		PM-F44
				PM-F44P
		R type		PM-R44
				PM-R44P
	With connector	K type		PM-K54
				PM-K54P
		T type		PM-T54
				PM-T54P
		L type		PM-L54
				PM-L54P
		Y type		PM-Y54
				PM-Y54P
		F type		PM-F54
				PM-F54P
		R type		PM-R54
				PM-R54P

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

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Miniature Sensors

PM

Technical specifications

Type		Ultra small type	Small type		
		With cable	With cable	With connector	Built-in connector
Model no.	NPN	PM-❑24 (Note 1)	PM-❑-44	PM-❑54	PM-❑64
	PNP	PM-❑24P	PM-❑44P	PM-❑54P	PM-❑64P
Sensing range		5mm (fixed)			
Minimum sensing object		0.8 x 1.8mm opaque object			
Repeatability		0.03mm or less		0.01mm or less	
Supply voltage		5 to 24V DC ± 10%			
Output		PNP / NPN open-collector transistor, max. 50mA			
Output operation		Incorporated with 2 outputs: Light-ON / Dark-ON			
Response time		Under light incident condition: 20µs or less Under light incident condition: 100µs or less (Response frequency: min. 1kHz)			
Emitting element		Infrared LED			
Connection method		Cable 1m		Connector (Note 2)	Built-in connector (Note 2)

Notes:
1) K = K type
   L = L type
   F = F type
   R = R type
   U = U type
   T = T type
   Y = Y type
2) Cable not included in delivery, please order separately (accessories, page 125)

PM2

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

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Miniature Sensors

PM2

Convergent reflection sensing ensures stable detection

Features

■ Stable detection by convergent reflective mode

The stable detection characteristics of the **PM2** series are obtained since it is a convergent reflective type and senses a limited area. Thus regardless of the background, stable detection is possible.

Object to be sensed
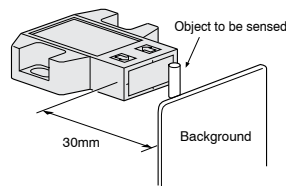
30mm   Background

■ 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.

■ Minimum sensing object

A 0.05mm copper wire can be detected at a distance of 5mm.

Typical applications

Minute object detectable
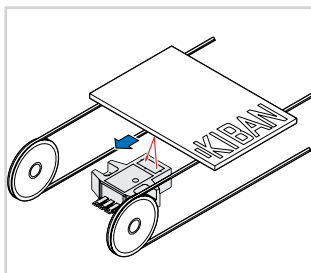
Starting point and overrun is sensed using the dog on the base

Overrun sensing Dog

Start point sensing

Overrun sensing
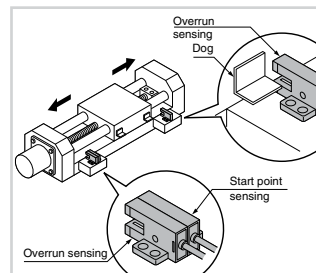
Detecting capacitors in tray

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

PM2-LH10-C1
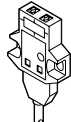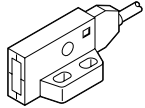
Technical specifications

Type		Appearance	Model no.
Connector type	Top sensing		**PM2-LH10**
			PM2-LH10B
	Front sensing		**PM2-LF10**
			PM2-LF10B
	L type (Top sensing)		**PM2-LL10**
			PM2-LL10B
Cable type	Top sensing		**PM2-LH10-C1**
			PM2-LH10B-C1
	Front sensing		**PM2-LF10-C1**
			PM2-LF10B-C1
	L type (Top sensing)		**PM2-LL10-C1**
			PM2-LL10B-C1

Type		Connector type			Cable type		
		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 (15x15mm)					
Minimum sensing object		Ø 0.05mm copper wire (setting distance: 5mm)					
Repeatability (perpendicular to sensing axis)		0.08mm					
Supply voltage		5 to 24V DC ± 10%					
Output		NPN open-collector transistor, max. 50mA					
Response time		0.8ms or less					
Emitting element		Infrared LED					
Connection method		Connector for soldering (Note)			Cable, 1m		

Note: Cable is not included in delivery. Please select under accessories (page 125)

EQ-500

Long range sensing capability up to 2.5m

Features

■ 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.
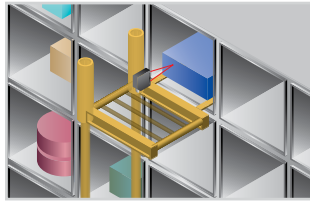
■ Not affected by background objects

Due to the 2-segment photo-diode 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 ar 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. **EQ-500** series can function with 24 to 240V AC and 12 to 240V DC. Therefore, almost any power supply anywhere in the world will work.

■ Equipped with BGS/FGS function

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

■ Convenient timer function models

Types with an ON-delay/OFF-delay timer available. (EQ-5□T)
- Operation: ON-delay OFF-delay
- Timer period: 0.1 to 5s (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 particles appearing close to the front surface of the unit.

■ Convenient terminal block type

Cabling is enabled by way of a terminal block.

Display

Distance adjuster (2-turn)

ON delay timer adjuster

OFF delay timer adjuster

Terminal block

Conduit connector

Technical specifications

Type	Multi-voltage type				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
Sensing range	0.2 to 2.5m		0.2 to 1.0m		0.2 to 2.5m		0.2 to 1.0m	
Supply voltage	24 to 240V AC ±10%, or 12 to 24V DC ±10%				12 to 24V DC ±10%			
Output	Relay contact 1a 3A/250V AC				PNP / NPN open-collector transistor, max. 100mA			
Output operation	Light-ON or Dark-ON							
Response time	20ms or less (for EQ-50☐T dependent on the setting timer period)				20ms or less (for EQ-51☐T dependent on the setting timer period)			
Timer periods	–	Incorporated with variable ON-delay / OFF-delay timer (0.1 to 5s)	–	Incorporated with variable ON-delay / OFF-delay timer (0.1 to 5s)	–	Incorporated with variable ON-delay / OFF-delay timer (0.1 to 5s)	–	Incorporated with variable ON-delay / OFF-delay timer (0.1 to 5s)
Protection	IP67 (IEC)							
Ambient temperature	−20 to +55°C							
Emitting element	Infrared LED							
Connection method	Convenient terminal block							
Dimensions (HxWxD)	68x26x68mm							
Accessories	Screwdriver, 1 pc.							

EQ-30

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors
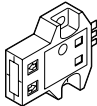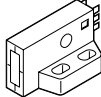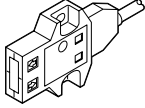
Ionizers/ Electrostatic Sensors

Accessories

Index

Trigonometric Sensors

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 68x20x40mm (HxWxD) has been designed.

■ 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)

The plug-in connector type (M12) of the EQ-30 series can be easily disconnected for replacement.

Technical specifications

Type		Diffuse	Diffuse/double output
Model no.	NPN	EQ-34 (J) (Note)	EQ-34W
	PNP	EQ-34PN (J)	–
Rated sensing distance		2.0m	
Sensing range		0.1-2m	Near: 0.1-2m Far: 0.2-2m
Detectable target		Transparent and opaque material	
Hysteresis		<10% of measurement	
Response time		2ms or less	
Supply voltage		10 to 30V DC ± 10%	
Output		PNP / NPN open-collector transistor, max. 100mA	
Emitting element		Infrared LED	
Rated current consumption without load		NPN type: 50mA PNP type: 55mA	2 x NPN type: 90mA
Material		Plastic	
Protection		IP67 (IEC)	
Ambient temperature		−20 to +55°C	
Connection method		Cable 2m or M12 connector	
Dimensions (HxWxD)		68x20x40mm	
Accessories		Screwdriver, 1 pc.	

Note: Suffix J = M12 connector type

Typical applications
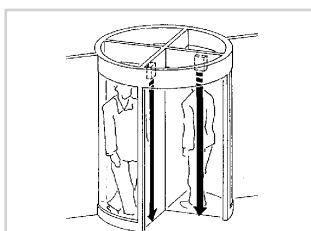
Long distance sensing
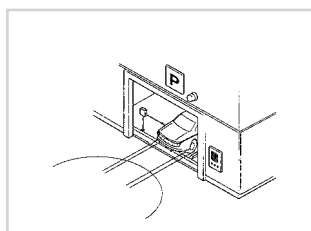
Object detection

Color-independent detection

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 the area reflective type sensor **MQ-W** can detect white or black objects at the same distance.

■ No-miss operation regardless of backgrounds

Area reflective type sensors do not detect objects beyond the set range.

■ Resistant to lens surface soiling

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

Technical specifications

Type		Diffuse		
Model no.	NPN	MQ-W3A(R) (Note)	MQ-W20A(R)	MQ-W70A1224EMJ
	PNP	MQ-W3C(R)	MQ-W20C(R)	MQ-W70C1224EMJ
Sensing range		40mm	200mm	700mm
Adjustable range		20-40mm	40-200mm	200-700mm
Detectable target		Transparent and opaque material		
Hysteresis		< 10% of measurement range		< 20% of measurement range
Detection frequency		250Hz		
Response time		2ms or less		
Supply voltage		9 to 30V DC		
Output		PNP / NPN open-collector transistor, max. 100mA		
Emitting element		Infrared LED; Type R: Red LED		Infrared LED
Rated current consumption without load		Max. 30mA		
Material		Zinc die cast		
Protection		IP67 (IEC)		
Ambient temperature		−25 to +55°C		
Connection method		Cable, 2m		
Dimensions (HxWxD)		32x12.6x32mm		52x18.6x52mm
Accessories		Mounting brackets, 1 set		

Note: Suffix R = Red LED

Typical applications
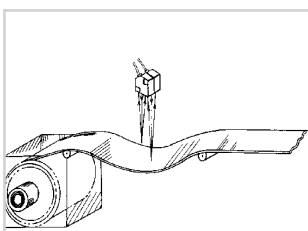
Distance detection
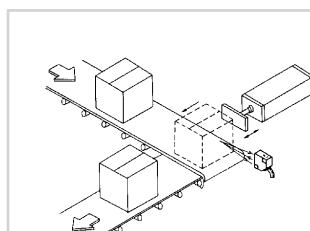
Position detection
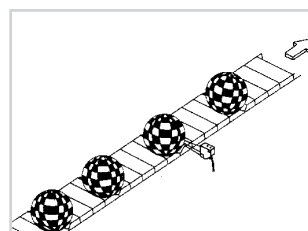
Color-independent detection

NA1-11

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

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Area Sensors

NA1-11

Cross-beam scanning system to detect slim objects

Features

■ Letters, postcards can be detected

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

■ Beam pitch: 10mm

A minimum sensing object size of ø13.5mm is realized by using a beam pitch of 10mm.

■ Long sensing range

Though very slim, a wide sensing area of 1m length and 100mm width is realized. 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.
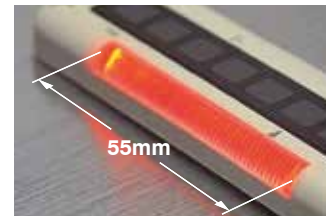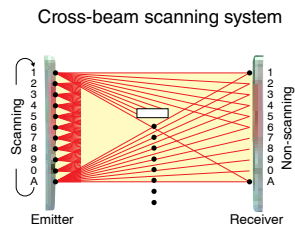
Cross-beam scanning system

Typical applications

Detecting postcards

NA1-11 can detect thin postcards due to its crossbeam scanning system.
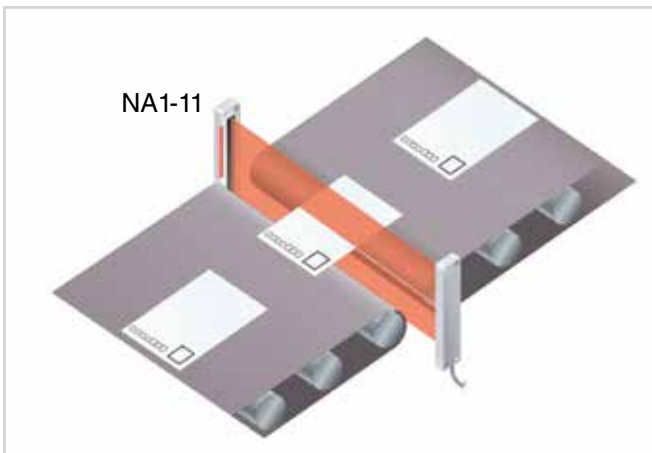
Detection of haphazardly falling objects
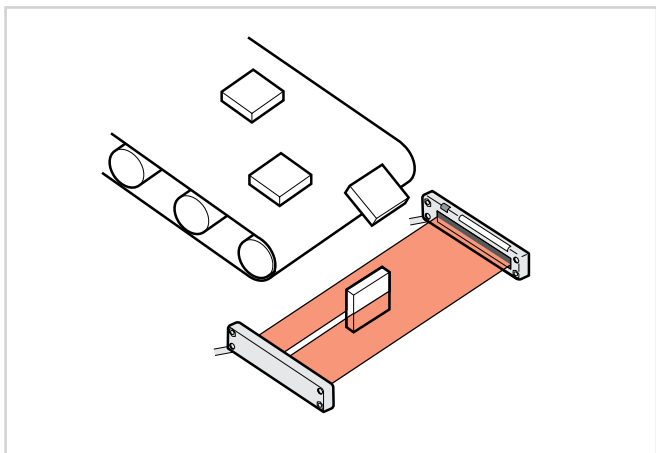
NA1-11

Technical specifications

Type	NPN	PNP
Model no.	NA1-11	NA1-11-PN
Sensing height	100mm	
Sensing range	0.17 to 1m	
Beam pitch	10mm	
Numbers of beam channels	11 each on the emitter and the receiver, respectively	
Object to be sensed	> ø13.5mm; opaque object	
Supply voltage	12 to 24V DC ± 10%	
Output	NPN open-collector transistor, max. 100mA	PNP open-collector transistor, max. 100mA
Ambient temperature	−10 to +55°C	
Connection method	Cable, 2m	
Dimensions (HxWxD)	140x30x10mm	

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

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Ionizers/ Electrostatic Sensors

Accessories

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Area Sensors

NA1-PK5/ NA1-PK3

NA1-PK5/ NA1-PK3

Pick-to-light sensor – Ultra-slim body
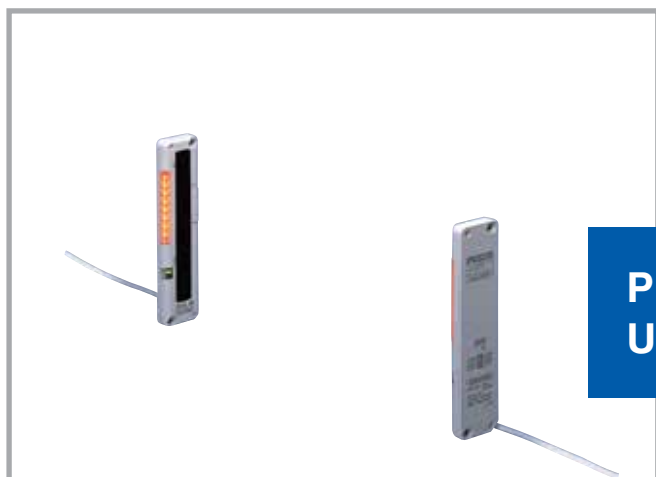
Features

■ 10 mm thick: half the thickness of conventional models

Space saving now possible; ultra-thin design does not obstruct picking operations.

Cable can be freely arranged in any position

■ Two unit installations are possible

Sensor units can now be set to different light emission frequencies in order to prevent mutual interference.

Two units can now be operated in a side-by-side configuration without interference for problem-free detection over wide areas.
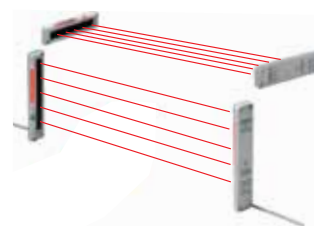
■ Lighting pattern selectable

The job indicator operation can be selected as either continuous lighting or blinking.

Continuous lighting   Blinking

Changeover
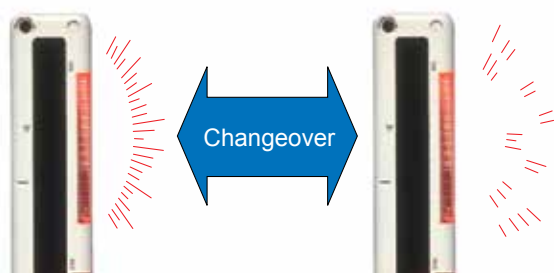
■ Selectable detection operation

Sensor units can be set to detect the interruption of 1 beam channel or 2 or more beam channels.

Single beam interruption   Double beam interruption

Changeover
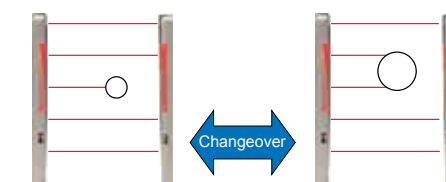
All opaque bodies with ø35mm or greater will be detected.

The accidental passage of small objects through the beam axis will not trigger detection, yet the operator's hands will always be accurately detected. This function is also useful when small objects regularly interrupt the beam axis.

Typical applications

Cell production line

Assembly line

Technical specifications

Type	NPN		PNP	
Model no.	NA1-PK5	NA1-PK3	NA1-PK5-PN	NA1-PK3-PN
Sensing height	100mm	49.2mm	100mm	49.2mm
Sensing range	0.1 to 1.2m	0.03 to 0.3m	0.1 to 1.2m	0.03 to 0.3m
Beam pitch	25mm	24.6mm	25mm	24.6mm
Number of beam channels	5 beam channels	3 beam channels	5 beam channels	3 beam channels
Object to be sensed	> ø35mm, opaque object	> ø29mm, opaque object	> ø35mm, opaque object	> ø29mm, opaque object
Supply voltage	12 to 24V DC ± 10%			
Output	NPN open-collector transistor max.100mA		PNP open-collector transistor max.100mA	
Connection method	Cable, 2m			
Dimensions (HxWxD)	140x30x10mm	70x24x8mm	140x30x10mm	70x24x8mm

FX-100

Excellent price / performance ratio

Features

■ Easy to read

The digital dual display allows you to check both the threshold value and incident light intensity at the same time. 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 can be greatly reduced.

■ Designed in a 3-layer structure to accomodate basic through advanced settings

Setting details are divided into three levels for clearer operation, so that settings 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

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

Wafer detection

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

FD-WKZ1

Porte-wafers

FT-L8Y

Wafer

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

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FX-100
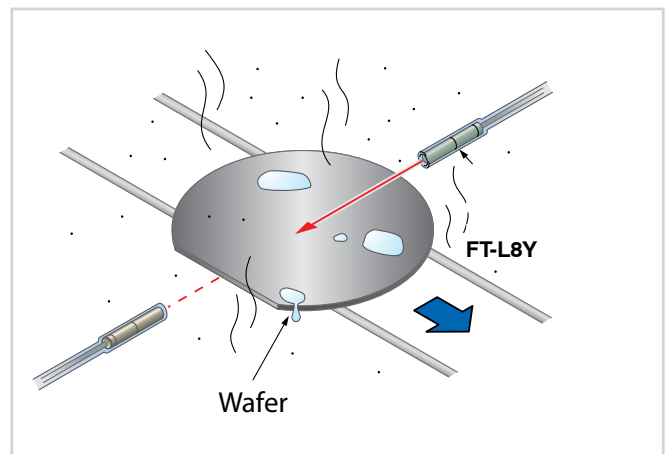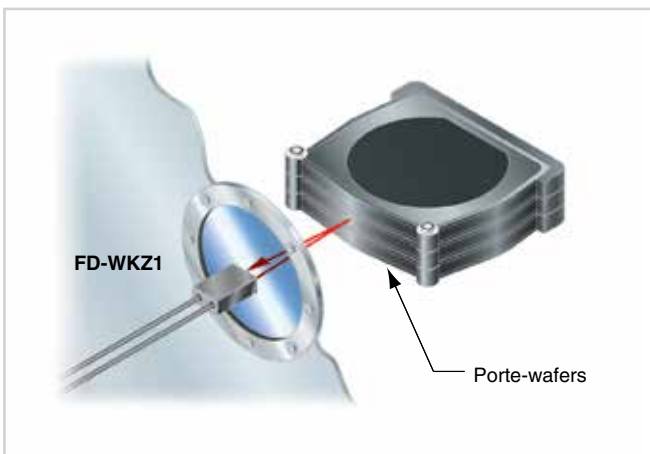
Detection of breaks / cracks of glass

FV-SV2   FT-H30-M1V-S
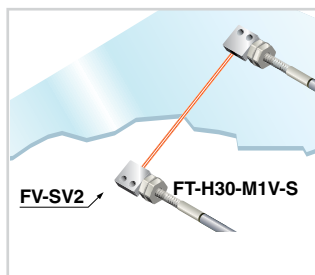
Detection over long ranges
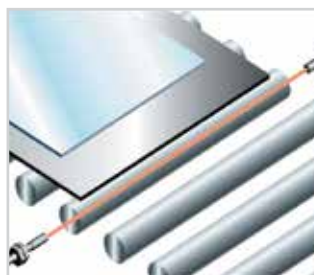
Detection of glass substrate in vacuum chamber
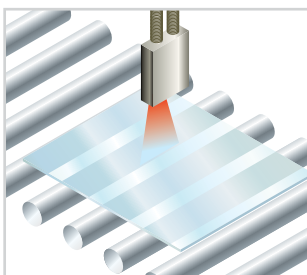
Detection of glass substrate on robot hand
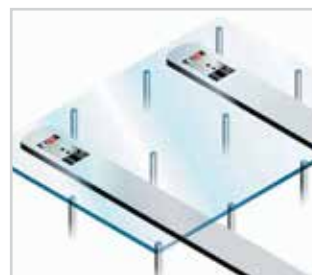
Technical specifications

| Type		Standard type		Long sensing range	
		Connector type	Cable type	Connector type	Cable type
Model no.	NPN	FX-101 (-Z) (Note 2)	FX-101-CC2	FX-102 (-Z) (Note 2)	FX-102-CC2
	PNP	FX-101P (-Z) (Note 2)	FX-101P-CC2	FX-102P (-Z) (Note 2)	FX-102P-CC2
Supply voltage		12 to 24V DC ±10%			
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)			
Response time		Response time 0: 250µs or less Response time 1: 450µs or less Response time 2: 500µs or less Response time 3: 600µs or less		Response time 1: 2.5ms or less Response time 2: 2.8ms or less Response time 3: 3.2ms or less Response time 4: 5.0ms or less	
Output		PNP / NPN open-collector transistor, max. 100mA			
Output operation		Selectable either Light-ON or Dark-ON			
Short-circuit protection		Incorporated			
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, switchable either effective or ineffective. [Timer period:1ms, 5ms, 10ms, 20ms, 40ms, 50ms, 100ms, 500ms, 1000ms]			
Interference prevention		Incorporated Selectable response time method (Note 1) (Functions at response time 1, 2 or 3)		Incorporated Selectable response time method (Note 1) (Functions at response time 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)			
Emitting element		Red LED			
Material		Enclosure: polycarbonate; key switch: polycarbonate; fiber lock lever: PBT			
Connection method		Small connector M8 connector (Note 3)	Cable, 2m	Small connector M8 connector (Note 3)	Cable, 2m
Dimensions (HxWxD)		32x9x66.4mm			
Accessories		—	CN-14A-C2 (Connector attached cable: 2m): 1 pc.	—	CN-14A-C2 (Connector attached cable: 2m): 1 pc.

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) Suffix -Z = M8 connector type
3) The cable is not included in delivery. Please select under accessories (page 125)

FX-301

Enhanced functions
- strong performance
- 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.

■ Super high speed response of 35μs

The **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.

■ 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.

FX-301 series
double
coupling lens

Conventional fiber sensors
(no lens)
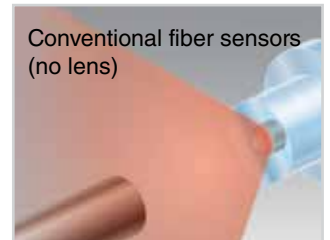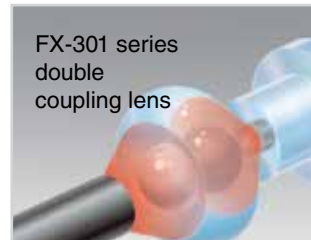
Stable sensing comparison

Short-term stability

Deviation

FX-301(P)(-HS)

Three-chemical
emitting element

Light-emitting amount

Long-term stability

Time

Typical applications

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Index

FX-301

Workpiece detection

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

Sensing translucent stickers

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

Register mark detection

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

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 rough environments 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.

Engine block

FD-WKZ1

Wire breakage detection

Wide beams are ideal for moving wire detection.

FT-WA8

Technical specifications

Type		Standard type	High speed
Model no.	**NPN**	**FX-301(/-B/-G/-H) (Note 1)**	**FX-301-HS**
	PNP	**FX-301(/-B/-G/-H)P**	**FX-301P-HS**
Supply voltage		12 to 24V DC ±10%	
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
Output		PNP / NPN open-collector transistor, max. 100mA	
Output operation		Selectable either Light-ON or Dark-ON, with jog switch	
Sensitivity setting		2-level teaching/Limit teaching/ 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	
Emitting element		**FX-301(P)**: Red LED, **FX-301B(P)**: Blue LED, **FX-301G(P)**: Green LED, **FX-301H(P)**: Infrared LED	Red LED
Connection method		Connector (Note 2)	
Dimensions (HxWxD)		30.5x10x64.5mm	
Accessories		**FX-MB1** Amplifier protection seal	

Notes:
1) Without suffix = Red LED
   Suffix -B = Blue LED
   Suffix -G = Green LED
   Suffix -H = Infrared LED
2) The cable for amplifier connection is not supplied as an accessory. Please select under accessories (page 125)

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. Since the potentiometer is illuminated, you can even make adjustments easily in dark areas.

■ **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

The blue LED type can accurately sense yellow marks on white backgrounds that are difficult to sense using the red LED type.
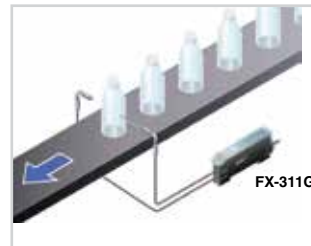
FX-311G

Technical specifications

Model no.	NPN	FX-311
	PNP	FX-311P
Supply voltage		12 to 24V DC ±10%
Power consumption		840mW or less (Current consumption 35mA or less at 24V supply voltage)
Response time		250μs or less (STD / S-D), 2ms or less (LONG) selectable with selection switch
Output		PNP / NPN open-collector transistor, max. 100mA
Output operation		Selectable either Light-ON or Dark-ON, with selection switch
Short-circuit protection		Incorporated
Operation of indicators		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)
Emitting element		Red LED
Material		Enclosure: Heat-resistant ABS, Case cover: polycarbonate
Connection method		Connector (Note 2)
Dimensions (HxWxD)		34.5x10x70.5mm

Notes:
1) When the power supply is switched on, the light emission timing is automatically set for interference prevention
2) The cable for amplifier connection is not supplied as an accessory. Please select under accessories (page 125)

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FX-500

FX-500

Fiber amplifier at the industry's leading edge

Features

Optimized stability

When used with the super quality fiber as a set, the incident light intensity variation among units is decreased to only 1/4 of that of conventional models.

High performance

The **FX-500** with its ultra high response time improves of 25μs productivity.

HYPER mode incorporated

FX-500 in combination with the small diameter fiber can handle challenging detections over a super long sensing range.

Improved accuracy!

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

Super quality fiber + FX-500 series
Threshold value / Incident light intensity

Digital control is essentially achieved
Stability of the incident light intensity is by 4 times improved. Values stay close together even after replacing an amplifier.

Max. 5.6 times!

FX-500

Previous model

FT-WA8
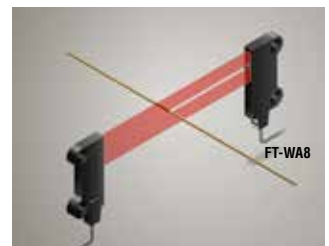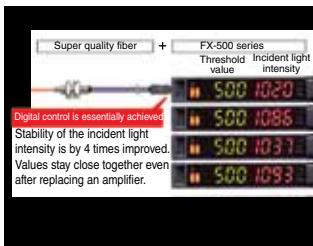
■ No PLC necessary, saving material and programming costs

Detection fiber

Synchronization fiber
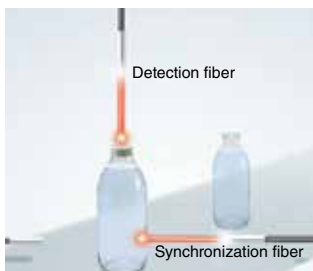
Logical operation of sensors

Three logical calculations (AND/OR/XOR) are selectable using Output 1 of multiple FX-500 series amplifiers. You can logically connect two outputs of an FX-500 or one input of a normal sensor to the output of an FX-500 sensor.

Calculation of 2 neighboring FX-500 amplifiers

Upper side Output 1 — Calculation result output
Lower side Output 2 — Normal operation

Communication direction

Calculation of two outputs in one FX-500   **FX-502(P) / 505(P)-C2**

Output 1 — Calculation result output
Output 2 — Normal operation

Calculation of one FX-500 and external input   **FX-502(P) / 505(P)-C2**

External input setting (sensor, contact, PLC, etc.)
Output 1 — Calculation result output

■ Analog output cable type FX-505

The sensor outputs an analog signal of 4-20mA in proportion to digital value displayed for the current light intensity received.
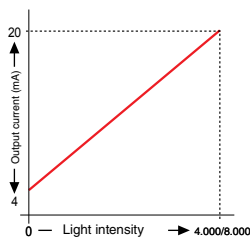
Edge tracking of film or sheet

Actual position

Deviation
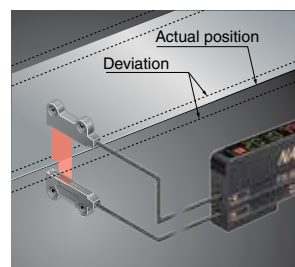
Drifting path can be tracked as the light intensity changes.

20

4

Output current (mA)

0 — Light intensity → 4.000/8.000

37
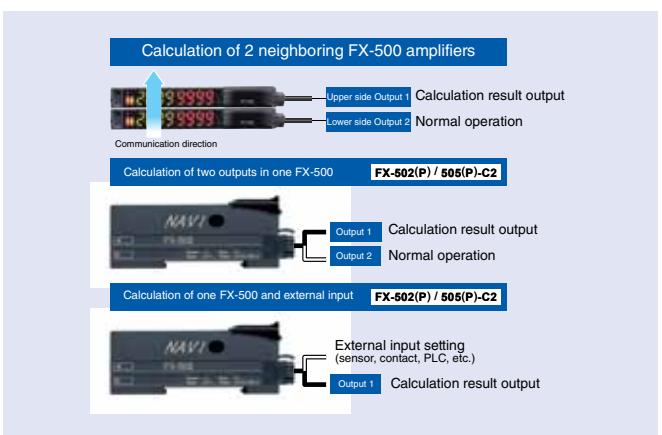
Typical applications

Counting of IC pins

FT-H20W-M1
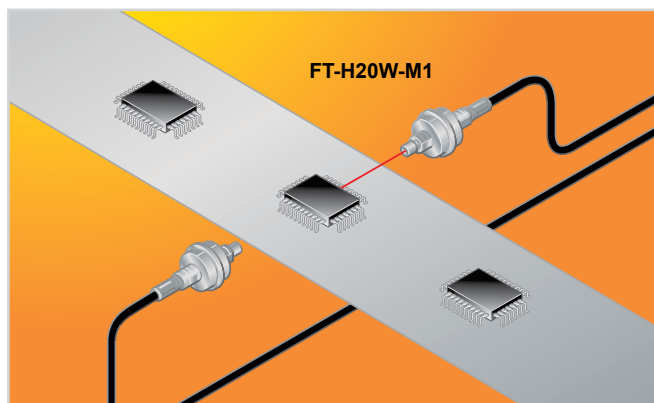
Check crimping
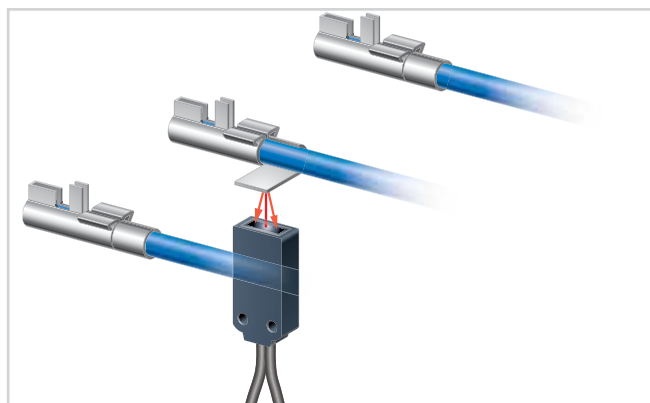
Glass substrate sensing
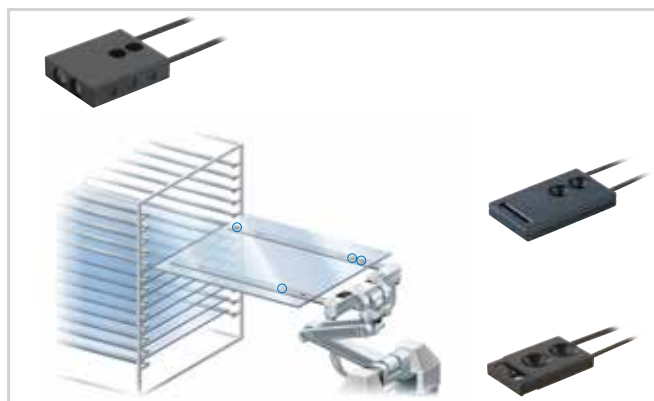
Technical specifications

Type		Standard type	2 outputs	Analog output type
Model no.	NPN	FX-501	FX-502	FX-505-C2
	PNP	FX-501P	FX-502P	FX-505P-C2
Digital fiber sensor amplifier		Digital		Analog
Timer function		Adjustable: 0.1ms to 999.9ms in 0.1ms steps, 1 to 9999ms in 1ms steps, 1 to 32s in 1s steps		
Interference prevention		Auto interference prevention function for up to 12 units and selectable emission frequency method		
Response time		25µs / 60µs / 250µs / 2ms / 4ms / 24ms or less		
Analog voltage output		–		4 to 20mA
Supply voltage		12 to 24V DC ±10%		
Output		PNP / NPN open-collector transistor, max. 100mA		
Emitting element		Red LED		
Material		Enclosure: polycarbonate, switch: POM		
Rated current consumption (without load)		Normal operation: 40mA or less at 24V supply voltage Eco mode: 30mA or less at 24V supply voltage		
Protection		IP40 (IEC)		
Ambient temperature		−10 to +55°C		
Connection method		Connector (Note)		Cable, 2m
Dimensions (HxWxD)		34x10x75mm		
Accessories		**FX-MB1** Amplifier protection seal		

Note: The cable for amplifier **FX-501❏**, **FX-502❏** is not supplied as an accessory. Please select under accessories (page 125).

Fiber-optic Sensors
Now with communication interface!

Fibers with integrated high-precision plug

■ Stable light intensity

Optical **fibers** with insertion plug-in achieve a very high quality standard. Through the integrated high-precision plug, the fiber core can be centered to within ±40µm. Variation in light intensity could thus be reduced to ±10%.

■ New fiber core

Now the core consists of only one fiber instead of several single fibers. This design improves sensing stability dramatically because there is no variation in light intensity among individual fibers.

New

Old

■ Sharp bending and flexible fibers

With a bending radius of 4mm, the optical fibers easily cope with millions of bending cycles.
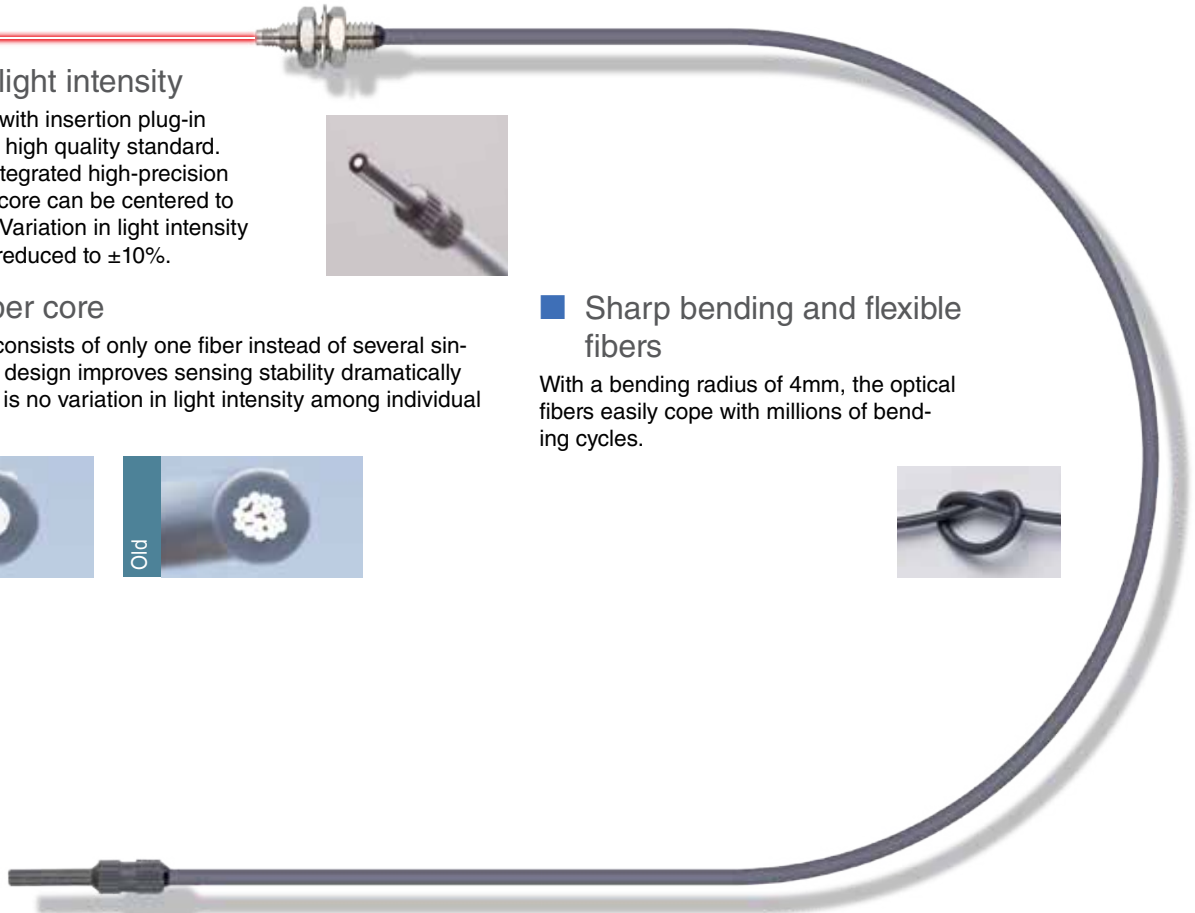
Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

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Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Super quality fibers

■ Thru-beam type (one pair set)
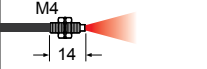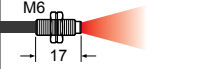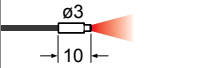
Type		Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm)			Beam axis dia. (mm)	Protec-tion	Ambient temperature
						FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102			
Threaded	M3	M3 →12←	**Tough** FT-30	R2	2m	STD 400 / HYPR 1,350	810 650 210 75	135 400	ø0.5	IP67 (IEC)	−55 to +80°C
Threaded	M4	M4 →15←	**Tough** FT-40	R4		STD 1,200 / HYPR (Note) 3,600	2,200 1,700 530 190	320 870	ø1		
Cylindrical type	ø1.5	ø1.5 →10←	**Tough** FT-S20	R2		STD 400 / HYPR 1,350	810 650 210 75	135 400	ø0.5		
Cylindrical type	ø3	ø3 →10←	**Tough** FT-S30	R4		STD 1,200 / HYPR (Note) 3,600	2,200 1,700 30 190	320 870	ø1		

Note: The length of the fiber cable affects the sensing range.

■ Reflective type

Type		Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note)			Protection	Ambient temperature
						FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102		
Threaded	M3	M3 →12←	**Tough** FD-30	R2	2m	STD 160 / HYPR 600	330 250 80 25	45 155	IP67 (IEC)	−55 to +80°C
Threaded	M4	M4 →14←	**Tough** FD-40	R2						
Threaded	M6	M6 →17←	**Tough** FD-60	R4		STD 520 / HYPR 1,550	900 740 260 90	140 420		
Cylindrical	ø3	ø3 →10←	**Tough** FD-S30	R4		STD 160 / HYPR 600	330 250 80 25	45 155		

Note: The sensing range is specified for white, matt paper.

Tough High flexibility: min. bending radius of 4mm, 10 mio. bending cycles (@ radius 10mm)

Threaded fibers

■ Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1)			Beam axis dia. (mm)	Protection	Ambient temperature
					FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102			
M3 Threaded	M3 →12←	**FT-31** (Tough)	R2	2m	STD 315 / HYPR 1,350	770 / 550 / 210 / 70	130 / 340	ø0.5	IP67 (IEC)	−55 to +80°C
	M3 →12←	**FT-31W**	R1		STD 260 / HYPR 990	590 / 440 / 150 / 53	80 / 240			−40 to +60°C
M4	Lens mountable: FX-LE1, FX-LE2, FX-SV1 M4 →15←	**FT-43**	R4		STD 1,400 / HYPR (Note 2) 3,600	2,800 / 2,100 / 770 / 240	350 / 970	ø1.5		−55 to +80°C
	Lens mountable: FX-LE1, FX-LE2, FX-SV1 M4 →15←	**FT-42** (Tough)			STD 1,130 / HYPR (Note 2) 3,600	2,050 / 1,600 / 530 / 190	30 / 800	ø1		
	Lens mountable: FX-LE1, FX-LE2, FX-SV1 M4 →15←	**FT-42W**	R1		STD 800 / HYPR 3,300	1,900 / 1,400 / 490 / 160	260 / 720			−40 to +60°C
	Lens mountable: FX-LE1, FX-LE2, FX-SV1 M4 →20←	**FT-45X**	R4	1m	STD 1,200 / HYPR (Note 2) 1,600	1,600 (Note 2) / 1,600 (Note 2) / 630 / 200	340 / 920			−55 to +80°C
Elbow	Lens mountable: FX-LE1, FX-LE2, →15← M4	**FT-R40** (Tough)	R4		STD 930 / HYPR (Note 2) 3,600	1,750 / 1,500 / 500 / 160	270 / 740			
M3 Square head	M3 W5.5 × H8 × D16	**FT-R31** (Tough)	R2	2m	STD 270 / HYPR 1,000	580 / 440 / 160 / 55	100 / 340	ø0,5		
M4 Square head	M4 W7 × H9 × D13.9	**FT-R41W**			STD 800 / HYPR 3,200	1,800 / 1,400 / 460 / 150	250 / 710	ø1	IP40 (IEC)	−40 to +60°C
	With expansion lens M4 W7 × H9 × D14.4	**FT-R42W**	R1		STD 2,200 / HYPR (Note 2) 3,600	3,600 (Note 2) / 3,500 / 1,300 / 460	510 / 2,000	ø2.2		
	Lens mountable: FX-LE1, FX-LE2, FX-SV1 M4 W7 × H9 × D13.5	**FT-R43**	R4		STD 720 / HYPR 3,000	1,600 / 1,100 / 430 / 130	210 / 640	ø1	IP67 (IEC)	−55 to +80°C
M14 Long sensing range	With expansion lens M14 →40←	**FT-140** (Tough)	R4	10m	STD (Note 2) 19,600 / HYPR (Note 2) 19,600	19,600 (Note 2) / 19,600 (Note 2) / 16,000 / 6,300	14,000 / 19,600 (Note 2)	ø10		−40 to +70°C

Notes:
1) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut
2) The length of the fiber cable affects the sensing range

Tough High flexibility: min. bending radius of 4mm, 10 mio. bending cycles (@ radius 10mm)

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Ionizers/ Electrostatic Sensors

Accessories

Threaded fibers

■ Reflective type

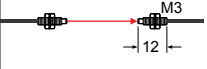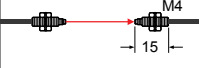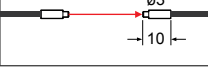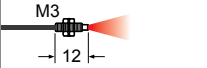| Type		Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1, 2)			Protection	Ambient temperature
						FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102		
M3		M3 →│ 12 │←	**Tough** FD-31	R2	2m	STD ■125 HYPR ■515	290 220 80 25	35 140	IP67 (IEC)	−55 to +80°C
		M3 →│ 12 │←	FD-31W	R1		STD ■80 HYPR ■330	180 140 45 12	15 60		−40 to +60°C
		Coaxial • Lens mountable: FX-MR3, FX-MR6 M3 →│ 17 │←	**Tough** FD-32G	R2		STD ■200 HYPR ■650	380 270 95 27	70 190	IP40 (IEC)	−55 to +80°C
		Lens mountable: FX-MR3, FX-MR6, Coaxial, Stainless-jacketed M3 →│ 18 │←	FD-32GX	R2	1m (Note 3)	STD ■200 HYPR ■630	410 360 100 30	75 210		
	Ultra-small diameter	Lens mountable: FX-MR3, FX-MR6, Coaxial M3 →│ 16 │←	FD-EG30	R4	500mm	STD ■48 HYPR ■170	130 110 30 9	20 70		−40 to +70°C
		Lens mountable: FX-MR3, FX-MR6, Coaxial M3 →│ 16 │←	FD-EG31	R4		STD ■20 HYPR ■85	45 35 12 3.5	7 25		−20 to +60°C
Threaded	M4	M4 →│ 14 │←	**Tough** FD-41	R2	2m	STD ■125 HYPR ■515	290 220 80 25	35 140	IP67 (IEC)	−55 to +80°C
		M4 →│ 14 │←	FD-41W	R1		STD ■270 HYPR ■900	630 430 150 45	80 230		−40 to +60°C
		Lens mountable: FX-MR1, FX-MR2, FX-MR3, FX-MR5, FX-MR6, Coaxial M4 →│ 25 │←	**Tough** FD-42G	R2		STD ■200 HYPR ■650	380 270 95 27	70 190	IP40 (IEC)	−55 to +80°C
		Lens mountable: FX-MR1, FX-MR2, FX-MR3, FX-MR5, FX-MR6, Coaxial M4 →│ 25 │←	FD-42GW	R1		STD ■150 HYPR ■670	340 280 90 25	45 140		−40 to +60°C
	M6	M6 →│ 17 │←	FD-62	R4		STD ■520 HYPR ■1,500	1,000 940 340 110	170 450	IP67 (IEC)	−55 to +80°C
		M6 →│ 17 │←	**Tough** FD-61	R4		STD ■450 HYPR ■1,400	840 670 200 70	120 410		
		M6 →│ 17 │←	FD-61W	R1		STD ■270 HYPR ■900	630 430 150 45	80 230		−40 to +60°C
		Coaxial M6 →│ 17 │←	**Tough** FD-61G	R4		STD ■420 HYPR ■1,100	800 650 200 60	120 350	IP40 (IEC)	−55 to +80°C
		Stainless-jacketed M6 →│ 22 │←	FD-64X	R4	1m	STD ■280 HYPR ■670	500 410 160 50	75 220		
	Elbow	→│ 15 │← M6	**Tough** FD-R60	R4	2m	STD ■290 HYPR ■1,100	600 550 190 65	110 240	IP67 (IEC)	

Notes:
1) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut
2) The sensing range is specified for white, matt paper
3) The allowable cutting range is 700mm from the end inserted at the amplifier

Tough High flexibility: min. bending radius of 4mm, 10 mio. bending cycles (@ radius 10mm)

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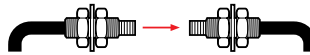Inductive Proximity
Sensors

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Cylindrical fibers

Standard Fibers

Cylindrical fibers
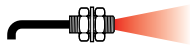
■ Thru-beam type (one pair set)

Type			Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1)			Beam axis dia. (mm)	Protection	Ambient temperature
							FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102			
Cylinder type	Cylinder type	ø1	ø1 6	**Tough** FT-S11	R2	500mm	STD 90 HYPR 350	210 160 60 19	40 90	ø0.25	IP67 (IEC)	−55 to +80°C
		ø1.5	ø 1.5 10	**Tough** FT-S21		2m	STD 315 HYPR 1,350	770 550 210 70	130 340	ø0.5		
		ø1.5	ø 1.5 10	FT-S21W	R1		STD 260 HYPR 990	590 440 150 53	80 240			−40 to +60°C
		ø2.5	With lens, long sensing range ø2.5 8	FT-S32	R10		STD 3,100 HYPR (Note 2) 3,600	3,600 (Note 2) 3,600 (Note 2) 1,800 600	1,100 3,000	ø2	IP40 (IEC)	−40 to +70°C
		ø3	ø3 10	FT-S31W	R1		STD 800 HYPR 3,300	1,900 1,400 490 160	260 720	ø1	IP67 (IEC)	−40 to +60°C
	Ultra-small diameter	ø3	Narrow beam ø0.125mm ø0.25 ø3 5 15	**Tough** FT-E13	R2	1m	STD 15 HYPR 52	30 24 8 2	6 19	ø0.125		−40 to +70°C
			Narrow beam ø0,25mm ø0.4 ø3 5 15	**Tough** FT-E23			STD 75 HYPR 270	160 125 42 13	22 80	ø0.25		
	Side sensing ø4		ø4 13 25	**Tough** FT-V40	R4	2m	STD 3,500 HYPR (Note 2) 3,600	3,600 (Note 2) 3,600 (Note 2) 2,400 850	1,000 3,100	ø2.5	IP50 (IEC)	−40 to +60°C

Notes:
1) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut.
2) The length of the fiber cable affects the sensing range.

■ Reflective type

Type			Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1, 2)			Protection	Ambient temperature
							FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102		
Cylindrical	Cylindrical	ø1.5	ø 1.5 10	**Tough** FD-S21	R2	1m	STD 80 HYPR 190	130 110 37 11	25 70	IP40 (IEC)	−55 to +80°C
		ø3	ø3 15	**Tough** FD-S32	R4	2m	STD 420 HYPR 1,200	790 660 220 75	120 345	IP67 (IEC)	
			ø3 15	FD-S32W	R1		STD 270 HYPR 900	630 430 150 45	80 230		−40 to +60°C
			ø3 10	**Tough** FD-S31	R2		STD 125 HYPR 515	290 220 80 25	35 140		−55 to +80°C
			Coaxial ø3 15	FD-S33GW	R1		STD 150 HYPR 670	340 280 90 25	45 140		−40 to +60°C
	Ultra-small diameter	ø1.5	ø1.5 ø0.48 15 3	FD-E13	R4	1m	STD 12 HYPR 50	29 25 7 2	5 15	IP40 (IEC)	
		ø3	ø3 ø0.63 15 5	FD-E23			STD 55 HYPR 170	120 80 30 9	20 70		−40 to +70°C

Notes:
1) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut
2) The sensing range is specified for white, matt paper

Fibers with sleeve

■ Thru-beam type (one pair set)

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Fibers with sleeve

Type		Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1, 2)			Beam axis dia. (mm)	Protection	Ambient temperature
						FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102			
Threaded	M3	Sleeve 40mm ø0.88 M3 10	**Tough** FT-31S	R2	2m	STD 315 HYPR 1,220	740 550 195 63	130 340	ø0.5	IP67 (IEC)	−55 to +80°C
	M4	Sleeve 40mm ø1.48 M4 12	**Tough** FT-42S (Note 3)	R4		STD 1,130 HYPR (Note 2) 3,600	2,050 1,600 530 190	300 800	ø1		
Cylindrical	Ultra-small diameter ø3	Narrow beam ø0.125mm ø0.25 ø3 5 15	**Tough** FT-E13	R2	1m	STD 15 HYPR 52	30 24 8 2	6 19	ø0.125		−40 to +70°C
		Narrow beam ø0.25mm ø0.4 ø3 5 15	**Tough** FT-E23			STD 75 HYPR 270	160 125 42 13	22 80	ø0.25		
	Side sensing ø2	ø1 ø2 20 15	**Tough** FT-V23	R4	2m	STD 450 HYPR 1,800	1,000 880 280 90	160 400	ø0.75	IP30 (IEC)	−55 to +80°C
		ø1 ø2 15 15	**Tough** FT-V25	R2		STD 240 HYPR 900	550 480 140 45	95 260	ø0.5		
		ø1 ø2 15 15	FT-V24W	R1		STD 110 HYPR 380	230 200 60 20	35 90			−40 to +60°C
	ø2.5	ø1,5 ø2,5 20 15	**Tough** FT-V30	R4		STD 680 HYPR 2,200	1,200 1,000 340 100	180 480	ø1.0		−55 to +80°C

Notes:
1) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut
2) The length of the fiber cable affects the sensing range
3) The bending radius of the sleeve is >10mm

Tough High flexibility: min. bending radius of 4mm, 10 mio. bending cycles (@ radius 10mm)

Standard Fibers

■ Reflective type

Type			Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1, 2)			Protection	Ambient temperature
							FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102		
Threaded	Ultra-small diameter	M3	Sleeve 15mm; M3 ø0.8; 15	FD-EG30S	R4	1m	STD ■50 / HYPR ■170	110 80 30 9	20 70	IP40 (IEC)	−40 to +70°C
	M4	M4	Sleeve 40mm; M4 ø1.48; 12; Tough	FD-41S	R2 (Note 3)	2m	STD ■125 / HYPR ■515	290 220 80 25	35 140	IP67 (IEC)	−55 to +80°C
			Sleeve 40mm; M4 ø1.48; 12	FD-41SW	R1 (Note 3)		STD ■80 / HYPR ■330	180 140 45 12	15 60		−40 to +60°C
	M6	M6	Sleeve 40mm; M6 ø2.5; 15; Tough	FD-61S	R4 (Note 3)		STD ■420 / HYPR ■1,200	790 660 220 75	130 360		−55 to +80°C
Cylindrical	Ultra-small diameter	ø1.5	ø1.5 ø0.48; 15; 3	FD-E13	R4	1m	STD ■12 / HYPR ■50	29 25 7 2	5 15	IP40 (IEC)	−40 to +60°C
		ø3	ø3 ø0.63; 15; 5	FD-E23			STD ■55 / HYPR ■170	120 80 30 9	20 70		−40 to +70°C
	Side sensing	ø3	15 15 ø3 ø1.5 ...2; Tough	FD-V30	R2	2m	STD ■65 2,559 / HYPR ■240	130 120 35 14	25 75	IP30 (IEC)	−55 to +80°C
		ø3	15 15 ø3 ø1.5 ...2	FD-V30W	R1		STD ■20 / HYPR ■80	40 30 10 2	6 20		−40 to +60°C
		ø5	15 20 ø5 ø2 ...3; Tough	FD-V50	R4		STD ■120 / HYPR ■370	220 210 75 25	40 100		−55 to +80°C

Notes:
1) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut
2) The sensing range is specified for white, matt paper
3) The bending radius of the sleeve is >10mm

Tough High flexibility: min. bending radius of 4mm, 10 mio. bending cycles (@ radius 10mm)

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Flat fibers

Flat fibers

■ Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1)			Beam axis dia. (mm)	Protection	Ambient temperature
					FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102			
Flat	Top sensing W3 × H8 × D12, Tough	FT-Z30H	R2	2m	STD 3,500 / HYPR (Note2) 3,600	3,600 (Note 2) / 3,600 (Note 2) / 2,600 / 810	1,400 / 3,200	2×3	IP40 (IEC)	−40 to +60°C
	Top sensing W3 × H8 × D12	FT-Z30HW	R1	2m	STD 3,500 / HYPR (Note2) 3,600	3,600 (Note 2) / 3,600 (Note 2) / 2,600 / 810	1,400 / 3,200	2×3	IP40 (IEC)	−40 to +60°C
	Side sensing W3 × H12 × D8, Tough	FT-Z30E	R2		STD 3,500 / HYPR (Note2) 3,600	3,600 (Note 2) / 3,600 (Note 2) / 2,400 / 740	1,200 / 3,200	2×3		
	Side sensing W3 × H12 × D8	FT-Z30EW	R1		STD 3,400 / HYPR (Note2) 9,600	3,600 (Note 2) / 3,600 (Note 2) / 2,000 / 630	1,400 / 2,600			
	Front sensing W8.5 × H12 × D3, Tough	FT-Z30	R2		STD 2,100 / HYPR (Note2) 3,600	3,600 (Note 2) / 3,600 (Note 2) / 1,200 / 410	710 / 2,300	ø2		
	Front sensing W8,5 × H12 × D3	FT-Z30W			STD 1,500 / HYPR (Note2) 3,600	3,300 / 3,200 / 1,000 / 280	540 / 1,800	ø2		
With boss	Front sensing W10 × H7 × D2	FT-Z20W		1m	STD 530 / HYPR (Note2) 1,600	1,100 / 900 / 330 / 100	230 / 670	ø1.5	–	
	Top sensing W2 × H10 × D10	FT-Z20HBW	R1		STD 260 / HYPR 1,100	670 / 570 / 180 / 55	100 / 320	ø0.5	IP67 (IEC)	
	Front sensing W14 × H7 × D3.5	FT-Z40W		2m	STD 1,400 / HYPR 3,500	3,300 / 2,300 / 890 / 290	330 / 1,000	ø1.5	–	
	Top sensing W3.5 × H14 × D11	FT-Z40HBW			STD 800 / HYPR 3,300	1,900 / 1,400 / 490 / 160	260 / 720	ø1	IP67 (IEC)	

Notes:
1) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut.
2) The length of the fiber cable affects the sensing range.

■ Reflective type

Type	Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1, 2)			Protection	Ambient temperature
					FX-500 series	U-LG LONG FAST H-SP	FX-101 Fx-102		
Flat / With boss	Front sensing W10 × H7 × D2	FD-Z20W	R1	1m	STD 2 to 65 / HYPR 1 to 230	1 to 110 / 1 to 85 / 3 to 35 / 5 to 13	2 to 20 / 1 to 70	–	−40 to +60°C
	Top sensing W2 × H10 × D10	FD-Z20HBW			STD 2 to 85 / HYPR 1 to 340	1 to 210 / 1 to 180 / 2 to 55 / 3 to 15	2 to 30 / 1 to 90	IP67 (IEC)	
	Front sensing W14 × H7 × D3.5	FD-Z40W		2m	STD 110 / HYPR 430	230 / 180 / 1.5 to 65 / 3 to 25	1 to 55 / 160	–	
	Top sensing W3.5 × H14 × D11	FD-Z40HBW			STD 260 / HYPR 760	540 / 470 / 1 to 160 / 2 to 50	1 to 90 / 0.5 to 240	IP67 (IEC)	

Notes:
1) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut
2) The sensing range is specified for white, matt paper

Tough High flexibility: min. bending radius of 4mm, 10 mio. bending cycles (@ radius 10mm)

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers / Electrostatic Sensors

Accessories

Wide beam fibers

Wide beam fibers

■ Reflective type

Type	Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1)			Beam axis dia. (mm)	Protection	Ambient temperature
					FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102			
Wide beam	Sensing width 32mm W5 × H69 × D20	**Tough** FT-A32	R2		STD (Note 2) 3,600 HYPR (Note 2) 3,600	3,600 (Note 2) 3,600 (Note 2) 3,600 (Note 2) 2,100	3,600 (Note 2) 3,600 (Note 2)	3.2 × 32	IP40 (IEC)	–40 to +60°C
Wide beam	Sensing width 32mm W5 × H69 × D20	FT-A32W	R1		STD (Note 2) 3,600 HYPR (Note 2) 3,600	3,600 (Note 2) 3,600 (Note 2) 3,600 (Note 2) 3,000				–40 to +55°C
Wide beam	Sensing width 11mm W4.2 × H31 × D13.5	**Tough** FT-A11	R2	2m	STD (Note 2) 3,600 HYPR (Note 2) 3,600	3,600 (Note 2) 3,600 (Note 2) 3,600 (Note 2) 1,100	1,900 3,600 (Note 2)	2.2 × 11		–40 to +70°C
Wide beam	Sensing width 11mm W4.2 × H31 × D13.5	FT-A11W	R1		STD (Note 2) 3,600 HYPR (Note 2) 3,600	3,600 (Note 2) 3,600 (Note 2) 1,300	1,700 3,400			–40 to +55°C
Array	Sensing width 5.5mm W5 × H15 × D15	**Tough** FT-AL05	R2		STD 860 HYPR 2,300	1,550 1,500 50 170	250 660	0.25 × 5.5		–55 to +80°C

Notes:
1) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut.
2) The length of the fiber cable affects the sensing range.

■ Reflective type

Type	Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1, 2)			Protection	Ambient temperature
					FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102		
Wide beam	W7 × H15 × D30	**Tough** FD-A16	R4	2m	STD 200 HYPR cannot use	200 200 140 75	120 240	IP40 (IEC)	–40 to +60°C
Array	W5 × H20 × D20	**Tough** FD-AL11	R2		STD 320 HYPR 670	530 510 180 50	100 285		–55 to +80°C

Notes:
1) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut
2) The sensing range is specified for white, matt paper

Tough High flexibility: min. bending radius of 4mm, 10 mio. bending cycles (@ radius 10mm)

Convergent reflective fibers for glass detection

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Convergent reflective fibers

■ Reflective type

Type	Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1, 2)			Protection	Ambient temperature
					FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102		
Glas substrate detection	Side sensing W25 × H7.3 × D30	FD-L32H	R4	✂ 4m	STD 0 to 56 HYPR 0 to 110	0 to 87 0 to 74 1 to 38 Cannot use	16 to 30 0 to 50	IP40 (IEC)	−40 to +60°C
	Long sensing range W20 × H29 × D3.8	Tough FD-L30A	R2	✂ 3m	STD 0 to 43 HYPR 0 to 43	0 to 43 0 to 43 0 to 42 0 to 29	0 to 40 0 to 50		0 to +70°C
	Long sensing range W23.5 × H29 × D4.5	Tough FD-L31A	R4		STD 4 to 33 HYPR 3 to 35	4 to 33 4 to 33 4 to 32 5 to 25	5 to 30 4 to 33		
	Long sensing range W17 × H29 × D3.8	Tough FD-L22A	R2	✂ 2m	STD 0 to 24 HYPR 0 to 31	0 to 28 0 to 27 0 to 24 0 to 18	0 to 19 0 to 25		
	Short sensing range W18 × H29 × D3.8	Tough FD-L23		✂ 3m	STD 0 to 29 HYPR 0 to 30	0 to 30 0 to 30 0 to 28 1.5 to 24	0 to 28 0 to 30		−20 to +70°C
	Short sensing range W12 × H19 × D3	Tough FD-L11	R4		STD 0 to 9.5 HYPR 0 to 11.5	0 to 10.5 0 to 10 0 to 9 0 to 8	0 to 8 0 to 9		−40 to +60°C
	Short sensing range W12 × H19 × D3	Tough FD-L10			STD 0 to 5 HYPR 0 to 6	0 to 5.5 0 to 5.5 0 to 4.5 0 to 4	0 to 4.5 0 to 5.5		
	W24 × H21 × D4	Tough FD-L21	R2	✂ 2m	STD 1.5 to 16 HYPR 1 to 19	1 to 18 1 to 18 2 to 15 3 to 12	3 to 15 1.5 to 16		
	W24 × H21 × D4	FD-L21W	R1		STD 3 to 14 HYPR 1.5 to 15	2 to 15 2 to 15 4 to 14 6.5 to 10	7 to 12 3 to 14		
	W6 × H18 × D14	Tough FD-L20H	R2		STD 23 HYPR 45	35 32 2 to 15 5 to 9	5 to 15 1 to 30		−40 to +70°C
Ultra-small	W7.2 × H7.5 × D2	FD-L12W	R1	✂ 1m	STD 8 HYPR 14	12,5 12 0.5 to 7 0.5 to 4	1 to 4.5 0.5 to 7	IP30 (IEC)	−40 to +60°C

Notes:
1) The sensing range specified for transparent glass 100×100×0.7mm (**FD-L32H**: edge, **FD-L21** and **FD-L21W**: t2mm). (**FD-L20H**: white non-glossy paper, **FD-L10**: silicon wafers 100×100x2mm)
2) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut

■ Retroreflective type

Type	Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1, 2)			Protection	Ambient temperature
					FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102		
With polarizing filter	W5.2 × H9.5 × D16 W30 × H30 × D0.5	FR-Z50HW	R1		STD 100 to 990 HYPR 100 to 1,900	100 to 1,400 100 to 1,200 100 to 780 100 to 490	100 to 550 100 to 830	IP40 (IEC)	−25 to +55°C
Side sensing	W7.5 × H2.2 × D11.2 W4 × H2 × D21.5	Tough FR-KZ22E	R2	✂ 2m	STD 15 to 310 HYPR 15 to 570	15 to 460 15 to 410 15 to 220 15 to 100	15 to 200 15 to 360	IP30 (IEC)	−40 to +60°C
Narrow view / Top sensing	W5.2 × H9.5 × D21 W10.6 × H28 × D10.1	Tough FR-KZ50H			STD 20 to 300 HYPR 20 to 1,000	20 to 800 20 to 400 20 to 200 20 to 200	20 to 200 20 to 350		
Narrow view / Side sensing	W9.5 × H25 × D5.2 W28 × H10.6 × D10.1	Tough FR-KZ50E							

Notes:
1) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut
2) The sensing range is specified for the reflector

Heat-resistant fibers

■ Thru-beam type (one pair set)

Type	Temperature	Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1)			Beam axis dia. (mm)	Ambient temperature
						FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102		
Heat-resistant fiber	350°C	Lens mountable: FX-LE1/LE2/SV1 M4 ←30→	FT-H35-M2	R25	2m	STD 430 HYPR 1,200	880 670 250 80	170 490	ø1.2	−60 to +350°C
		Sleeve 60mm M4 ø2,1 ←27→	FT-H35-M2S6	Standard fibers R25 Sleeve **R10**						
	200°C	Lens mountable: FX-LE1/LE2/SV1 M4 ←23→	FT-H20W-M1	**R10**	1m	STD 470 HYPR (Note2) 1,600	1.000 840 300 90	100 300	ø0.8	−60 to +200°C
		Lens mountable: FX-LE1/LE2/SV1 M4 ←23→	FT-H20-M1	R25		STD 540 HYPR (Note2) 1,600	1,300 960 330 110	210 540	ø1.2	
	130°C	Lens mountable: FX-LE2 M4 ←16→	FT-H13-FM2		✂ 2m	STD 700 HYPR 3,300	1,900 1,300 410 140	250 700	ø1.5	−60 to +130°C
Heat-resistant (joint)	200°C	Lens mountable: FX-LE1/LE2/SV1 M4 ← 23 →	FT-H20-J20-S (Note 5)	Heat resistant R18 (Note 4)	✂ 200mm (Note 3)	STD 470 HYPR 1,600	1,000 790 300 90	135 420	ø1.2	−60 to +200°C
			FT-H20-J30-S (Note 5)		✂ 300mm (Note 3)					
			FT-H20-J50-S (Note 5)		✂ 500mm (Note 3)					
		Side sensing 24 ø3.8 ø4	FT-H20-VJ50-S (Note 5)			STD 600 HYPR 2,100	1,300 980 390 120	150 500		
			FT-H20-VJ80-S (Note 5)		✂ 800mm (Note 3)					

Notes:
1) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut
2) The length of the fiber cable affects the sensing range
3) The fiber length of the heat-resistant side cannot be cut
4) Bending radius R=25mm or more
5) Heat-resistant side and ordinary temperature fiber are sold together as a set

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Heat-resistant fibers

■ Reflective type

Type		Tempera-ture	Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1, 2)			Ambient temperature
							FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102	
Heat-resistant fiber	Threaded	350°C	Coaxial M6, 25	FD-H35-M2	R25	2m	STD 260 / HYPR 720	540 / 460 / 150 / 45	75 / 280	−60 to +350°C
			Sleeve 60mm M6 ø 2.8, 22	FD-H35-M2S6	Standard fibers R25 Sleeve R10					
			Sleeve 90mm M4, 27, ø 2.1	FD-H35-20S		1m	STD 260 / HYPR 840	550 / 440 / 140 / 45	85 / 200	
		200°C	Coaxial M6, 28	FD-H20-M1	R25		STD 330 / HYPR 840	550 / 500 / 200 / 55	120 / 300	−60 to +200°C
			Coaxial M4, 27	FD-H20-21			STD 230 / HYPR 770	500 / 380 / 130 / 45	90 / 280	
		130°C		FD-H13-FM2		2m	STD 350 / HYPR 880	640 / 600 / 200 / 65	100 / 280	−60 to +130°C
	Glass substrate detection convergent reflective	300°C	W19 × H27 × D5	FD-H30-L32		2m	STD 17 / HYPR 40	30 / 25 / 12 / 1.5 to 6	2 to 9 / 0 to 17	−60 to +300°C
		250°C	W21 × H33,2 × D5	FD-H25-L43		3m	STD 1.5 to 26 / HYPR 1 to 31	1 to 30 / 1 to 28 / 1.5 to 24 / 2 to 18	4 to 16 / 4 to 23	−20 to +250°C Standard fibers −20 to +70°C
			W21 × H34,5 × D5	FD-H25-L45			STD 5 to 42 / HYPR 4 to 43.5	4 to 43 / 4.5 to 43 / 5 to 40 / 6.5 to 34	7 to 35 / 7 to 38	
		180°C	W19 × H27 × D5	FD-H18-L31		2m	STD 16 / HYPR 60	32 / 24 / 13 / 2 to 6.5	0 to 10 / 0 to 25	−60 to +180°C

Notes:
1) The sensing range is specified for white, matt paper (50×50mm, glas substrate: **FD-H30-L32**, **FD-H18-L31**, clear glas 100×100×0.7mm: **FD-H25-L43** and **FD-H25-L45**)
2) The length of the fiber cable affects the sensing range

Chemical-resistant fibers

■ Thru-beam type (one pair set)

Type	Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 1)			Beam axis dia. (mm)	Protection	Ambient temperature
					FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102			
Chemical-resistant	SEMI W7 x H15 x D13	FT-Z802Y	R25	2m	STD 3,100 / HYPR (Note 2) 3,600	3,600 (Note 2) 3,600 (Note 2) 1,900 470	520 3,100	ø3.7	IP67 (IEC)	0 to +60°C
	Heat-resistant 115°C ø5.5 (25)	FT-HL80Y	R30	2m (Note 3)	STD (Note 2) 3,600 / HYPR (Note 2) 3,600	3,600 (Note 2) 3,600 (Note 2) 2,300 740	990 2,340		IP67g (IEC)	−40 to +115°C
	ø5.5 (25)	FT-L80Y			STD (Note 2) 3,600 / HYPR (Note 2) 3,600	3,600 (Note 2) 3,600 (Note 2) 2,800 920	1.100 2.600			−40 to +70°C
	Side sensing ø5.5 (25)	FT-V80Y			STD 1,300 / HYPR (Note 2) 3,600	2,800 2,200 800 240	340 800	ø2.8		

Notes:
1) The sensing range of the free-cut type fiber may be reduced depending upon how the fiber is cut
2) The length of the fiber cable affects the sensing range
3) The allowable cutting range is 500mm from the end inserted at the amplifier

Vacuum-resistant fibers

■ Thru-beam type (one pair set)

Type		Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm)			Beam axis dia. (mm)	Ambient temperature
						FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102		
Vacuum-resistant	Thru-beam type	300°C Lens mountable: **FV-LE1/SV2** M4 30	FT-H30-M1V-S (Note)	R18	1m	STD 27 / HYPR 1,000	590 470 160 55	110 280	ø1.2	−30 to +300°C

Note: Sold as a set comprising vacuum type fiber and photo-terminal (**FV-BR1**)

■ Reflective type
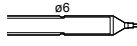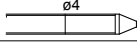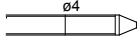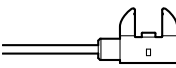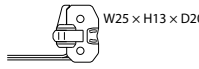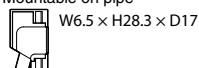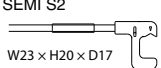
Type			Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Sensing range (mm) (Note 2)			Ambient temperature
							FX-500 series	U-LG LONG FAST H-SP	FX-101 FX-102	
Vacuum-resistant	Convergent reflective		300°C W9.5 × H5.2 × D15	FD-H30-KZ1V-S (Note 1)	R18	1m	STD 20 to 200 / HYPR 5 to 500	10 to 340 15 to 270 20 to 120 20 to 45	25 to 80 10 to 220	−30 to +300°C
	Convergent reflective		300°C, Glass substrate detection W19 × H5 × D27	FD-H30-L32V-S (Note 1)		3m	STD 8 / HYPR 18	12 10 5,5 1.5 to 3	2.5 to 6.5 0 to 11	

Notes:
1) Sold as a set comprising vacuum type fiber and photo-terminal (**FV-BR1**)
2) The sensing range is specified for transparent glass 100×100×0.7mm

Fibers for liquid leak/liquid detection

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Fibers for liquid leak / detection Fiber accessories

Type		Shape of fiber head (mm)	Model no.	Bending radius	Fiber cable length	Description	Protection	Ambient temperature
Contact type	Liquid level sensing	Heat resistant 125°C Fluorine resin coating ø6	FD-F8Y	Protective tube R40 Standard fibers R15	2m (Note)	ø6mm Protective tube: Fluorine resin, Length 1m (not cuttable) Liquid surface not contacted: beam received Liquid surface contacted: no beam received	IP68 (IEC)	–40 to +125°C
		Heat resistant 105°C Fluorine resin coating ø4	FD-HF40Y	Protective tube R20 Standard fibers R10	2m	ø4mm Protective tube: Fluorine resin, Length 500mm (not cuttable) Liquid surface not contacted: beam received Liquid surface contacted: no beam received	IP67 (IEC)	–40 to +105°C
		Heat resistant 70°C Fluorine resin coating ø4	FD-F41Y			ø4mm Protective tube: Fluorine resin, Length 500mm (not cuttable) Liquid surface not contacted: beam received Liquid surface contacted: no beam received		–40 to +70°C
Pipe-mountable type	Liquid leak detection	SEMI S2 W20×H30×D10	**Tough** FD-F71	Protective tube R20 Standard fibers R4	5m	Liquid leak detection Leak absent: beam received Leak present: no beam received		–20 to +60°C
	Liquid level sensing	Default W25 × H13 × D20	FD-F41	R10	2m	Applicable pipe diameter: Outer dia.: ø6mm to ø26mm Material: transparent pipe, PFA (fluorine resin, polycarbonate, acrylic, glass) Wall thickness: 1 to 3mm Liquid absent: beam received Liquid present: no beam received	–	–40 to +100°C
		For wall thickness 1mm W25 × H13 × D20	FD-F4			Applicable pipe diameter: Outer dia.: ø6mm to ø26mm Material: transparent pipe, PFA (fluorine resin). Wall thickness: 1mm. Liquid absent: beam received Liquid present: no beam received		
	Liquid leak detection	Mountable on pipe W6.5 × H28.3 × D17	**Tough** FD-FA93	R4		Applicable pipe diameter: Outer dia.: ø8mm or more (When used with the tying bands: ø8mm to ø80mm) Material: transparent pipe, PFA (fluorine resin). Liquid absent: beam received Liquid present: no beam received	IP40 (IEC)	–40 to +70°C
		SEMI S2 W23 × H20 × D17	**Tough** FT-F93	Protective tube R20 Standard fibers R2		Applicable pipe diameter: Outer dia.: ø3mm to ø10mm Material: transparent pipe, PFA (fluorine resin). Wall thickness: 0.3 to 1mm Liquid absent: beam received Liquid present: no beam received		–40 to +60°C

Note: The allowable cutting range is 500mm from the end inserted at the amplifier

Tough   High flexibility: min. bending radius of 4mm, 10 mio. bending cycles (@ radius 10mm)

Accessories

- **RF-003** (Reflector for **FR-KZ21**/**KZ21E**)
- **RF-13** (Reflective tape for reflective type)
- **FX-CT1** (Fiber cutter)
- **FX-CT2** (Fiber cutter)
- **FX-CT3** (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 fiber, Black/Gray)
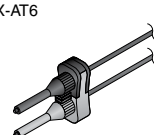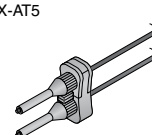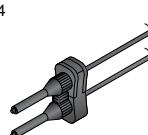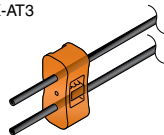
RF-003   RF-13   FX-CT1   FX-CT2
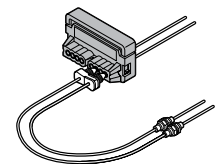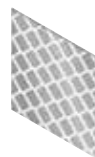
FX-CT3   FX-AT2   FX-AT3   FX-AT4   FX-AT5   FX-AT6
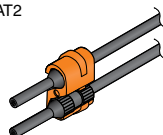
Standard Fibers

Photoelectric
Sensors

Fiber-optic
Sensors

Standard Fibers

Fiber Sensors
Communication
Units

Mark Sensors

Laser Sensors

Safety Sensors
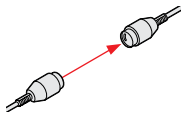
Pressure & Flow
Sensors

Inductive Proximity
Sensors
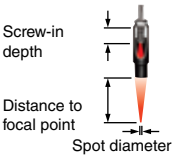
Measurement
Sensors

Ionizers /
Electrostatic
Sensors

Accessories

Fiber
accessories

■ Lens (for thru-beam type fiber)

Model no.	Picture	Description	Applicable fibers
FX-LE1		Expansion lens increases the sensing range by 5 times or more, ambient temperature: -60 to +350°C (Note 1, 2)	FT-43, FT-42, FT-42W, FT-45X, FT-R40, FT-R43, FT-H35-M2, FT-H20W-M1, FT-H20-M1, FT-H20-J50-S, FT-H20-J30-S, FT-H20-J20-S
FX-LE2		Expansion lens increases the sensing range by 6 times or more, ambient temperature: -60 to +350°C (Note 1, 2)	
FX-SV1		Side-view lens, beam axis is bent by 90°, ambient temperature: -60 to +300°C (Note 1, 2)	
FV-LE1		Expansion lens for vacuum fiber increases the sensing range by 4 times or more, ambient temperature: -60 to +350°C (Note 1, 2)	FT-H30-M1V-S
FV-SV2		Vacuum resistant side-view lens, beam axis is bent by 90°, ambient temperature: -60 to +300°C (Note 1, 2)	

■ Lens (for reflective type fiber)

Model no.	Picture	Description	Applicable fibers
FX-MR1		Pinpoint spot lens, distance to focal point 6±1mm, spot diameter Ø 0.5mm, ambient temperature -40 to +70°C (Note 1, 2)	**FD-42G, FD-42GW**
FX-MR2	Screw-in depth / Distance to focal point / Spot diameter	Zoom lens, screw-in depth (7-14mm), distance to focal point (18.5- 43mm), spot diameter Ø 0.7-2mm, ambient temperature: -40 to +60°C (Note 1, 2)	
FX-MR3	Distance to focal point / Spot diameter	Extremely fine spot, distance to focal point: 7.5±0.5mm, spot diameter: **FD-EG31** Ø 0.15mm/ **FD-EG30** Ø 0.3mm/ **FD-42G, FD-42WG , FD-32G, FD-32GX** Ø 0.5, ambient temperature: -40 to +70°C (Note 1, 2)	**FD-EG31, FD-EG30, FD-42G, FD-42GW, FD-32G, FD-32GX**
FX-MR5	Distance to focal point / Spot diameter	Zoom lens, screw-in depth, (8-14mm), distance to focal point (13-30mm), Spot diameter Ø 0.5-3mm, ambient temperature: -40 to +70°C (Note 1, 2)	**FD-42G, FD-42GW**
FX-MR6	Distance to focal point / Spot diameter	Extremely fine spot, distance to focal point 7.5 ±0.5mm, spot diameter: **FD-EG31** Ø 0.1mm/ **FD-EG30** Ø 0.2mm/ **FD-42G, FD-42WG, FD-32G, FD-32GX** Ø 0.4mm. ambient temperature: -40 to +60°C (Note 1, 2)	**FD-EG31, FD-EG30, FD-42G, FD-42GW, FD-32G, FD-32GX**
FX-MR7		Lens for extremely small spot, fits on M3 fiber, distance to focal point 7.0 ±0.5mm, Spot diameter: **FD-EG31** Ø0.1mm/ **FD-EG30** Ø0.2mm/ **FD-42G**, **FD-42WG**, **FD-32G**, **FD-32GX** Ø0.4mm. Ambient temperature: -40 to +60°C (Note 1,2)	**FD-R33EG, FD-EG31, FD-R34EG, FD-R32EG, FD-EG30, FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW**
FX-MR8		Zoom lens, variable spot diameter, sensing range 10-30mm, spot diameter Ø0.4-3.5mm, Ambient temperature: -40 to +60°C (Note 1, 2)	**FD-R33EG, FD-EG31, FD-R34EG, FD-R32EG, FD-EG30, FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW**
FX-MR9		Lens for parallel light emission; sensing range 0-30mm, Beam spot Ø0,4mm, Ambient temperature: -40 to +60°C (Note 1,2)	**FD-R33EG, FD-EG31, FD-R34EG, FD-R32EG, FD-EG30, FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW**

Notes:
1) Consider the ambient temperature of the fibers to be used in combination
2) Please test the functionality after mounting the lenses

FX-CH2

External input unit for fiberoptic sensors

Functions

■ Combining up to 16 sensors

Up to 16 sensors can be set/switched simultaneously by an external signal. The sensors can beare operated from a PLC, a touch panel, a push button, or some other external signal generating device.

■ Simultaneous teaching

- ■ Full-auto teaching
- ■ 2-level teaching

Even the enable/disable command for the key lock setting, a function designed to prevent operational mistakes, can be effectuated 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	PNP input
Model no.	FX-CH2	FX-CH2-P
Applicable sensor	FX-301(P), FX-305(P)	
Power supply voltage	12 to 24VDC ±10%	
Input	Low: 0 to +2VDC High: +5V to +V DC, or open	Low: 0 to +0.6V DC, or open High: 4V to +V DC
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 closed together: −10 to +45°C)	
Connection method	Connector (Note)	
Dimensions (HxWxD)	10x27x68.5mm	

Note: Please select under accessories (page 125).

Typical applications

■ 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 function

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 (Light-ON/Dark-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

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

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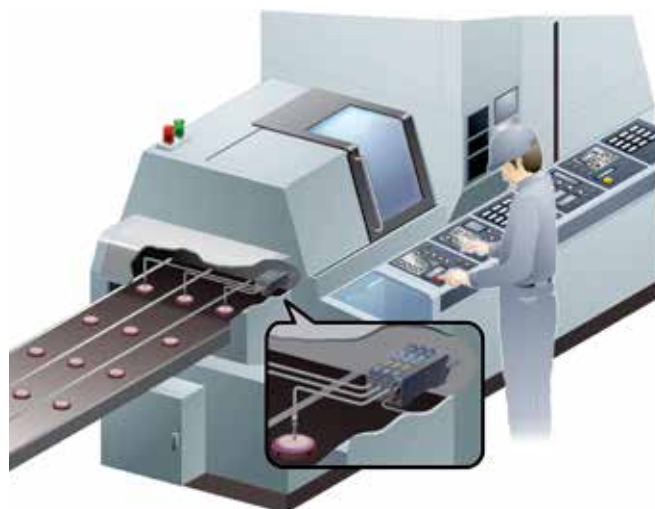
SC-GU1-485

Fiber sensor communication units

Functions

■ 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 e.g. FX-301(P), but also received-light amount and output status verifications greatly enhance workability during startup and maintenance.

FX-301(P)

PLC

SC-GU1-485

RS-485 communication
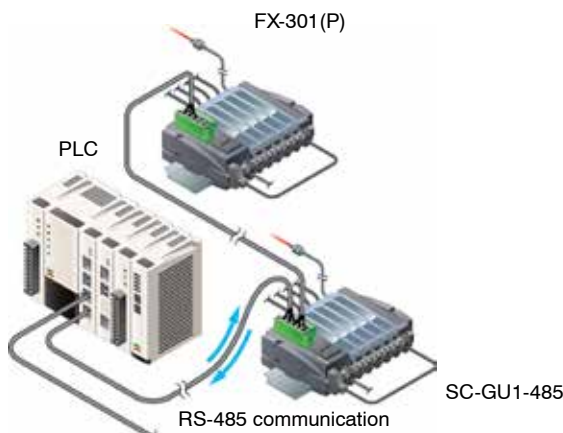
■ Series connection (RS-485) of a maximum of 31 nodes is possible

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.

1 node   2 nodes   3 nodes   4 nodes…   ….

…Max. 31 nodes
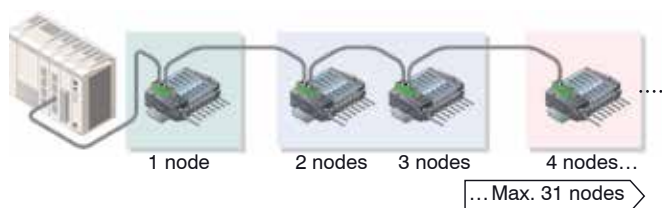
Technical specifications

Type	Main unit for RS-485
Model no.	SC-GU1-485
Applicable sensors	FX-501(P), FX502(P), FX-301(P), 305(P), LS-403, DPS-401(P), DPS-402(P), SC-T1JA (Note)
Number of connectable units	16
Baud rate	57,600bps/ 38,400bps / 19,200bps / 9,600bps selectable by DIP switch
Total extension length	100m or less (power supply cable 10m or less)
Communication method	2 wire half duplex method
Power supply voltage	24V DC ±10%
Current consumption	45mA or less
Ambient temperature	−10 to +55°C (if 4 to 7 digital sensors are connected in cascade: −10 to +50°C, if 8 to 16 digital sensors are connected in cascade: −10 to +45°C)
Material	Enclosure: ABS, Connector cap: silicone rubber
Accessories	End unit: SC-GU1-EU 1pc. / Quick-connection cable: CN-73-C2 1 pc. / Link cable: SC-GU1- CC02 1pc.

Note: Suffix P= PNP output

SC-GU3

Communication unit for open network

Functions

■ Operation procedure

The **SC-GU3** Communication Units make it easy to connect various sensors to your PLC or PC via an open network.

Quick connection technology simplifies exchanging single units or expanding the whole system.

■ Combining different units

The ability to combine different sensor types, e.g. laser sensors, pressure sensors or digital fiber-optic sensors, opens up many application areas, especially for special purpose machinery manufacture. The sensors themselves communicate with each other via an infrared interface.

### ■ Intuitive integration at the controller level

Rapid integration at the controller level enables reliable monitoring, remote maintenance or remote control via open networks. Several units can be configured with minimal wiring efforts. Data can be saved centrally, where it can be archived or used for evaluation purposes.
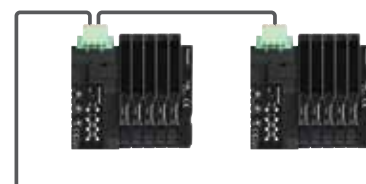
Technical specifications

Type	Communication unit for CC-Link	Communication unit for DeviceNet	Communication unit for EtherCAT
Model no.	SC-GU3-01	SC-GU3-02	SC-GU3-03
Applicable sensors	FX-501, FX502, FX-301, 305, LS-403, DPS-401, DPS-402, SC-T1JA (Note)		
Number of connectable units	16 (FX-500: 12 units)		
Baud rate	10Mbps / 5Mbps / 2.5 Mbps / 625kbps / 156kbps	500kbps / 250kbps / 125kbps	100Mbps
Total extension length	100 to 1200m or less (differs depending on the extension length)	100m (depending on the cable) or less	100m or less
Communication method	CC-Link Ver.1.10	DeviceNet compliant	Process data, telegram (IEEE802.3u)
Power supply voltage	24V DC ±10%	11 to 25V DC	24V DC+10%/−15%
Current consumption	120mA or less	80mA or less	100mA or less
Ambient temperature	−10 to +55°C (if 4 to 7 digital sensors are connected in cascade: −10 to +50°C, if 8 to 16 digital sensors are connected in cascade: −10 to +45°C)		
Material	Enclosure: polycarbonate		

Note: Only NPN
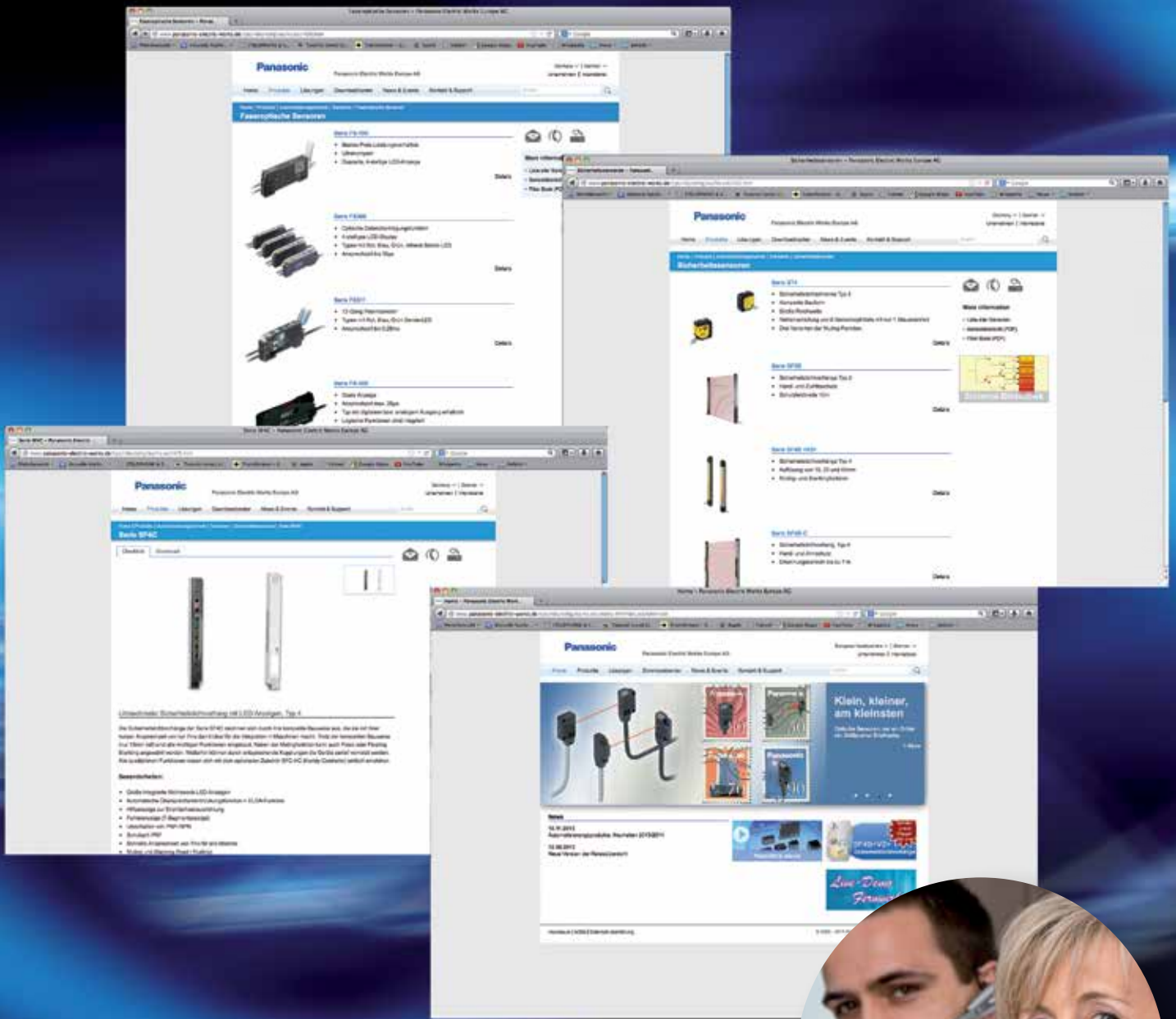
www.panasonic-electric-works.com

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or call us:

Tel.: +49(0)8024 648-737

LX-100

Introducing the 3-LED mark sensor

Functions

■ 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.

⚠ Image schematic
Coaxial reflective and a sharp 1x5mm spot enable high precision sensing.

■ 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.

RED
GREEN
BLUE
Automatic selection

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.

The color around letters is detected as a mark.

Predetermined colors are detected as marks.

Sensor

■ 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) is simple, 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

Cable and plug-in connector types are available depending on the equipment used. These sensors can be easily integrated into already existing systems.
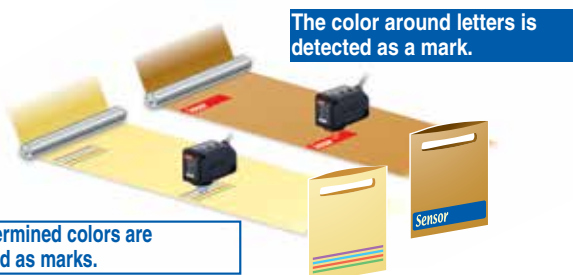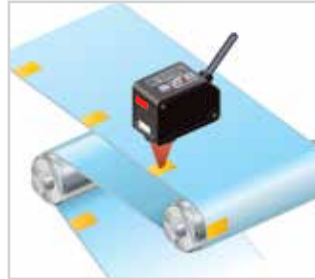
Typical applications

Tube positioning
Detects printed marks to align tubes.

Mark detection
Mark detection of packaging film.

Technical specifications

Type		Cable	M12 plug-in connector type
Model no.	**NPN output**	LX-101	LX-101-Z (Note 1)
	PNP output	LX-101-P	LX-101-P-Z
Sensing range		10±3mm	
Power supply voltage		12 to 24V DC ±10%	
Output		2 x NPN or 2 x PNP open-collector transistor; 50mA or less	1 x NPN or 1 x PNP open-collector transistor; 100mA or less
	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: 45µs or less; color mode: 150µs or less	
Sensitivity setting		Mark mode: 2-level teaching / Limit teaching; Color mode: 1-level teaching	
Protection		IP67 (IEC)	
Ambient temperature		−10 to +55°C	
Emitting element		Combined Red / Green / Blue LED (Peak emission wave length: 640nm / 525nm / 470nm)	
Connection method		Cable 2m	M12 connector (Note 2)
Dimensions (HxWxD)		35×24×57mm	35×24×71.5mm
Accessories		M4 screws with washers, 2 pcs.	

Notes:
1) Suffix -Z=M12 connector type
2) Cable is not included in delivery. Please select under accessories (page 125)

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers / Electrostatic Sensors
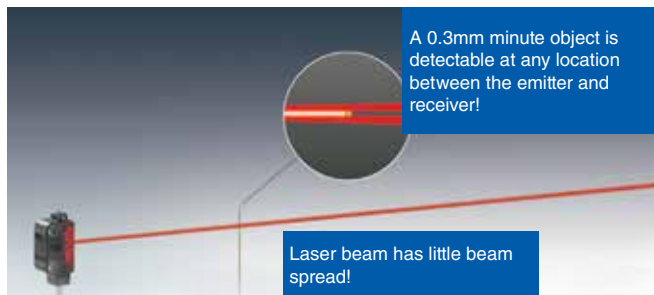
Accessories

Index

LX-100

EX-L200

## Miniature laser sensor with a built-in amplifier!

Features

■ Minute object sensing type EX-L211 (thru-beam)

The beam of the **EX-L200** series is purposely widened to have a lower beam density and little beam spread so that when detecting minute objects, even a slight change in the light received intensity will not be missed.

A 0.3mm minute object is detectable at any location between the emitter and receiver!

Laser beam has little beam spread!

■ Minute detection (reflective)

With a repeatability of 0.02mm the sensor is perfectly suited for positioning tasks.
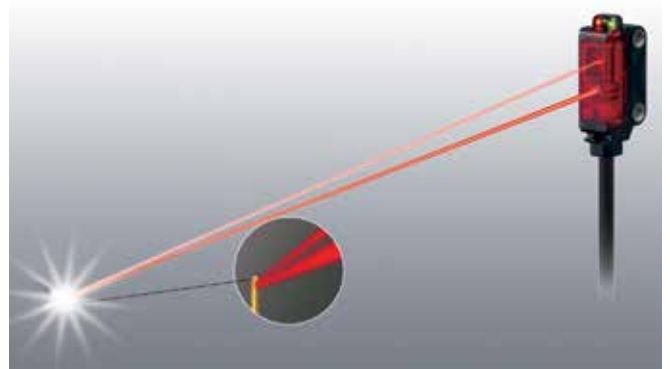
■ Environmental resistance

Thanks to the IP67 casing, the sensor is suitable for installation in humid and dusty environments.

■ Easy alignment

Beam alignment is carried out by looking at the red spot reflected on the beam alignment screen to match with the actual object. The optimum position can be understood at a glance by looking at the beam alignment screen and stability indicator (green).

Stability indicator (Green)

Sensing object

Beam alignment screen

Bright red spot

Shadow of sensing object
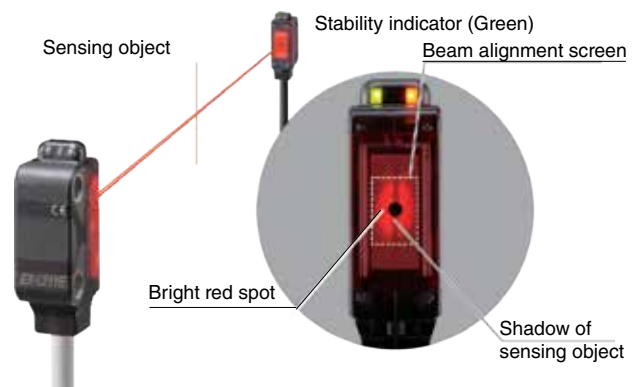
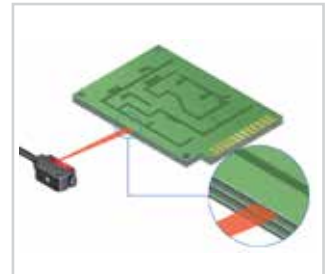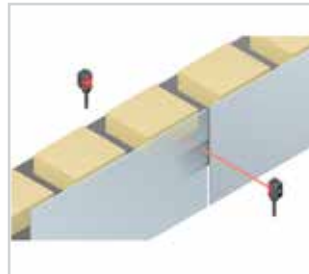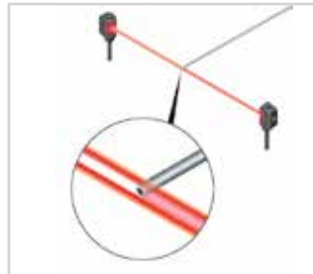**Easy adjustment by reflecting the shadow of the detection object.**
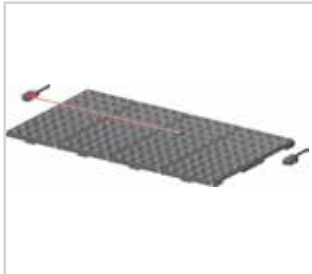
Typical applications

Detecting ICs that are out of position in multiple palettes

Detecting the tip of a very thin pipe

Detecting objects from an opening

Detecting very small objects

Technical specifications

Type		Thru-beam type	Thru-beam type	Reflective type	Reflective type		
					Spot reflective	Convergent reflective spot	Convergent reflective line spot
Model no.	NPN output	EX-L211	EX-L212	EX-L291	EX-L221	EX-L261	EX-L262
	PNP output	EX-L211P	EX-L212P	EX-L291P	EX-L221P	EX-L261P	EX-L262P
Sensing range		1m	3m	4m	45 to 300mm	20 to 50mm	20 to 70mm
Emission spot size		6x4mm at 1m	8x5.5mm at 1m	6x4mm at 1m	Ø 1mm (at 300mm)	Ø 1mm at 50mm (convergent point: 22mm)	1x5mm at 50mm (convergent point: 22mm)
Object to be sensed		Ø 2mm (opaque)	Ø 3mm (opaque)	Ø 25mm (opaque)	Opaque, transparent		
Power supply voltage		12 to 24V DC ±10%					
Output		PNP / NPN open-collector transistor, 50mA or less					
Response time		0.5ms or less					
Emitting element		Red semiconductor laser (class 1)					
Protection		IP67 (IEC)					
Ambient temperature		−10 to +55°C					
Material		Enclosure: PBT, front cover: acrylic; lenses: glass					
Connection method		Cable, 2m					
Dimensions (HxWxD)		25.9x 8.2x12mm		29.9x8.2x13mm		29.9x8.2x13.5mm	
Accessories		Mounting plates **MS-EXL2-2** 2 pcs.		Reflector RF330, mounting plate **MS-EX-L2-3** 1 pc.		Mounting plate **MS-EX-L2-3** 1 pc.	

LS-400

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 photo-electric sensors, and the mounting method is identical.

Long sensing range line reflective type: **LS-H22**

Long sensing range spot reflective type: **LS-H21**
(Class 1 type is also available.)

Coaxial retroreflective type: **LS-H91**
Long sensing range coaxial retroreflective type: **LS-H92**
(Class 1 type is also available.)

General purpose
photoelectric sensor
CX-400 series

Slim size
11.2mm

Identical shape and mounting

Industry standard
mounting pitch
25.4mm

■ 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.

Spot-size adjuster
(multiple turn)

■ 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.

10 mm thickness

Threshold value
Green LED, 4 digits
(max. display: 9999)

Current light receiving
amount display
Red LED, 4 digits
(max.: 9999)

Large
jog switch

Large MODE
key

■ 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-400** series amplifiers can be connected side-by-side with FX-300/FX-500 series fiber sensors.

Fiber sensor

Photoelectric
Sensors

Fiber-optic
Sensors

Standard Fibers

Fiber Sensors
Communication
Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow
Sensors

Inductive Proximity
Sensors

Measurement
Sensors

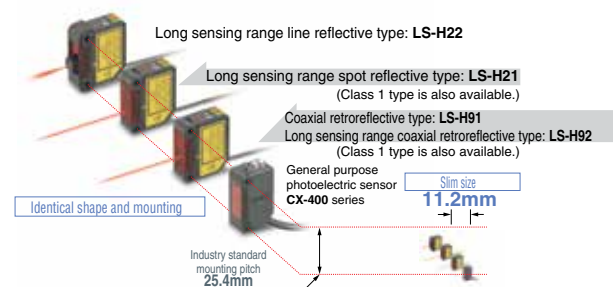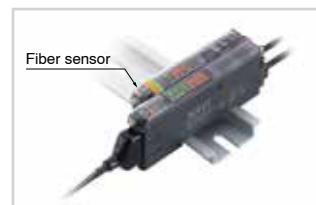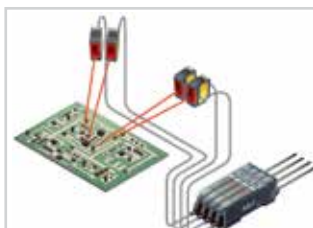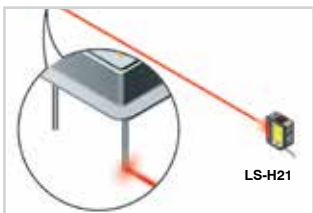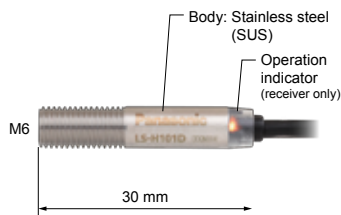Ionizers/
Electrostatic
Sensors

Accessories

Index

LS-400

Typical applications

Interference prevention

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.

IC pin check from remote position

LS-H21

Checking protrusion of glass substrate

Technical specifications

■ Sensor heads

Type	Coaxial retroreflective		Diffuse reflective	
	Standard	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 1.000mm (U-LG) 30 to 500mm (STD) 30 to 300mm (FAST/H-SP)	30 to 1.000mm (U-LG) 30 to 500mm (STD) 30 to 300mm (FAST/H-SP)
Ambient temperature	−10 to +55°C			
Emitting element	Red semiconductor laser, LS-H□: Laser class 2, LS-H□-A: Laser class 1,			
Dimensions (W×H×D)	11.2×31×25mm			
Accessories	Reflector RF-330 1 pc., warning label (English) 1 pc.	Reflector RF-230 1pc. warning label (English) 1 pc.	Warning label (English) 1 pc.	LS-MR1 Lens attachment for line reflective 1 pc., warning label (English) 1 pc.

Notes:
1) **LS-H**x conforms to IEC/JIS/GB standards
   LS-Hx**F** conforms to FDA/IEC/JIS standards
2) **LS-H91(F)-A, LS-H21(F)-A**: Class 1 type
3) **LS-H22(F)** = **LS-H21(F)** with the **LS-MR1** lens attachment for line reflective type

■ Amplifiers

Type		Connector type (Note)	Cable type
Model no.	NPN output	LS-401	LS-401-C2
	PNP output	LS-401P	LS-401P-C2
Power supply voltage		12 to 24V DC ±10%	
Output		PNP / NPN open-collector transistor, 100mA or less	
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	
Digital display		4 digit (green) and 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 sensors are mounted close together: −10 to +50°C) (If 8 to 16 sensors are mounted close together: −10 to +45°C)	
Connection method		Connector (Note)	Cable, 2m
Dimensions (W×H×D)		10×30×75mm	

Note:
The cable for amplifier connection is not supplied as an accessory with the connector type amplifier. Please select under accessories (page 125)

LS-500

Miniature laser head with user-friendly amplifier

Features

■ Different sensor heads available

The **LS-500** series of laser sensors offers four different laser heads. Select the appropriate shape of the heads depending on the requirements of your application.

Body: Stainless steel (SUS)
Operation indicator (receiver only)
M6
30 mm

■ Robust sensor head

The robust sensor head is made of stainless steel and can be used under rough mounting conditions. The type with M6 screws is mountable even in the smallest spaces. You can check immediately with the LED indicator at the receiver whether the light is received correctly.

Reflective surface
Laser light
Emitting element
Sensing object
Reflected light
Receiving lens
Receiving element
Coaxial principle

Reflective photoelectric sensor
Emitting part
Receiving part

Coaxial design
Receiving part

■ Highest precision

With the help of the coaxial precise light direction, the object sensing can be executed even through smallest openings. With a beam diameter of max. 6mm the retroreflective type has a sensing range of up to 2.5m.
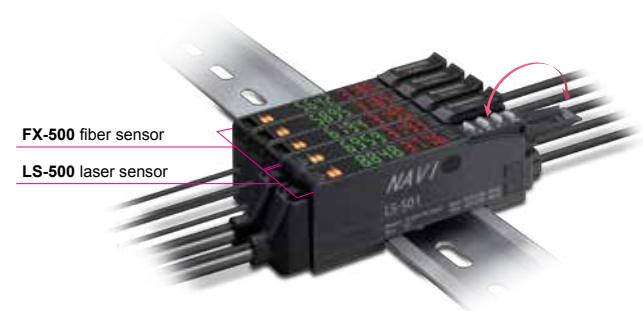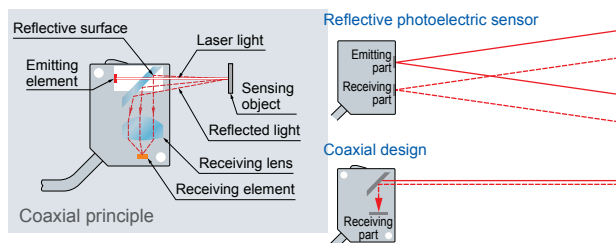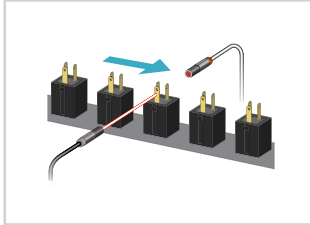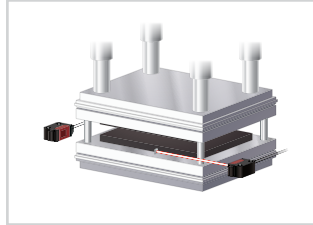
■ Multifunctional amplifier

The LS-500 series amplifier with its clearly laid-out display offers a user-friendly design. The definition of settings, such as the adjustment of threshold values, database and logic functions, is quite simple. The model with the analog current output provides a comfortable reading out of measurement values.

■ Easy to combine

Due to its design and the possibility to mount the sensor on a DIN rail, the LS-500 can be connected quickly and easily to other sensors such as fiber amplifiers or pressure sensors.

FX-500 fiber sensor
LS-500 laser sensor

Typical applications

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors
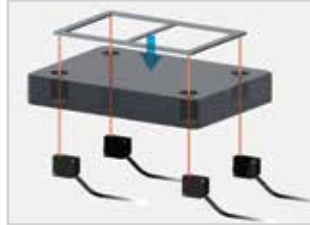
Accessories

Index
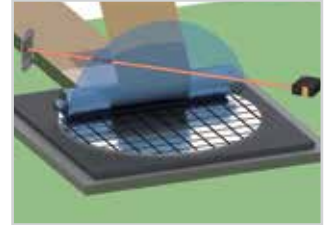
LS-500

Position control of a workpiece

Detecting marks in a mold

Detecting workpieces through a worktop

Detection of a transparent foil

Technical specifications

■ Sensor heads

Type	Thru-beam		Coaxial thru-beam type	Coaxial retroreflective type
	Cylindrical	Rectangular	–	–
Model no.	**LS-H101**	**LS-H102**	**LS-H201**	**LS-H901**
Sensing range	1m	1m	600mm (U-LG), 300mm (STD), 150mm (H-SP)	0.01 to 2m (U-LG), 0.01-1m (STD), 0.01-1m (H-SP)
Ambient temperature	−10 to +55°C			
Emitting element	Red semiconductor laser (laser class 1)			
Dimensions (ØxD)/ (HxWxD)	M6x30mm	8.2x26x12mm	6.4x24x18mm	
Accessories	M6 screws, 4 pcs., washer, 2 pcs.	**MS-EXL2-2** (mounting plate) 2 pcs.	**MS-LS-1** (mounting bracket) 1 pc.	**MS-LS-1** (mounting bracket) 1 pc. **RF-330** (reflector) 1 pc.

■ Amplifiers

Type		Connector type (Note)	Cable type
Model no.	NPN output	**LS-501**	**LS-501-C2**
	PNP output	**LS-501P**	**LS-501P-C2**
Supply voltage		12 to 24V DC+10/-15%	
Output		PNP/NPN open-collector transistor, max. 50mA	
Analog output		-	4 to 20mA
Output operation		Selectable either Light-ON or Dark-ON	
Response time		Max. 60µs (H-SP), 150µs (FAST), 250µs (STD), 500µs (LONG), 5ms (U-LG), 24ms (HYPR)	
Digital display		4 digit, dual LED display (green and red)	
Automatic interference prevention function		Built-in (up to 4 sensors: STD, LONG, U-LG, H-SP; up to 2 sensors: FAST; 0 sensors: HYPR)	
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)	
Connection method		Connector (Note)	2m cable
Dimensions (HxWxD)		10x32x77mm	

Note : Cable is not included in delivery. Please select under accessories (page 125)

ST4

Type 4 · PLe · SIL3

Cascadable thru-beam sensors

Features

■ Series connection of six sets of sensor heads to one controller

The concept of connecting six sets of sensor heads to one controller in series offers you maximum flexibility to solve your safety application.

■ Beam axis alignment and operation confirmation

The beam interruption indicator is incorporated in both the emitter and receiver. This indicator can be used not only to confirm operation but also to align the beam axis.

■ Compact sensor head saves space

The size of this type 4 long sensing range type is similar to general purpose photoelectric sensors.
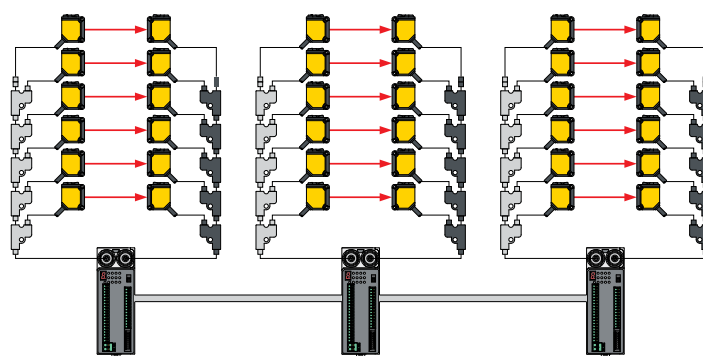
■ IP67 (IEC)

The sensor heads can be used safely even in rough production environments.

■ Interference prevention

The emission amount adjuster can be used to prevent interference to the surrounding sensors.

■ Supports both PNP and NPN polarities

A single unit supports both PNP and NPN polarities, easing stock management.
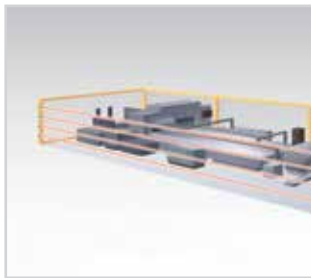
Connection of up to 3x6 units

Emission amount adjustment function

Typical applications

Protection for long sensing ranges

Guard areas up to 15m in length, for example where protective fences are difficult to install.

Protection for small openings

For small openings where light curtains do not fit, ST4 sensor heads ensure safety.

Protection against non-authorized entry

Sensor heads can be mounted flexibly and muting control implemented easily.

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Index

ST4

Technical specifications

■ Sensor heads

Type	Cable length 0.2m		Cable length 1.0m	
	–	With sensitivity adjuster	–	With sensitivity adjuster
Model no.	ST4-A1-J02	ST4-A1-J02V	ST4-A1-J1	ST4-A1-J1V
Safety category	Type 4, PLe, SIL3			
Cascading	Up to 6 pieces to one controller			
Power supply voltage	Supplied from controller (**ST4-C11** or **ST4-C12EX**)			
Sensing range	0.1 to 15m			
Sensing object	Ø9mm opaque			
Emitting element	Infrared LED			
Protection	IP67 (IEC)			
Ambient temperature	−10 to +55°C			
Material	Enclosure: PBT/Cover: acrylic			
Connection method	Cable with connector enclosed, 0.2m		Cable with connector enclosed, 1.0m	
Dimensions (HxWxD)	31x14x28mm			

■ Control device

Type	Standard	High-functional controller
Model no.	ST4-C11	ST4-C12EX
Safety category	Type 4, PLe, SIL3	
Power supply voltage	24V DC +10% / −15%	
Control outputs	OSSD1 and OSSD2 (2x PNP or 2x NPN transistor outputs with open collector, switchable, 200mA or less)	
Response time	ON -> OFF: 25ms or less, OFF -> ON: 140ms or less	
Current consumption	100mA or less (excluding sensor heads)	120mA or less (excluding sensor heads)
Protection	Enclosure: IP40 (IEC), Terminal: IP20 (IEC)	
Ambient temperature	−10 to +55°C	
Material	Enclosure: ABS	
Connection method	Connector (sensors), terminal block	
Dimensions (HxWxD)	130x46x80mm	

Note: For a system configuration, please contact your sales office or service hotline: +49(0)-8024648-737.

SF2B

Type 2 · PLd · SIL2

Excellent basic functions at a reasonable price

Features

■ Unit length = Protective height, "ZERO" dead zone

Non-wasteful installation is possible, with no dead corners within the sensing width.
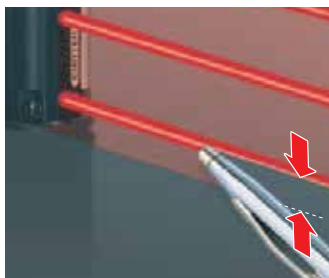
■ Also suppresses mutual interference and effects of extraneous light

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.
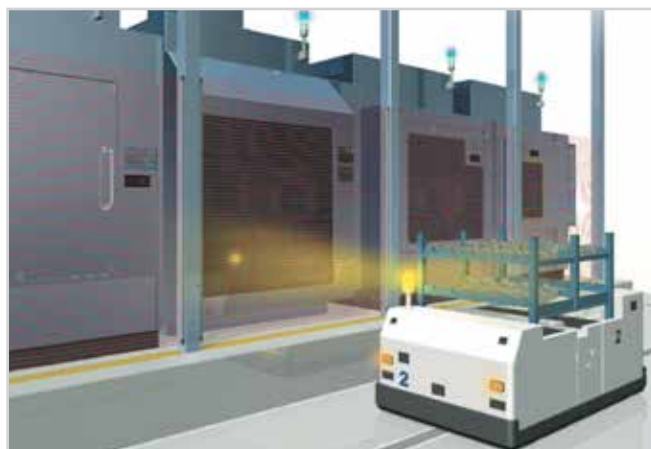
■ Seamless structure using an inner enclosure

The internal unit fits into an inner enclosure, completely eliminating seams (joints) inside the product and conforming to IP67 (IEC).

End unit

Internal unit

Protective enclosure

Inner enclosure

■ Digital error indicator

The digital error indicator supports the resolution of electrical problems when starting up lines.
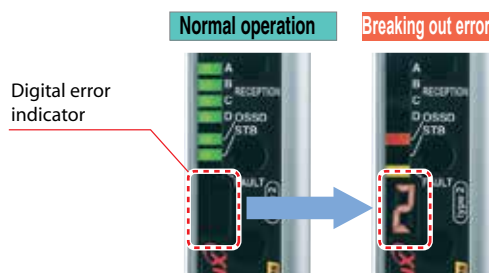
Normal operation   Breaking out error

Digital error
indicator

Technical specifications

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors
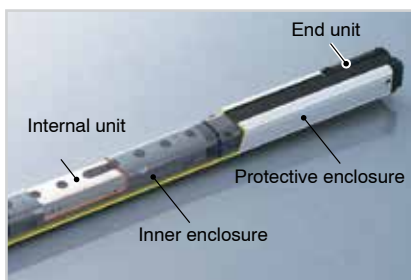
Ionizers/ Electrostatic Sensors

Accessories

Index

SF2B

Type		Hand protection type	Arm / Foot protection type
Model no.	NPN output	SF2B-H□N (Note)	SF2B-A□N
	PNP output	SF2B-H□P	SF2B-A□P
Safety category		Type 2, PLd, SIL2	
Sensing height		168 to 1912mm	
Sensing range		0.2 to 13m	
Resolution		20mm	40mm
Minimum sensing object		Ø > 27mm (opaque)	Ø > 47mm (opaque)
Power supply voltage		24V DC ±15%	
Response time		ON -> OFF: 15ms or less / OFF -> ON: 60ms or less	
Control outputs		OSSD1 and OSSD2 (2 x PNP or 2 x NPN open collector transistor, switchable), max. 200 mA	
Emitting element		Infrared LED	
Protection		IP65 (IEC)	
Ambient temperature		−10 to +55°C	
Material		Frame: aluminum, die-cast zinc / Inner unit: polycarbonate, polyester resin / Enclosure: PBT	
Connection method		Connector	
Dimensions (HxWxD)		Hx28x24mm (H= protective height)	

Note: For a system configuration, please contact your sales office or service hotline: +49(0)-8024648-737

■ Sensing height

	Model no.			Protective height (mm)	Installation height (mm)	No. of beam axes
	PNP type	NPN type	Sub sensors for serial connection			
Hand protection type	SF2B-H8-P	SF2B-H8-N	SF2B-H8SL	168	168	8
	SF2B-H12-P	SF2B-H12-N	SF2B-H12SL	232	232	12
	SF2B-H16-P	SF2B-H16-N	SF2B-H16SL	312	312	16
	SF2B-H20-P	SF2B-H20-N	SF2B-H20SL	392	392	20
	SF2B-H24-P	SF2B-H24-N	SF2B-H24SL	472	472	24
	SF2B-H28-P	SF2B-H28-N	SF2B-H28SL	552	552	28
	SF2B-H32-P	SF2B-H32-N	SF2B-H32SL	632	632	32
	SF2B-H36-P	SF2B-H36-N	SF2B-H36SL	712	712	36
	SF2B-H40-P	SF2B-H40-N	SF2B-H40SL	792	792	40
	SF2B-H48-P	SF2B-H48-N	SF2B-H48SL	952	952	48
	SF2B-H56-P	SF2B-H56-N	SF2B-H56SL	1112	1112	56
	SF2B-H64-P	SF2B-H64-N	SF2B-H64SL	1272	1272	64
	SF2B-H72-P	SF2B-H72-N	SF2B-H72SL	1432	1432	72
	SF2B-H80-P	SF2B-H80-N	SF2B-H80SL	1592	1592	80
	SF2B-H88-P	SF2B-H88-N	SF2B-H88SL	1752	1752	88
	SF2B-H96-P	SF2B-H96-N	SF2B-H96SL	1912	1912	96

	Model no.			Protective height (mm)	Installation height (mm)	No. of beam axes
	PNP type	NPN type	Sub sensors for serial connection			
Arm / Foot protection type	SF2B-A4-P	SF2B-A4-N	SF2B-A4SL	168	168	4
	SF2B-A6-P	SF2B-A6-N	SF2B-A6SL	232	232	6
	SF2B-A8-P	SF2B-A8-N	SF2B-A8SL	312	312	8
	SF2B-A10-P	SF2B-A10-N	SF2B-A10SL	392	392	10
	SF2B-A12-P	SF2B-A12-N	SF2B-A12SL	472	472	12
	SF2B-A14-P	SF2B-A14-N	SF2B-A14SL	552	552	14
	SF2B-A16-P	SF2B-A16-N	SF2B-A16SL	632	632	16
	SF2B-A18-P	SF2B-A18-N	SF2B-A18SL	712	712	18
	SF2B-A20-P	SF2B-A20-N	SF2B-A20SL	792	792	20
	SF2B-A24-P	SF2B-A24-N	SF2B-A24SL	952	952	24
	SF2B-A28-P	SF2B-A28-N	SF2B-A28SL	1112	1112	28
	SF2B-A32-P	SF2B-A32-N	SF2B-A32SL	1272	1272	32
	SF2B-A36-P	SF2B-A36-N	SF2B-A36SL	1432	1432	36
	SF2B-A40-P	SF2B-A40-N	SF2B-A40SL	1592	1592	40
	SF2B-A44-P	SF2B-A44-N	SF2B-A44SL	1752	1752	44
	SF2B-A48-P	SF2B-A48-N	SF2B-A48SL	1912	1912	48

SF2C

Type 2 · PLc · SIL1

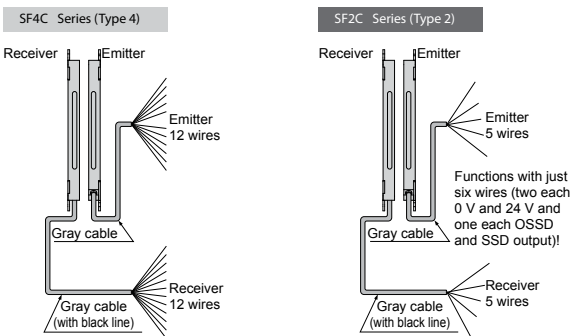**Very small safety light curtain with reduced wiring**

Features

■ Dramatically less wiring work

The safety light curtain consists of only five wires for emitter and receiver, respectively. The implementation of this safety light curtain requires the same amount of time as mounting a conventional sensor.

■ Beam axis alignment made easy

The emitter has an effective aperture angle of max. ±5° for an operating range of 3m. Compared to type 4 light curtains (which have an effective aperture angle of max. ±2.5°), the SF2C series is easy to align and install.
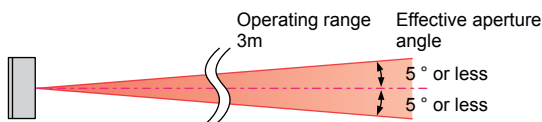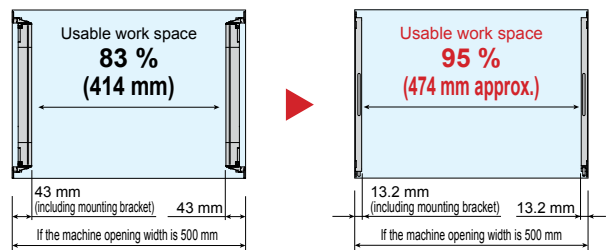
■ Light weight

The **SF2C** series is made of resin that is lighter than the conventional aluminum case type. Its lightweight body eases the burden on the mounting surface of the equipment and contributes to overall reduced weight during equipment transportation or overseas shipment.

■ Includes cables and mounting brackets

The SF2C series includes cables (3m) for use with all models and standard mounting brackets.

■ IP67 (IEC) protection

Even if the housing is made from polycarbonate, the IP67 (IEC) rating is achieved with an ultra-slim size for protection from environmental factors.

■ Slim size for efficient applications

Available work space is expanded from the previous model, and productivity is improved.
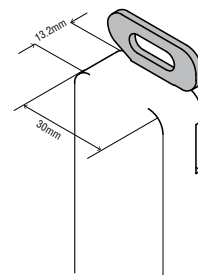
Technical specifications

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

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SF2C

Type		Hand protection type
Model no.	NPN output	SF2C-H☐N (Note)
	PNP output	SF2C-H☐P
Safety category		Type 2, PLc, SIL1
Protective height		160 to 640mm
Sensing range		0.1 to 3m
Beam pitch		20mm
Minimum sensing object		Ø > 25mm (opaque)
Supply voltage		24V DC ±20%
Response time		ON -> OFF: max. 20ms / OFF -> ON: max. 100ms
Control outputs		OSSD1 and OSSD2 (2 x PNP or 2 x NPN open collector transistor, switchable), max. 200 mA
Emitting element		Infrared LED, 850nm
Protection		IP67 (IEC)
Ambient temperature		-10 to +55°C
Material		Frame, sensor enclosure: Polycarbonate
Connection method		Cable, 3m
Dimensions (HxWxD)		Hx30x13.2mm (H= depending on protective

Note: For a system configuration, please contact your sales office or service hotline: +49(0)-8024648-737

■ Protective height

	Model no.		Protective height (mm)	Installation height (mm)	No. of beam axes
	PNP type	NPN type			
Hand protection type	SF2C-H8-P	SF2C-H8-N	160	Max. 184	8
	SF2C-H12-P	SF2C-H12-N	240	Max. 264	12
	SF2C-H16-P	SF2C-H16-N	320	Max. 344	16
	SF2C-H20-P	SF2C-H20-N	400	Max. 424	20
	SF2C-H24-P	SF2C-H24-N	480	Max. 504	24
	SF2C-H28-P	SF2C-H28-N	560	Max. 584	28
	SF2C-H32-P	SF2C-H32-N	640	Max. 664	32

■ Options

Metal protection case (2 pcs. per set for emitter and receiver)

Applicable beam channels SF2C-H	Model no.
8	MS-SFCH-8
12	MS-SFCH-12
16	MS-SFCH-16
20	MS-SFCH-20
24	MS-SFCH-24
28	MS-SFCH-28
32	MS-SFCH-32

MS-SFCH-8

MS-SFCH-☐ (Excluding **MS-SFCH-8**)

SF4B (V2)

Type 4 · PLe · SIL3

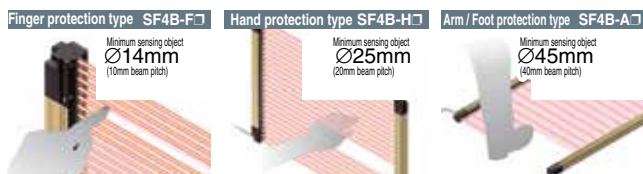**New concepts combining greater safety and higher productivity!**
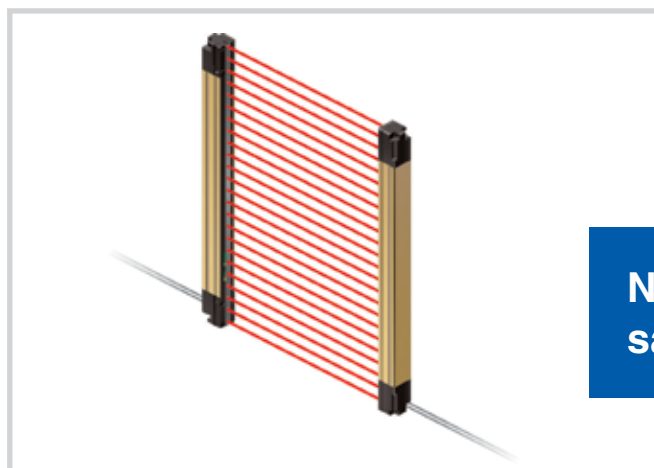
Features

■ Sensor height = protective height

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

■ Finger/hand and arm/foot protection available

| Finger protection type SF4B-F□	Hand protection type SF4B-H□	Arm / Foot protection type SF4B-A□
Minimum sensing object Ø14mm (10mm beam pitch)	Minimum sensing object Ø25mm (20mm beam pitch)	Minimum sensing object Ø45mm (40mm beam pitch)

■ 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 person passes through the light curtain, not when an object passes through.

Muting lamp

Light curtain **SF4B** series

Muting sensor **CX-400** series
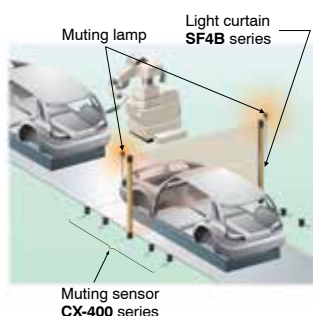
■ Built-in safety relay

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.

### ■ Improved ambient light immunity

The integrated ELCA function (Extraneous Light Check & Avoid) prevents interference from ambient light or other light curtains and even from welding plants.

■ 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.

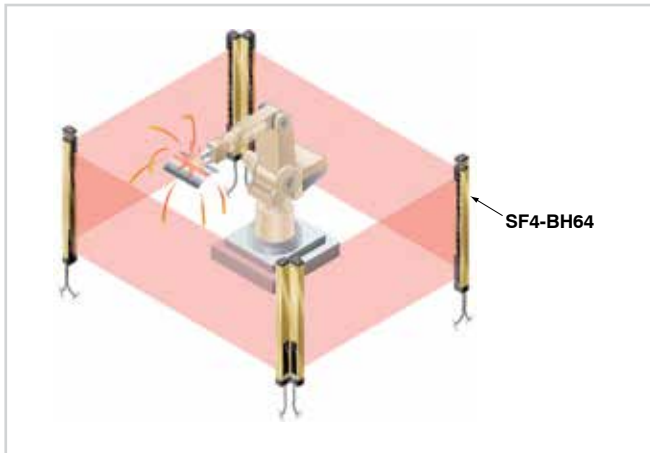### ■ Universal design that can be used anywhere in the world

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.
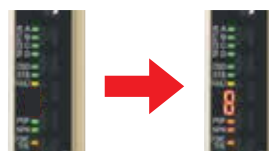
Typical applications

Guarding space around welding robot

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

SF4-BH64

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

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SF4B

Technical specifications

Type	Finger protection type	Hand protection type	Arm / Foot protection type
Model no.	SF4B-F☐(V2) (Note)	SF4B-H☐(V2)	SF4B-A☐(V2)
Safety category	Type 4, PLe, SIL3		
Sensing height	230 to 1270mm	230 to 1910mm	
Sensing range	0.3 to 7m (depending on type up to 9m)		
Resolution	10mm	20mm	40mm
Minimum sensing object	Ø > 14mm (opaque)	Ø > 25mm (opaque)	Ø > 45mm (opaque)
Power supply voltage	24V DC +/−10%		
Response time	ON -> OFF: max. 14ms / OFF -> ON: max. 90ms		
Control outputs	OSSD1 and OSSD2 (2 x PNP or 2 x NPN open collector transistor, switchable), 200mA or less		
Emitting element	Infrared LED		
Protection	IP67 / IP65 (IEC)		
Ambient temperature	−10 to +55°C		
Material	Frame: Aluminium / Enclosures: Acrylic, Polycarbonate, ABS		
Connection method	Connector		
Dimensions (HxWxD)	Hx30x28mm (H= protective height)		

Notes: For a system configuration, please contact your sales office or service hotline: +49(0)-8024648-737

Safety Sensors

■ Sensing height

	Sensing range	Model no.	Protective height (mm)	Installation height (mm)	No. of beam axes
Finger protection type	0.3-7m	SF4B-F23(V2)	230	286	23
		SF4B-F31(V2)	310	366	31
		SF4B-F39(V2)	390	446	39
		SF4B-F47(V2)	470	526	47
		SF4B-F55(V2)	550	606	55
		SF4B-F63(V2)	630	686	63
		SF4B-F71(V2)	710	766	71
		SF4B-F79(V2)	790	846	79
		SF4B-F95(V2)	950	1006	95
		SF4B-F111(V2)	1110	1166	111
		SF4B-F127(V2)	1270	1326	127
Hand protection type	0.3-9m	SF4B-H12(V2)	230	286	12
		SF4B-H16(V2)	310	366	16
		SF4B-H20(V2)	390	446	20
		SF4B-H24(V2)	470	526	24
		SF4B-H28(V2)	550	606	28
		SF4B-H32(V2)	630	686	32
		SF4B-H36(V2)	710	766	36
		SF4B-H40(V2)	790	846	40
		SF4B-H48(V2)	950	1006	48
		SF4B-H56(V2)	1110	1166	56
		SF4B-H64(V2)	1270	1326	64
	0.3-7m	SF4B-H72(V2)	1430	1486	72
		SF4B-H80(V2)	1590	1646	80
		SF4B-H88(V2)	1750	1806	88
		SF4B-H96(V2)	1910	1966	96
Arm / Foot protection type	0.3-9m	SF4B-A6(V2)	244	334	6
		SF4B-A8(V2)	324	414	8
		SF4B-A10(V2)	404	494	10
		SF4B-A12(V2)	484	574	12
		SF4B-A14(V2)	564	654	14
		SF4B-A16(V2)	644	734	16
		SF4B-A18(V2)	724	814	18
		SF4B-A20(V2)	804	894	20
		SF4B-A24(V2)	964	1054	24
		SF4B-A28(V2)	1124	1214	28
		SF4B-A32(V2)	1284	1374	32
	0.3-7m	SF4B-A36(V2)	1444	1534	36
		SF4B-A40(V2)	1604	1694	40
		SF4B-A44(V2)	1764	1854	44
		SF4B-A48(V2)	1924	2014	48

SF4B-C

Type 4 · PLe · SIL3

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors
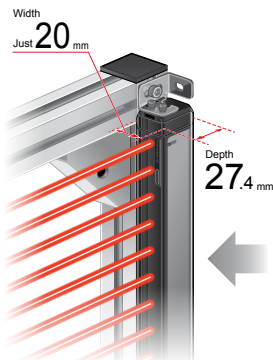
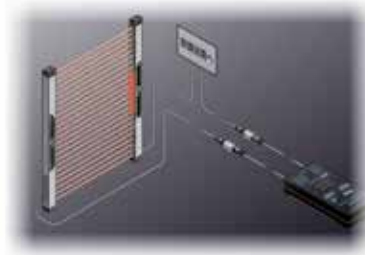Ionizers/ Electrostatic Sensors

Accessories

Index

SF4B-C

Mounts flush on aluminum frames

Features

■ **Compact size**

The **SF4B-C** series has been designed to mount flush with the aluminum frame. This means the machine opening will not be made any narrower. It can even be installed with zero dead zone.

Width Just **20** mm

Depth **27**.4 mm

■ **Easy mounting on aluminum frame**

Mounts flush on aluminum frames.

Buried mounting (side)

The light curtain mounts flush, even in installations with buried mounting.

■ There is no risk of workpieces bumping into the light curtain.

Rear mounting

■ The light curtain fits onto a 20 × 20mm aluminum frame perfectly.

■ **The SFB-HC handy controller (optional)** offers easy access to settings for a range of functionality.

■ **With the pigtailed type, the large indicator is easy to see also from the side**

The SF4B-C series incorporates a large multi-purpose indicator (orange) positioned at workers' eye level. The indicator signals the presence of the light curtain, helping to prevent stoppages due to inadvertent interruption of its beams. The indicator can be used in a variety of applications, including as a muting indicator or operation indicator. The large multi-purpose indicator shines brightly through the plastic body to ensure exceptional visibility from the side.
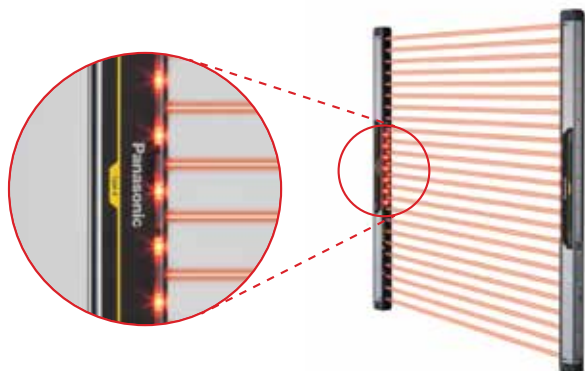
Technical specifications

Type	Pigtailed type (Note 1, 2)		Cable type	
	Hand protection type	Arm protection type	Hand protection type	Arm protection type
Model no.	SF4B-H☐CA-J05	SF4B-A☐CA-J05	SF4B-H☐C	SF4B-A☐C
Safety category	Type 4, PLe, SIL3			
Protective height	263.4 to 1623.4mm			
Sensing range	0.1 to 7m			
Beam pitch	20mm	40mm	20mm	40mm
Minimum sensing object	Ø > 25mm (opaque)	Ø > 45mm (opaque)	Ø > 25mm (opaque)	Ø > 45mm (opaque)
Supply voltage	24V DC ±10%			
Response time	ON -> OFF: 14ms or less / OFF -> ON: 90ms or less			
Control outputs	OSSD1 and OSSD2 (2 x PNP or 2 x NPN open collector transistor, switchable), max. 200mA			
Emitting element	Infrared LED, 850nm			
Protection	IP65 (IEC)			
Ambient temperature	-10 to +55°C			
Material	Polycarbonate			
Connection method	12-wire PVC cable with connector, 0.5m		8-wire PVC cable, 5m	
Dimensions (HxWxD)	Hx20x27,4mm (H= depending on protective height)			

Notes:
1) For a system configuration, please contact your sales office or service hotline: +49 (0) 8024-8024648-737
2) Integrated muting function

■ Protective height

Model no.		Protective height (mm)	Installation height (mm) (Note)	No. of beam axes
Pigtailed type (Note)	Cable type			
SF4B-H12CA-J05	SF4B-H12C	263.4	294.4	12
SF4B-H16CA-J05	SF4B-H16C	343.4	374.4	16
SF4B-H20CA-J05	SF4B-H20C	423.4	454.4	20
SF4B-H24CA-J05	SF4B-H24C	503.4	534.4	24
SF4B-H28CA-J05	SF4B-H28C	583.4	614.4	28
SF4B-H32CA-J05	SF4B-H32C	663.4	694.4	32
SF4B-H36CA-J05	SF4B-H36C	743.4	774.4	36
SF4B-H40CA-J05	SF4B-H40C	823.4	854.4	40
SF4B-H48CA-J05	SF4B-H48C	983.4	1014.4	48
SF4B-H56CA-J05	SF4B-H56C	1143.4	1174.4	56
SF4B-H64CA-J05	SF4B-H64C	1303.4	1334.4	64
SF4B-H72CA-J05	SF4B-H72C	1463.4	1494.4	72
SF4B-H80CA-J05	SF4B-H80C	1623.4	1654.4	80
SF4B-H88CA-J05	SF4B-H88C	1783.4	1814.4	88
SF4B-H96CA-J05	SF4B-H96C	1943.4	1974.4	96

(Hand protection type)

Pigtailed type	Cable type	Protective height (mm)	Installation height (mm)	No. of beam axes
SF4B-A8CA-J05	SF4B-A8C	343.4	374.4	8
SF4B-A12CA-J05	SF4B-A12C	503.4	534.4	12
SF4B-A16CA-J05	SF4B-A16C	663.4	694.4	16
SF4B-A20CA-J05	SF4B-A20C	823.4	854.4	20
SF4B-A24CA-J05	SF4B-A24C	983.4	1014.4	24
SF4B-A28CA-J05	SF4B-A28C	1143.4	1174.4	28
SF4B-A32CA-J05	SF4B-A32C	1303.4	1334.4	32
SF4B-A36CA-J05	SF4B-A36C	1463.4	1494.4	36
SF4B-A40CA-J05	SF4B-A40C	1623.4	1654.4	40
SF4B-A44CA-J05	SF4B-A44C	1783.4	1814.4	44
SF4B-A48CA-J05	SF4B-A48C	1943.4	1974.4	48

(Arm protection type)

Note: The installation height depends on the mounting bracket. Specifications with standard mounting bracket **MS-SF4BC-1**

Photoelectric
Sensors

Fiber-optic
Sensors

Standard Fibers

Fiber Sensors
Communication
Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow
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Inductive Proximity
Sensors

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Electrostatic
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SF4C

SF4C

Type 4 · PLe · SIL3

Ultra-slim light curtain safeguards machines without sacrificing productivity

Features

■ Large, built-in, multi-purpose LED indicators

Large LED bars on each side of the light curtain provide a wide visibility indicator that can be customized for various applications by means of independent external inputs. The indicator can be used as an operation indicator (muting) or job indicator, etc.

■ Finger/hand protection

The **SF4C** series covers a sensing height of 160mm to 640mm. This is true for the finger and hand protection types (resolution up to 10 or 20mm).

Green   Red   Green / Red

External input device
(Lighting / blinking signal)

Large multi-purpose
indicator
Input 1

Input 2
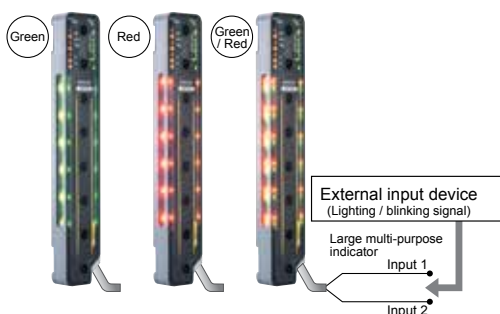
■ Can be used in a variety of applications for simplified equipment (large multi-purpose indicator)

Wire-saving when connecting to safety devices. Contact outputs such as emergency stop switches or safety door switches can be connected to the light curtain. Also, by using the handy-controller SFC-HC, up to three sets of light curtains can be cascade connected for a consolidated safety output.

■ IP67 (IEC)

An IP67 (IEC/JIS) rating is achieved with an ultra-slim size for protection from environmental factors.

■ Mutual interference is reduced without need for interference prevention lines

The light curtain is equipped with the ELCA (Extraneous Light Check & Avoid) function, which has been proven to be strong against mutual interference. Because it automatically shifts the scanning time of the light curtain in order to avoid interference, it is not necessary to wire interference prevention lines between machinery.

■ A fast response time of 7ms* for all models

A fast response time of 7ms* for all models regardless of the number of beam channels. This reduces the safety distance as well as the calculation work required for the safety distance among models with different beam channels.

* When connecting safety sensors (light curtains, etc.) to the safety input, the response time will be the total time of connected units.

■ Safety, productivity, and cost reduction [muting control function]

The muting sensors and muting lamps can be connected directly to the light curtain. Furthermore, the large multi-purpose indicators can be used as muting lamps, which contribute to less wiring troubles, improvement of safety, productivity, and cost reduction.

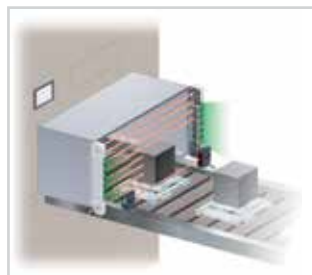# Typical applications

Use of internal muting lamp

There is no need to buy and install a separate muting lamp.

Selective muting area

Separate muting control function for each beam channel.

Industry first!

Wire-saving when connecting to safety devices (safety input function).

Technical specifications

Type	Finger protection type	Hand protection type
Model no.	SF4C-F☐ (Note)	SF4C-H☐
Safety category	Type 4, PLe, SIL3	
Sensing height	Depending on types (160 to 640mm)	
Sensing range	0.1 to 3m	
Resolution	10mm	20mm
Minimum sensing object	Ø > 14mm (opaque)	Ø > 25mm (opaque)
Power supply voltage	24V DC +10/−15%	
Control outputs	OSSD1 and OSSD2 (2x PNP or 2x NPN transistor outputs with open collector, switchable, 200mA or less)	
Response time	ON → OFF 9ms or less / OFF → ON 90ms or less	ON → OFF 7ms or less / OFF → ON 90ms or less
Rated current consumption	270mA or less (depending on type)	
Protection	IP67 / IP65 (IEC)	
Ambient temperature	−10 to +55°C	
Material	Polycarbonate	
Connection method	Cable, 5m or 0.5m with connector	
Dimensions (HxWxD)	Hx13.2x30mm (H= protective height)	

Note: For a system configuration, please contact your sales office or service hotline: +49(0)-8024648-737.

■ Sensing height

	Model no.		Protective height (mm)	Installation height (mm)	No. of beam axes
	Cable type	Cable with connector			
Finger protection type	SF4C-F15	SF4C-F15-J05	160	160	15
	SF4C-F23	SF4C-F23-J05	240	240	23
	SF4C-F31	SF4C-F31-J05	320	320	31
	SF4C-F39	SF4C-F39-J05	400	400	39
	SF4C-F47	SF4C-F47-J05	480	480	47
	SF4C-F55	SF4C-F55-J05	560	560	55
	SF4C-F63	SF4C-F63-J05	640	640	63

	Model no.		Protective height (mm)	Installation height (mm)	No. of beam axes
	Cable type	Cable with connector			
Hand protection type	SF4C-H8	SF4C-H8-J05	160	160	8
	SF4C-H12	SF4C-H12-J05	240	240	12
	SF4C-H16	SF4C-H16-J05	320	320	16
	SF4C-H20	SF4C-H20-J05	400	400	20
	SF4C-H24	SF4C-H24-J05	480	480	24
	SF4C-H28	SF4C-H28-J05	560	560	28
	SF4C-H32	SF4C-H32-J05	640	640	32

Photoelectric
Sensors

Fiber-optic
Sensors

Standard Fibers

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SD3-A1

SD3-A1

Type 3 · PLd · SIL2

Monitor dangerous areas for unauthorized entry using flexible detection zones!

Features

■ Freely configurable zones

Two zones can be monitored with the **SD3-A1**: the warning zone within a radius of 15m, and the protection zone within a radius of 4m. You can configure the contours of these zones to perfectly accomodate any application. You can configure up to eight zone patterns and switch between them at any given time, even during operation. This flexible zone configuration can be done by PC.

RS-232C
RS-422

Protection zone

Warning zone
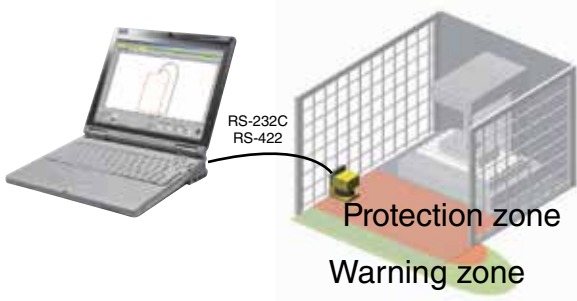
■ Monitors beam misalignment after installation of safety laser scanner

By activating the reference boundary function which enables constant detection of stationary objects, the safety laser scanner memorizes the position of stationary objects, and monitors for beam misalignment after installation.
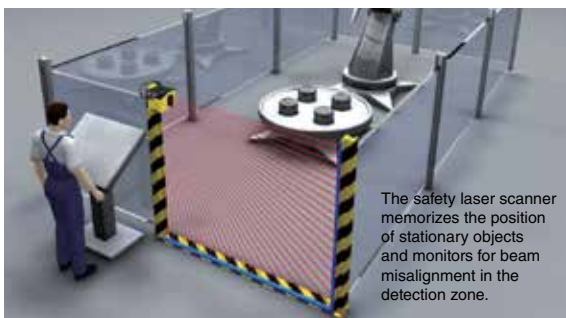
The safety laser scanner memorizes the position of stationary objects and monitors for beam misalignment in the detection zone.

■ Adjustment of response times enables interference prevention

The response time can be adjusted from 80 to 640ms. Mutual interference can be prevented by adjusting the response time when setting up multiple safety laser scanners in close vicinity.

Configuration plug

■ Memorized configurations make post-maintenance recovery easy (optional)

Configurations can be saved in the optional configuration plug's built-in memory and reloaded after maintenance or exchanging safety laser scanners.

Typical applications

Detecting entry into dangerous areas at processing machines

Warning and machine halt zones are implemented to detect workers in dangerous areas.

Confirming safety around automatically guided vehicles

The scanner is used to slow down the vehicle upon detection in the warning zone and stop the vehicle upon entering the protection zone.

Detecting presence in a defined field

Install two safety laser scanners to build a protection zone surrounding the object in question. Deactivating the zone is also possible.

Guarding the sides of automatic guided vehicles (AGV)

Prevent injuries from a moving AGV. Monitor fallen cargo to avoid collisions.

Detecting entry into dangerous areas of circular cycle tables

One safety laser scanner can safeguard the front opening where in the past two sets of light curtains were needed.

Detecting entry into robot working areas

The scanner detects a human body whenever it enters the field.

Technical specifications

Type	Safety laser scanner				
Model no.	SD3-A1				
Safety category	Type 3, PLd, SIL2				
Protection zone	Minimum sensing object	ø150mm	ø70mm	ø50mm	ø40mm	ø30mm
	Sensing range (radius)	0 to 4.0m	0 to 4.0m	0 to 2.8m	0 to 2.2m	0 to 1.6m
Warning zone	Minimum sensing object	ø150mm (fixed)				
	Sensing range (radius)	0 to 15m				
Scanning angle	190° / 180° (by setting)				
Measurement zone	Max. (radius) 50m				
Number of zone settings	Max. 7 + 1 (without detection zone)				
Min. zone setting range	200mm				
Power supply voltage	24V DC +20 / −30%				
Control outputs	OSSD 1 and OSSD 2 (2x PNP open collector transistor outputs; max. 250mA)				
Laser protection class	Class 1 (IEC)				
Protection	IP65 (IEC)				
Ambient temperature	0 to +55°C				
Material	Main body: die-cast aluminum, Scanner window: plastic				
Accessories	15-pin connector, 9-pin connector, installation and instruction manual, configuration and evaluation software, mounting screws				

SQ4

Type 4 · PLe · SIL3

Safe leakage monitoring

Features

■ Two-stage monitoring

The **SQ4** series' two-stage monitoring enables the sensors to differentiate between minor leaks that have just started and serious leaks that require immediate action.

■ Also suitable for chemicals

In addition to the standard type, types with PFA enclosures that are resistant to the most common chemicals are also available.

■ Operating without control unit

The sensor SQ4 can operate alone without a control unit, meaning it can replace existing systems easily.

■ Networking

You can connect up to four SQ4 leakage sensors with the control unit SQ4-C11, minizing wiring efforts.
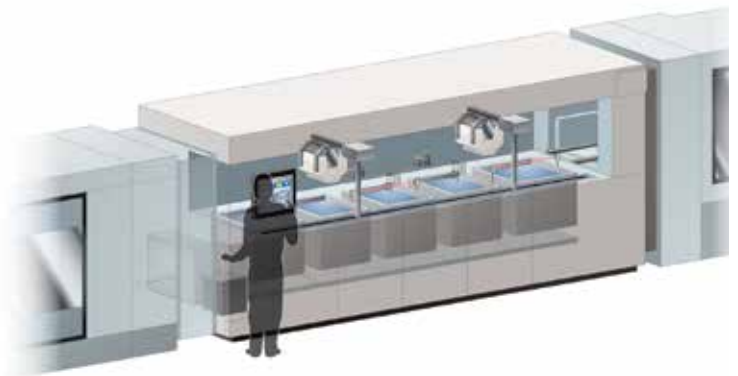
Technical specifications

■ Sensor heads

Type		Water	Other liquids
Model no.	NPN output	SQ4-A21-N	SQ4-A22-N
	PNP output	SQ4-A21-P	SQ4-A22-P
Safety category		Type 1 PLc, SIL1 (with controller Type 4, PLe, SIL3)	
Tolerable liquids		Water	Sulfuric acid, ammonia, galden, fluorinert, fluorine, etc.
Response time		10ms or less (ON → OFF)	
Power supply voltage		12 to 24V DC ±10%	
Output		PNP / NPN open-collector transistor, 50mA or less	
Rated current consumption		30mA or less	
Material		Polypropylene	PFA
Protection		IP65/IP67 (IEC)	
Ambient temperature		−10 to +55°C	
Connection method		Cable, 2m	
Dimensions (ØxH)		35.8x18.7mm	

■ Controller

Model no.	SQ4-C11
Safety category	Type 4, PLe, SIL3
Response time	20ms or less (ON → OFF)
Power supply voltage	24V DC +10/−15%
Control outputs	OSSD1 and OSSD2 (2x PNP or 2x NPN transistor outputs with open collector, switchable, 200mA or less)
Features	Interlock / Lockout cancel / Test input / External device monitor / Safety input
Rated current consumption	200mA or less
Protection	IP20 (IEC)
Ambient temperature	−10 to +55°C
Material	Polycarbonate/ABS
Connection method	Connector (sensors), terminal block
Dimensions (HxWxD)	100x48x66mm

Note: For a system configuration, please contact your sales office or service hotline: +49(0)-8024648-737

SF-C10

Photoelectric Sensors

Fiber-optic Sensors

Standard Fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Index

SF-C10

Less setup time for safety light 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

(SF-C11)

Removable terminal blocks are used. This reduces the work required for reconnecting wiring during maintenance.

Removable!
Through spring method
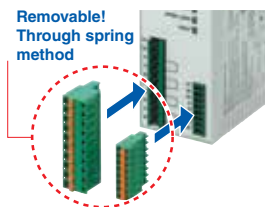
■ Metal enclosure with an IP65 (IEC) protective structure

(SF-C12)

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

Connector in metal housing

■ Slim design

(SF-C13)

22.5mm thickness for insertion even into narrow spaces inside panels.

22.5mm

■ Three safety circuit systems packaged into a single unit!

(SF-C14EX)

Three safety circuit systems are packaged into a single unit: light curtain output circuit, muting control circuit, and emergency stop circuit.

DP-100

Pressure sensors with dual display

Features

■ The current and threshold values can be checked at the same time!

Comparative Output 1 Operation indicator
Comparative Output 2 Operation indicator
Multi-function type: Analog voltage output Operation indicator
Main display
Sub display
Mode selection key
Increment key
Decrement key
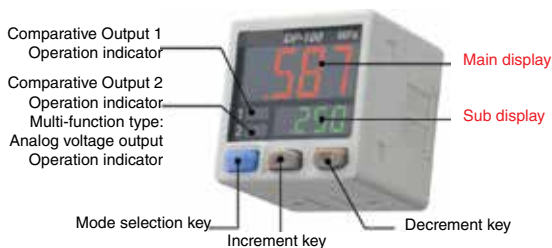
■ Dual display allows direct setting of threshold value

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

Current value
Threshold value
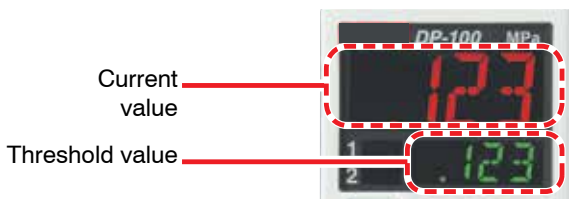
■ 3-color display (red, green, orange)

The main display color changes depending on the output status (ON/OFF operation) and while settings are being made. The sensor status can therefore be understood easily, and operating errors can be reduced.

Main display
OFF: Green (or Red)   ON: Red (or Green)   Set: Orange
During normal operation   During setting
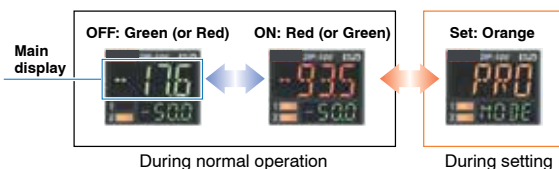
■ Easy-to-read digital display!

A clear 12-segment make numbers and letters easy to read.

For low pressure

■ High performance

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). Moreover it boasts ±0.5% F.S. temperature characteristics and ±0.1% F.S. repeatability.

■ Copy function saves time and reduces human error

Details transmitted
Details received
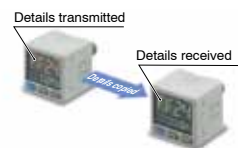
Sensors can be connected to a master sensor one by one and settings copied to them. When making the same settings for multiple sensors, this prevents setting errors from occurring and reduces the number of changes required to instruction manuals when equipment designs are changed.

■ Equipped with auto-reference and remote zero-adjustment functions A precise pressure management is possible

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 resets the display value to zero. 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
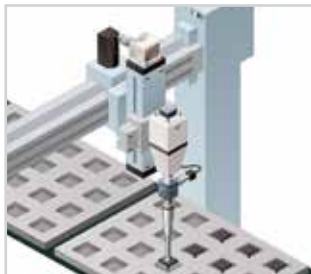
Confirming reference pressure

Leak test for PET bottles

Technical specifications

■ Cable types

Type			Standard		High-function controller	
Model no.	Asian		DP-101 (Note 1)	DP-102	DP-101A	DP-102A
	European		DP-101-E-P	DP-102-E-P	DP-101A-E-P	DP-102A-E-P
	M5 female thread	Short port-type	DP-101-M-P	DP-102-M-P	DP-101A-M-P	DP-102A-M-P
Rated pressure range (Note 3)			−1bar to +1bar (-100.0 to +100.0kPa)	−1bar to +10bar (-0.1 to +1.0MPa)	−1bar to +1bar (-100.0 to +100.0kPa)	−1bar to +10bar (-0.1 to +1.0MPa)
Applicable fluid			Non-corrosive gas			
Power supply voltage			12 to 24V DC ±10%			
Output			PNP / NPN open-collector transistor, 100mA or less			
Response time			2.5ms, 5ms, 10ms, 25ms, 50ms, 100ms, 250ms, 500ms, 1000ms, 5000ms, selectable by key operation			
Display			3-color LCD display, 12 segments, 4 digits			
Pressure port			Asian: M5 female thread + R (PT) 1/8 male thread European: M5 female thread + G 1/8 male thread			
Connection method			Connector (Note 2)			
Dimensions (HxWxD)			30x30x42.5mm			
Accessories			**CN-14A-C2** Connector attached cable 2m, 1 pc.			

Notes:
1) Suffix E = Air supply M5 female thread and G 1/8 male thread
   Suffix M = M5 short port type
   Suffix P= PNP output
2) **CN-14A-C2** cable 2m is included in delivery
3) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +20°C. Reference pressure=1atm

■ M8 connector types

Type	Standard		Multifunction	
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 (Note 1)	−1bar to +1bar (-100.0 to +100.0kPa)	−1bar to +10bar (-0.1 to +1.0MPa)	−1bar to +1bar (-100.0 to +100.0kPa)	−1bar to +10bar (-0.1 to +1.0MPa)
Applicable fluid	Non-corrosive gas			
Power supply voltage	12 to 24V DC ±10%			
Output	PNP open-collector transistor, 100mA or less			
Response time	2.5ms, 5ms, 10ms, 25ms, 50ms, 100ms, 250ms, 500ms, 1000ms, 5000ms, selectable by key operation			
Analog volt. output / external input	—		Incorporated	
Ambient temperature	−10 to +50°C			
Pressure port	G1/8 male thread + M5 female thread			
Material	Enclosure: PBT (glass fiber reinforced); LCD display: Acrylic; Pressure port: Stainless steel (SUS303); Thread part: Brass (nickel plated); Switch part: Silicone rubber, M8 connector part: Nickel-plated brass / brass gold plated contacts			
Connection method	M8 connector (Note 2)			
Dimensions (HxWxD)	30x30x47.5mm			
Accessories	Unit selection plate: 1 set			

Notes:
1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +20°C. Reference pressure=1atm
2) Cable not included in delivery, please select under accessories (page 125)

DP2

High-performance digital pressure sensors

Features

■ **High accuracy, high resolution, high speed**

The **DP2** series reaches a response time of 2.5ms at a resolution of 1/1000. It enables high-precision detection with extraordinary repeatability and temperature characteristics.
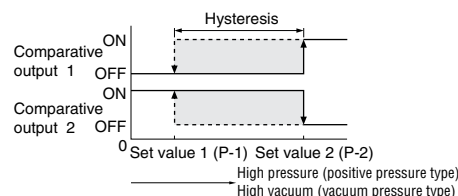
■ **Clearly visible LED display with 3.5 digits**

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.

■ **Six pressure units available for selection**

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

International System of Units (SI)

inHg → kPa → kgf/cm²

mmHg ← psi ← bar

➡: Vacuum pressure type   ⇨: Positive pressure type
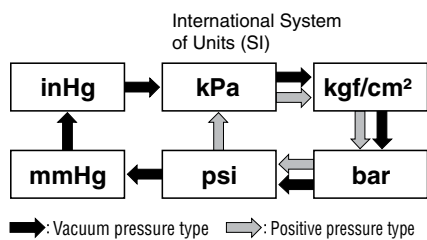
■ **Four output modes enable versatile pressure level control**

1) Hysteresis mode
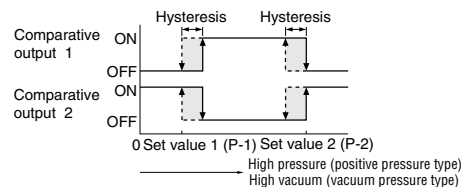
2) Window comparator mode
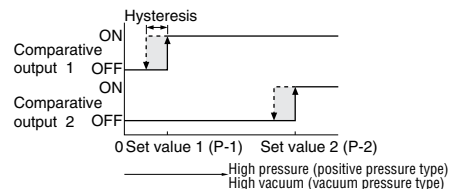
3) Dual output mode
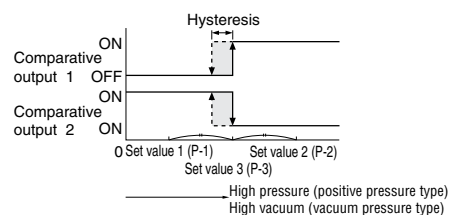
4) Automatic sensitivity setting mode

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.
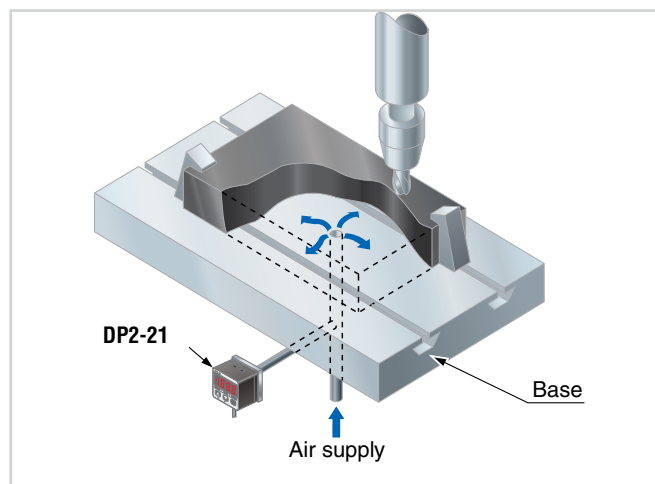
Detecting broken spool

The pressure sensor detects if a spool is chipped by sensing even slight air leakage in the air-supply system shown below.
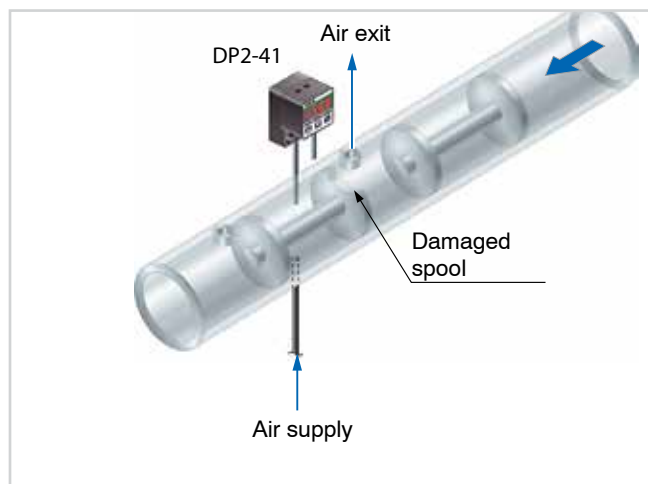
Technical specifications

<table>
<tr><th rowspan="3">Type</th><th colspan="4">Vacuum pressure</th><th colspan="6">Positive pressure</th></tr>
<tr><th colspan="4">- 1bar (- 100.0kPa)</th><th colspan="3">1bar (100.0kPa)</th><th colspan="3">10bar (1.0MPa)</th></tr>
<tr><th>Standard</th><th>Light weight</th><th>Flat</th><th>IP67</th><th>Standard</th><th>Flat</th><th>IP67</th><th>Standard</th><th>Flat</th><th>IP67</th></tr>
</table>

Model no.	Asian	DP2-20	DP2-80	—	DP2-60	DP2-21	DP2-41	DP2-61	DP2-22	DP2-42	DP2-62
	European	—	—	DP2-40E	DP2-60E	—	DP2-41E	DP2-61E	—	DP2-42E	DP2-62E

Type of pressure	Gauge pressure (Note)	
Rated pressure	0 to –1bar (0 to -100.0kPa) 0 to +1bar (0 to +100.0kPa) 0 to 10bar (0 to 1.0MPa)	
Applicable fluid	Non-corrosive gas	
Power supply voltage	12 to 24V DC +10%/−15%	
Output	Asia, (Standard, light weigth, flat and IP67 types) PNP or NPN open-collector transistor, 100mA or less	
Analog voltage output	Output voltage: 1 to 5V (overrated pressure range) Zero point: within 1V ± 5% F.S. Span: within 4V ± 5% F.S. Linearity: within ± 1% F.S. Output impedance: approx. 1kΩ	
Pressure port	Asian	Standard, Flat and IP67 types: Rc (PT) 1/8 female thread, Light weight type: M5 female thread
	European	Flat and IP67 types: G (PF) 1/8 female thread
Material	Front case: ABS, Rear case: PPS (glass fiber reinforced), Display surface: acrylic Pressure port: Die-cast zinc alloy (Light weight type: POM (glass fiber reinforced) Pressure port: nickel-plated brass) Front cover (IP67 type only): Polycarbonate	
Connection method	Cable, 2m	
Dimensions (HxWxD)	**DP2-2□**: 31.6x31.6x38.5mm **DP2-80**: 30x30x33.5mm **DP2-4□**: 30x30x35mm **DP2-6□**: 71.5x46x43mm	
Accessories	Hexagon-socket-head plug for pressure port: 1 pc. (Standard type only), Pressure unit label: 1 pc.	

Note: Reference pressure 1atm

DP-M

Precisely detects minut 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 ±1% 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.

■ **Analog current output**

An analog current output (4-20mA) enables real-time monitoring and control actions.

Typical applications

Detection of blocked filters
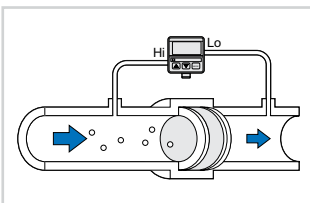
Technical specifications

Type	Standard type	With analog output
Model no.	DP-M2	DP-M2A
Type of pressure	Differential pressure	
Rated pressure	0 to 2.00kPa.D (0 to 204mmH2O.D)	
Applicable fluid	Non-corrosive gas	
Power supply voltage	12 to 24V DC +10% /−15%	
Output	NPN open-collector transistor, 100mA or less	
Analog current output	–	Output current: 4 to 20mA (from 0 to 1.96kPa.D (0 to 200mmH2O.D) Zero point: within 4mA ± 1% F.S. Span: within 16mA ± 3% F.S. Linearity: within ± 1% F.S. Load resistance: 0 to 250Ω
Ambient temperature	0 to +50°C	
Pressure port	ø4.8mm resin	
Material	Front case: ABS, Rear case: ABS, LED display: Acrylic, Pressure port: PA	
Connection method	0.18mm², 3-wire cable, 2m	0.18mm², 4-wire cable, 2m

Photoelectric
Sensors

Fiber Optic
Sensors

Standard Fibers

Fiber Sensors
Communication
Units

Mark
Sensors

Laser Sensors

Safety
Sensors

Pressure & Flow
Sensors

Inductive Proximity
Sensors

Measurement
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Ionizers/
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Sensors

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DPC-100/
DPH-100

DPC-100/
DPH-100

Single-axis type digital pressure sensor with optional dual 3-color display

Features

■ Automatic sensor head recognition

The controller automatically recognizes sensor heads when they are connected, even if their rated pressure ranges are different.

■ Dual display and direct setting

The dual display allows you to check current and threshold values simultaneously.

To facilitate setting operations, three modes have been devised:

- ■ "RUN mode" is for operation settings that are carried out daily
- ■ "MENU SETTING mode" for basic settings
- ■ "PRO mode" for special and detailed settings

Controllers can be connected to a master controller one by one, and the master can transmit settings to the slave controllers. This significantly reduces time required when you need to make multiple, identical settings, or during production changeovers. Moreover, it reduces the possibility for error in such cases.

■ Direct installation using a hexagonal wrench

The sensor head is tightened with a hexagonal wrench, making installation easy, especially in tight spaces.

Typical applications

Leak test

Reference pressure checking

Monitoring vacuum pressure

Technical specifications

■ Sensor heads

Type	Standard ±1bar (±100kPa)			Positive pressure ±1bar (±1.0MPa)		Vacuum pressure −1bar (-100kPa)		
Model no.	DPH-101	DPH-101-M3	DPH-101-M5	DPH-102	DPH-102-M5	DPH-103	DPH-103-M3	DPH-103-M5
Type of pressure	Gauge pressure (Note 1)							
Rated pressure	−1 to +1bar (-100.0 to +100.0kPa)			0 to 10bar (0 to +1.0MPa)		0 to -1bar (0 to -100.0kPa)		
Pressure resistance	5bar (500kPa)			15bar (1.5MPa)		5bar (500kPa)		
Applicable fluid	Air, non-corrosive gas							
Power supply voltage	12 to 24V DC ±10%							
Analog voltage output	Output voltage: 1 to 5V (overrated pressure range)							
Protection	IP40 (IEC)							
Ambient temperature	0 to +50°C							
Pressure port	DPH-10□: R1/8 male thread + M5 female thread, DPH-10□-M3: M3 male thread (for installing gasket) DPH-10□-M5: M5 male thread (for installing gasket)							
Rated current consumption (without load)	15mA or less							
Material	Front case: PBT, Rear case: PBT (glass fiber reinforced), Pressure port: stainless steel (SUS303), O-ring: NBR, Pressure element silicon diaphragm, PPS							
Connection method	Cable, 2m with attached connector							
Dimensions (HxWxD)	23x13.2x 23.4mm	17x10x 20.5mm	17.5x10x 20.5mm	23x13.2x 23.4mm	17.5x10x 20.5mm	23x13.2x 23.4mm	17x10x 20.5mm	17.5x 10x 20.5mm
Accessories	Connector (e-CON): 1 pc.							

■ Controller

Type	NPN output	PNP output
Model no.	DPC-101	DPC-101-P
Applicable sensor head	DPH-101□, DPH-102□, DPH-103□	
Rated pressure	Compound pressure type: −1 to +1bar (-100.0 to +100.0kPa) Positive pressure: 0 to 10bar (0 to +1.0MPa) Vacuum pressure: 0 to −1bar (0 to -100.0kPa)	
Power supply voltage	12 to 24V DC ±10%	
Output	PNP or NPN open-collector transistor, 100mA or less	
Power consumption	Normal operation: 960mW or less (Current consumption 40mA or less at 24V supply voltage) ECO mode (STD): 720mW or less (Current consumption 30mA or less at 24V supply voltage) ECO mode (FULL): 600mW or less (Current consumption 25mA or less at 24V supply voltage) Excluding the current consumption of sensor head and analog output current	
Ambient temperature	−10 to +50°C	
Material	Enclosure: PBT (glass fiber reinforced), LCD display: Acrylic, Threaded part: Brass (nickel plated) Switch part: Silicon rubber	
Protection	IP40 (IEC)	
Connection method	Connector (Note 2)	
Dimensions (HxWxD)	30x30x29.2mm	
Accessories	CN-66A-C2 Cable (2m) with attached connector Pressure unit label: 1 set	

Notes:
1) Reference pressure 1atm
2) **CN-66A-C2** cable 2m is included in delivery

Photoelectric
Sensors

Fiber Optic
Sensors

Standard Fibers

Fiber Sensors
Communication
Units

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DPC-L100 /
DPH-L100

DPC-L100 / DPH-L100

Powerful and simple high-precision detection of fluid and air pressure

Features

■ Head-separated sensor

The sensor head is very flexible and can be used with or without the control unit. High-precision measuring is possible with an analog current output of 1 to 5V and extremely accurate detection of 1% F.S.

■ Stainless steel construction

The enclosure is made of stainless steel and hence suitable in a wide range of appliatons. An oil-less, hermetically enclosed diaphragm prevents the fluids from being polluted. An integrated throttle controls the pressure and prevents damage by excess pressure.

Main circuit
Piezo-electric conversion

Stainless steel diaphragm
(Integrated pressure transducer)
SUS630

Pressure port
SUS304

Throttle
SUSXM7

■ Wide pressure ranges

Various sensor heads for different pressure ranges from vacuum pressure to positive pressure (up to 500bar/50MPa) are available. With the control unit, the pressure range can be output linearly as voltage or current.

Color continuum

| Air | Water | Oil |

DPH-L113V
-0.1 to +1.0 MPa

DPH-L113
0 to +1.0 MPa

For use with pressurized air and other media
(air mixed with water or oil)

DPH-L133
0 to +3.5 MPa

For use with pressurized fluid and other media
(water or chemical solutions)

DPH-L114
0 to +10 MPa

For use with pressurized oil
and other media

DPH-L154
0 to +50 MPa

−0.1 0   +1   +3.5   +10   +50
Pressure range (MPa)

Typical applications

Transport of glass sheets after washing (pressurized air containing water droplets)

Management of plastic filling machine pressure (pressurized fluid)

Management of press pressure (pressurized oil)

Technical specifications

■ Sensor heads

Type	Compound pressure type	Positive pressure			
Model no.	DPH-L113V	DPH-L113	DPH-L133	DPH-L114	DPH-L154
Rated pressure	-1 to +10bar (-0.1 to +1.0MPa)	0 to +10bar (0 to +1.0MPa)	0 to +35bar (0 to +3.5MPa)	0 to +100bar (0 to +10.0MPa)	0 to +500bar (0 to +50.0MPa)
Applicable fluid	Gases and fluids that do not corrode SUS630, SUS304, or SUSXM7				
Power supply voltage	9 to 36V DC				
Analog voltage output	1 to 5V DC overrated pressure range, Accuracy (Note): ±1% F.S. (at 23±2°C)				
Response time	1ms or less				
Medium temperature range	−20 to +70°C			−20 to +125°C	
Pressure port	R1/4 male thread ((throttle embedded)				
Protection	IP67 (IEC)				
Ambient temperature	−20 to +70°C			−20 to +80°C	
Material	Diaphragm: stainless steel (SUS630); mounting threaded part: stainless steel (SUS304), Throttle: Stainless steel (SUSXM7)				
Connection method	Cable with connector enclosed, 2m				
Dimensions (ØxD)	24.3x73mm				
Accessories	e- CON connector 1pc.				

Note: Accuracy including linearity, hysteresis and repeatability

■ Controller

Type	NPN output	DPC-L101				
Model no.	PNP output	DPC-L101P				
Applicable sensor head		DPH-L113V	DPH-L113	DPH-L133	DPH-L114	DPH-L154
Rated pressure		-1 to +10bar (-0.1 to +1.0MPa)	0 to +10bar (0 to +1.0MPa)	0 to +35bar (0 to +3.5MPa)	0 to +100bar (0 to +10.0MPa)	0 to +500bar (0 to +50.0MPa)
Power supply voltage		12 to 24V DC ±10%				
Output		2 PNP or NPN open-collector transistors, 50mA or less				
Analog voltage output		Output voltage 1 to 5V Zero point: within 1V ± 5% F.S. (Note 1) Span: 4V ± 0.5% F.S. Linearity: within ±0.1% F.S. Output impedance: approx. 1kΩ		Output current: 4 to 20mA Zero point: within 4mA ±1.0% F.S. (Note 2) Span: 16mA ± 1.5% F.S. Linearity: within ±0.1% F.S. Load resistance: 250kΩ or less		
Response time		5ms,10ms, 25ms, 50ms, 100ms, 250ms, 500ms, 1000ms, 5000ms selectable by key operation				
Protection		IP40 (IEC)				
Ambient temperature		−10 to +50°C				
Material		Enclosure: PBT, LCD display: acrylic; Mounting threaded part: brass (nickel plated), Switch part: silicone rubber				
Connection method		Connector				
Dimensions (HxWxD)		30x30x25.5mm				
Accessories		**CN-66A-C2** Cable, 2m with connector attached, Pressure unit label: 1 set				

Notes:
1) **DPH-L113V**: Zeropoint within 1.364V ± 0.5% F.S.
2) **DPH-L113V**: Zeropoint within 5.455mA ±1.0% F.S.

FM-200

Photoelectric
Sensors

Fiber Optic
Sensors

Standard Fibers

Fiber Sensors
Communication
Units

Mark
Sensors

Laser Sensors

Safety
Sensors

Pressure & Flow
Sensors

Inductive Proximity
Sensors

Measurement
Sensors

Ionizers/
Electrostatic
Sensors

Accessories

Index

FM-200

Flow sensor with dual display

Features

■ **Easy-to-read, 2-color display with sub display**

The 2-color digital display lets you check the operation status of the **FM-200** at a glance. The use of color makes it easy to distinguish between measurement values and functionality.

■ **High precision of ±3% F.S.**

Micro Electro Mechanical System (MEMS) technology allows the sensor to be mounted on a silicon sensor chip. The advantages are as follows: an extremely small heat capacity, a high precision of ±3% F.S., and a high-speed response time. Two temperature sensors, one on either side of the heater, detect heat distribution and make bidirectional detection possible.

■ **One sensor for both intake and exhaust**

A single sensor can detect flows bidirectionally, or the forward or reverse direction only, making it suitable for a variety of applications.

■ **Analog voltage output**

1 to 5V analog voltage output is incorporated.

■ **Integrated output and pulse output mode incorporated**

The FM-200 series can control and manage flows for a wide variety of applications. The integrated output mode will turn the output ON or OFF at the specified integrated value, allowing you to control air blowing volumes, for example. In pulse output mode, a pulse is generated once at each specified integrated value, allowing you to monitor the amount of air consumed, for example with an Eco-POWER METER.

■ **Integrated value reset function**

In integrated mode, values accumulate over time. As soon as the limit is reached, the digital output is set. This limit value can also be reset by an external input.

■ **Rattle prevention function**

To prevent rattling from rapid changes in flow or from noise, the response time can be set to one of seven steps, from 50ms to approximately 1500ms. The display update period can be changed to 250ms, 500ms or 1000ms in order to eliminate flickering.

■ **ECO Mode**

In ECO mode, the backlight is turned off after approximately one minute if no operation occurs to reduce power consumption.

Typical applications

Checking suction

Checking seating

Monitoring air blowing and purge gas

Technical specifications

Type		Plastic housing					
Model no.	PNP output	FM-252-4-P	FM-213-4-P	FM-253-4-P	FM-214-4-P	FM-254-8-P	FM-215-8-P
	NPN output	FM-252-4	FM-213-4	FM-253-4	FM-214-4	FM-254-8	FM-215-8
Full scale flow rate		500ml/min	1.0l/min	5l/min	10l/min	50l/min	100l/min
Display range		±9999999ml		±99999.99l		±999999.9l	
Setting and display resolution		1ml/min		0.01l/min		0.1l/min	
Rated pressure		−0.9 to +7bar (−0.09 to +0.7MPa)					
Pressure resistance		10bar (1.0MPa)					
Applicable fluid		Clean air, compressed air, nitrogen gas					
Linearity		3%F.S.					
Response time		50ms to 1.5s selectable					
Power supply voltage		12 to 24V DC ±10%					
Output		PNP or NPN open-collector transistor, 50mA or less					
Output modes		Output OFF mode, window comparator mode, hysteresis mode, integrated output mode, integrated pulse output mode					
Analog voltage output		1.0 to 5.0V					
Rated current consumption (without load)		Normal mode: 60mA or less, ECO mode: 40mA or less					
Protection		IP40 (IEC)					
Ambient temperature		0 to +50°C					
Material		Plastic					
Connection method		Cable with connector enclosed, 1m					
Dimensions (HxWxD)		37x55x17mm				43x55x17mm	
Temperature characteristics		Within ±0.2% F.S./°C (+15°C to +35°C)					
Port size		ø4 push-in				ø8 push-in	

Type		Aluminum housing			
Model no.	PNP output	FM-255-AR2-P	FM-255-AG2-P	FM-216-AR2-P	FM-216-AG2-P
	NPN output	FM-255-AR2	–	FM-216-AR2	–
Full scale flow rate		500l/min		1000l/min	
Display range		±999999.9l			
Setting and display resolution		1l/min			
Rated pressure		−0.9 to +7bar (-0.09 to +0.7MPa)			
Pressure resistance		10bar (1.0MPa)			
Applicable fluid		Clean air, compressed air, nitrogen gas			
Linearity		3%F.S.			
Response time		50ms to 1.5s selectable			
Power supply voltage		12 to 24V DC ±10%			
Output		PNP or NPN open-collector transistor, 50mA or less			
Output modes		Output OFF mode, window comparator mode, hysteresis mode, integrated output mode, integrated pulse output mode			
Analog voltage output		1.0 to 5.0V			
Rated current consumption (without load)		Normal mode: 60mA or less, ECO mode: 40mA or less			
Protection		IP40 (IEC)			
Ambient temperature		0 to +50°C			
Material		Resin/Aluminum body type			
Connection method		Cable with connector enclosed, 1m			
Dimensions (HxWxD)		50x80x30mm			
Temperature characteristics		Within ±0.2% F.S./°C (+15°C to +35°C)			
Port size		Rc½ female thread	G½ female thread	Rc½ female thread	G½ female thread
Accessories		CN-F15-C1 cable, 1m with attached connector			
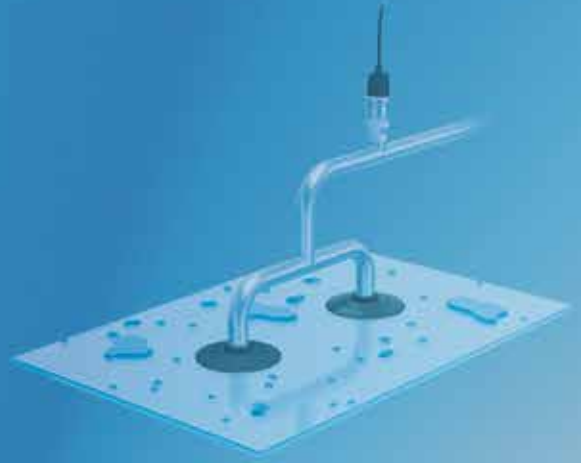
GX-M

Cylindrical inductive sensors

Features

■ 2- and 3-wire types

The **GX-M** series consists of 2- and 3-wire types. The 3-wire type is available as a shielded or non-shielded type. The 2-wire type is available as a shielded type and long-range type (up to 15mm). Reduced wiring efforts and space-saving installation reduce costs.

■ Various cylinder and thread types

M8, M12, M18 and M30 types means the GX-M series can be used to solve a wide range of automation task. Space-saving, case-by-case integration in production lines, testing and manual work stations.

■ Several connection possibilities

You can connect the GX-M sensor with either a 2m cable or M12 plug-in connector.

■ Special applications

IP69K (DIN) and IP68 (IEC) types are also available, e.g. for use in machine systems, i.e. the food processing machinery.

Typical applications

Control drilling depth   **Detect how far press lowers**   **Count parts**   **Control position of components**
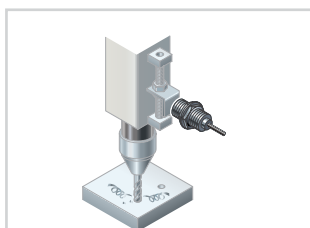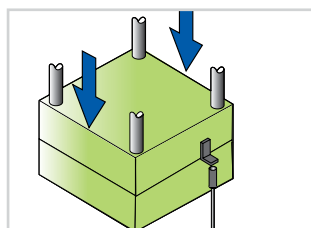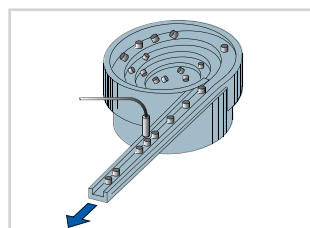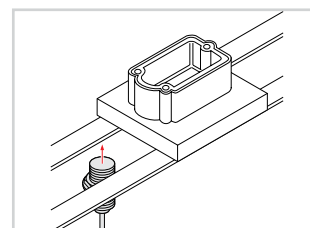
Technical specifications

◼ 3-wire type

Type	Shielded				Unshielded		
Model no.	GX-M8 (-A/ -B)(-P) (-Z) (Note 1,2,3)	GX-M12 (-A/ -B) (-P)(-Z)	GX-M18 (-A/ -B) (-P)(-Z)	GX-M30 (-A/ -B) (-P)(-Z)	GX-MK12 (-A/ -B) (-P)(-Z)	GX-MK18 (-A/ -B) (-P)(-Z)	GX-MK30 (-A/ -B) (-P)(-Z)
Rated sensing distance (Note 4)	1.5mm ±10%	2mm ±10%	5mm ±10%	10mm ±10%	7mm ±10%	12mm ±10%	22mm ±10%
Stable sensing distance (Note 5)	0 to 1.2mm	0 to 1.6mm	0 to 4mm	0 to 8mm	0 to 5.6mm	0 to 9.6mm	0 to 17.6mm
Standard sensing object (Note 6)	8x8mm	12x12mm	18x18mm	30x30mm	24x24mm	24x24mm	45x45mm
Hysteresis	Max. 15% of measurement distance						
Repeatability	Along sensing axis: max. 5% of measurement distance						
Power supply voltage	12 to 24V DC ±10%						
Output	Open collector transistor – 200mA or less (Note 2)						
Output operation	Normally closed (N.C.) or Normally open (N.O.) (Note 1)						
Switching frequency	5kHz	5kHz	2kHz	1kHz	2.5kHz	1kHz	0.5kHz
Protection	IP67 (IEC)	IP69K (DIN), IP68 (IEC) 2m cable type; IP67 (IEC) M12 connector type					
Ambient temperature	−25 to +70°C						
Material	Enclosure: Brass (nickel plated), Sensing part: PPS (polyphenylsulfide)						
Connection method	Cable, 2m or M12 plug-in connector type (Note 3)						
Dimensions (ØxL) — 2m cable	M8x33mm	M12x35mm	M18x39mm	M30x43mm	M12x55mm	M18x60mm	M30x63mm
Dimensions (ØxL) — M12 connector	M8x45mm	M12x50mm	M18x50mm	M30x55mm	M12x66mm	M18x72mm	M30x74mm
Accessories	Nuts 2 pcs.						

Notes:
1) Suffix A = Normally open type, suffix B= Normally closed type; i.e. **GX-M8B.**
2) Suffix P = PNP type, without suffix = NPN type; i.e. **GX-M8B.**
3) Without suffix = 2m cable, suffix -Z = M12 connector type; i.e. **GX-M8B-P-Z**
4) The specified rated sensing distance refers to the standard sensing object.
5) The specified stable sensing distance is the range in which the sensor works reliably even in case of deviations in temperature or voltage.
6) Standard sensing object = sheet steel, thickness: 1mm

◼ 2-wire type

| Type | Shielded | | | | | | | |
	Standard sensing distance				Large sensing distance			
Model no.	GX-M8(-A/-B)-U (Note 1, 2)	GX-M12(-A/-B)-U (-Z)	GX-M18(-A/-B)-U (-Z)	GX-M30(-A/-B)-U (-Z)	GX-ML8(-A/-B)-U	GX-ML12(-A/-B)-U (-Z)	GX-ML18(-A/-B)-U (-Z)	GX-ML30 (-A/-B)-U (-Z)
Rated sensing distance (Note 3)	1.5mm ±10%	2mm ±10%	5mm ±10%	10mm ±10%	2,5 ±10%	4mm ±10%	8mm ±10%	15mm ±10%
Stable sensing distance (Note 4)	0 to 1.2mm	0 to 1.6mm	0 to 4mm	0 to 8mm	0 to 2mm	0 to 3.2mm	0 to 6.4mm	0 to 12mm
Standard sensing object (Note 5)	8x8mm	12x12mm	18x18mm	30x30mm	8x8mm	12x12mm	18x18mm	30x30mm
Hysteresis	Max. 15% of measurement distance							
Repeatability	Along sensing axis: max. 5% of measurement distance							
Power supply voltage	12 to 24V DC ±10%							
Output	Non-contact DC 2-wire type, sink current 1.5 to 100mA, residual voltage max 4.2V (Note 6)							
Output operation	Normally closed (N.C.) or Normally open (N.O.) (Note 1)							
Switching frequency	1kHz	1kHz	1.2kHz	1.3kHz	1.1kHz	1.3kHz	1.5kHz	0.8kHz
Protection	IP67 (IEC)	IP69K (DIN), IP68 (IEC) 2m cable type; IP67 (IEC) M12 connector type						
Ambient temperature	− 25 to +70°C							
Material	Enclosure: Brass (nickel plated), Sensing part: PPS (polyphenylsulfide)							
Connection method	Cable, 2m	Cable, 2m or M12 plug-in connector type (Note 2)			Cable, 2m	Cable, 2m or M12 plug-in connector type (Note 2)		
Dimensions (ØxL) — 2m cable	M8x33mm	M12x35mm	M18x39mm	M30x43mm	M8x33mm	M12x35mm	M18x39mm	M30x43mm
Dimensions (ØxL) — M12 connector	–	M12x50mm	M18x50mm	M30x55mm	–	M12x50mm	M18x50mm	M30x55mm
Accessories	Nuts 2 pcs.							

Notes:
1) Suffix A = Normally open type, suffix B= Normally closed type; i.e. **GX-M8B-U**
2) Without suffix = 2m cable, suffix -Z = M12 connector type; i.e. **GX-M8B-P-Z**
3) The specified rated sensing distance refers to the standard sensing object.
4) The specified stable sensing distance is the range in which the sensor works reliably even in case of temperature or voltage deviations.
5) Standard sensing object = sheet steel, thickness: 1mm.
6) If you extend the cable residual voltage may rise.

Photoelectric Sensors

Fiber Optic Sensors

Standard fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Index

GX-M

GX-F/H

Stable sensing of work pieces

Features

■ Environmental resistance

This sensor has a long stable sensing range. It is easy to install.

- ■ IP68g protection: water and oil-resistant
- ■ Space-saving installation
- ■ A metal sleeve ensures a secure installation

The new, integrated construction method improves environmental resistance performance.

■ The LED indicators are easy to see

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

■ Stable detection

- ■ Large sensing range
- ■ Max. deviation at max. sensing range: ±8%
- ■ Max. deviation with temperature changes: ±8%

Typical applications

Checking up/down operation of compact molding equipment
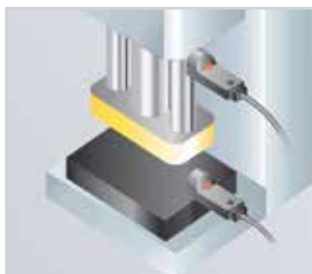
Sensing presence of metallic objects on a part feeder

Positioning metal pallets
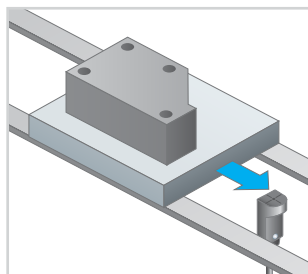
Muting control with light curtains

Shock resistance: 5000G

Vibration resistance: 500Hz

Technical specifications

Photoelectric Sensors

Fiber Optic Sensors

Standard fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

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Accessories

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GX-F/H
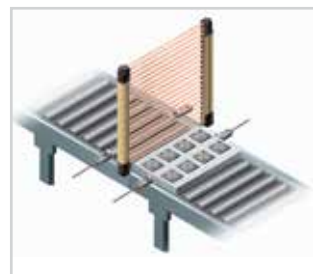
Model no.		GX-F6 (-A/ -B)(-I)(-P) (Note 1,2,3)	GX-F8 (-A/ -B)(-I)(-P)	GX-F12 (-A/ -B)(-I)(-P)	GX-F15(-A/ -B)(-I)(-P)	GX-FL15 (-A/ -B)(-I)(-P)
	Side sensing	GX-F6 (-A/ -B)(-I)(-P) (Note 1,2,3)	GX-F8 (-A/ -B)(-I)(-P)	GX-F12 (-A/ -B)(-I)(-P)	GX-F15(-A/ -B)(-I)(-P)	GX-FL15 (-A/ -B)(-I)(-P)
	Top sensing	GX-H6 (-A/ -B)(-I)(-P)	GX-H8 (-A/ -B)(-I)(-P)	GX-H12 (-A/ -B)(-I)(-P)	GX-H15 (-A/ -B)(-I)(-P)	GX-HL15 (-A/ -B)(-I)(-P)
Max. operating distance (Note 4)		1.6mm ±8%	2.5mm ±8%	4mm ±8%	5mm ±8%	8mm ±8%
Stable sensing distance (Note 5)		0 to 1.3mm	0 to 2.1mm	0 to 3.3mm	0 to 4.2mm	0 to 6.7mm
Standard sensing object (Note 6)		12x12mm	15x15mm	20x20mm	20x20mm	30x30mm
Repeatability		<0.04mm				
Interference prevention		Alternate frequency (Note 2)				
Power supply voltage		12 to 24V DC +10% / −15%				
Output		PNP / NPN open-collector transistor, 100mA or less (Note 3)				
Output operation		Normally closed (NC) or Normally open (NO) (Note 1)				
Switching frequency		400Hz	500Hz		250Hz	150Hz
Protection		IP68 (IEC)				
Ambient temperature		−25 to +70°C				
Material		Enclosure: PBT, display: polyester				
Connection method		Cable, 1m				
Dimensions (HxWxD)	Side sensing	6x6x24.5mm	7.4x8x23mm	7.1x12x27.8mm	8x15x31.5mm	
	Top sensing	6x6x25mm	8.2x8x25mm	12x12x27.4mm	16.5x15x29.5mm	

Notes:
1) Suffix A = Normally open type, suffix B= Normally closed type; i.e. **GX-F6B**
2) Suffix I = Alternate frequency type (interference prevention) i.e. **GX-F6BI**
3) Without suffix = NPN type, P = PNP type; i.e. **GX-F6BI-P**
4) The specified rated sensing distance refers to the standard sensing object.
5) The specified stable sensing distance is the range in which the sensor works reliably even in case of temperature or voltage deviations.
6) Standard sensing object = sheet steel, thickness: 1mm

HL-G1

Precision laser displacement sensors

Features

■ All-In-One Concept

All processing electronics are incorporated in a robust sensor housing. All settings can be made directly on the sensor. A 7-segment LED-display makes it easy to configure sensor operation while checking displacement values.

■ Compact and lightweight body

With its lightweight plastic body, weighing just 70g and dimensions of 20.4 x 60 x 57mm, it is easy to integrate the sensor in machines and production lines where space is tight.

■ Extended product range

With the extension of the HL-G1 series it is now possible to measure on specular surfaces with a high accuracy. Models with different measurement distances up to 82mm are available. Suitable applications can be for example in the semiconductor industry with specular wafer surfaces or other polished metal parts.

■ User-friendly

The **HL-G1** series can be operated directly, by touch terminal (GT02/GT12 series) or Windows software via RS-422/RS-485.

Typical applications

Control of dispenser height
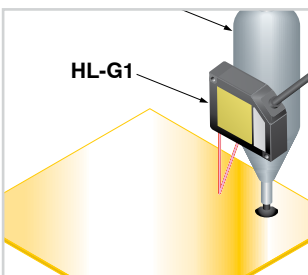
Detection of aluminum wheel grooves
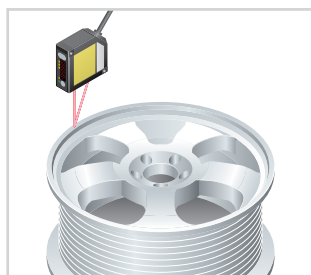
Measuring sheet slack and thickness
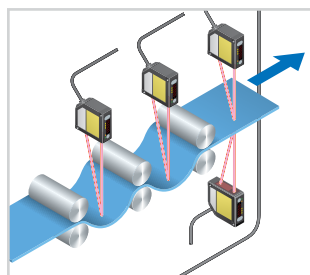
Positioning of specular wafer

Technical specifications

■ Standard type

Type	Diffuse reflective type					Specular reflective type		
Model no.	HL-G103-A-C5	HL-G105-A-C5	HL-G108-A-C5	HL-G112-A-C5	HL-G125-A-C5	HL-G103-RA-C5	HL-G105-RA-C5	HL-G-RA-C5
Rated pressure	30±4mm	50±10mm	85±20mm	120±60mm	250±150mm	26.3±2mm	47.3±5mm	82.9±10mm
Emission spot size	0.1x0.1mm	0.5x1mm	0.75x1.25mm	1.0x1.5mm	1.75x3.5mm	0.1x0.1mm		0.2x0.2mm
Power supply voltage	24V DC ±10%							
Analog voltage output	0 to 10V / 4 to 20mA							
Response time	200µs, 500µs, 1ms, 2ms (selectable)							
Resolution	0.5µm	1.5µm	2.5µm	8µm	20µm	0.5µm	1.5µm	2.5µm
Linearity	±0.1 %F.S.			±0.3 %F.S.		±0.2 %F.S.		
Emitting element	Red laser diode, 655nm (class 2)							
Output	PNP or NPN open-collector transistor, 50mA or less (selection by wiring)							
Protection	IP67 (IEC)							
Ambient temperature	−10 to +45°C							
Material	Enclosure: PBT / Front cover: Acrylic / Cable: PVC							
Connection method	Cable, 5m							
Dimensions (HxWxD)	60x20.4x57mm							
Accessories	Warning label (English): 1 set							

■ Multifunction type

Type	Diffuse reflective type					Specular reflective type		
Model no.	HL-G103-S-J	HL-G105-S-J	HL-G108-S-J	HL-G112-S-J	HL-G125-S-J	HL-G103-RS-J	HL-G105-RS-J	HL-G108-RS-J
Rated pressure	30±4mm	50±10mm	85±20mm	120±60mm	250±150mm	26.3±2mm	47.3±5mm	82.9±10mm
Emission spot size	0.1x0.1mm	0.5x1mm	0.75x1.25mm	1.0x1.5mm	1.75x3.5mm	0.1x0.1mm		0.2x0.2mm
Power supply voltage	24V DC ±10%							
Analog voltage output	0 to 10V / 4 to 20mA							
Interfaces	RS-485 / RS-422							
Response time	200µs, 500µs, 1ms, 2ms (selectable)							
Resolution	0.5µm	1.5µm	2.5µm	8µm	20µm	0.5µm	1.5µm	2.5µm
Linearity	±0.1 %F.S.			±0.3 %F.S.		±0.2 %F.S.		
Emitting element	Red laser diode, 655nm (class 2)							
Output	PNP or NPN open-collector transistor, 50mA or less (selection by wiring)							
Protection	IP67 (IEC)							
Ambient temperature	−10 to +45°C							
Material	Enclosure: PBT / Front cover: Acrylic / Cable: PVC							
Connection method	Cable with connector, 0.5m (Note)							
Dimensions (HxWxD)	60x20.4x57mm							
Accessories	Warning label (English): 1 set							

Note: Cable is not included in delivery. Please select under accessories (page 125)

Photoelectric Sensors

Fiber Optic Sensors

Standard Fibers

Fiber Sensor Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers / Electrostatic Sensors

Accessories

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HL-G1

HL-C1

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

Features

■ Sampling rate 10kHz

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 with minimal linearity error

Available with ultra-precise 1μm resolution measurement capability 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 possible on various surfaces

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. Installation to a DIN rail is also possible. Furthermore, all cables can be connected at the front of the controller in order to save further space.

Removable terminal block | 40 mm
120 mm
74 mm

■ Equipped with a serial output/input

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

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

Controller **HL-C1C-M**
Serial input/output
Sensor heads **HL-C1**☐(**-BK**)
Extension cable (optional)

Typical applications

Photoelectric Sensors

Fiber Optic Sensors

Standard Fibers

Fiber Sensor Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers / Electrostatic Sensors

Accessories

Index
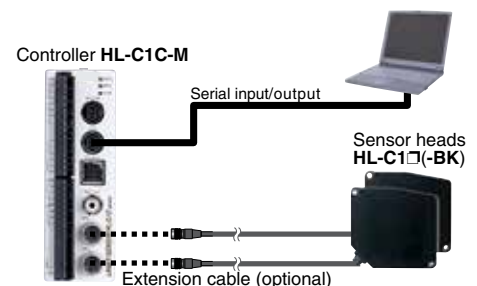
HL-C1

Measuring glass substrate thickness

The HL-C1 series specular reflective type realizes stable distance measurements even for specular and transparent objects.
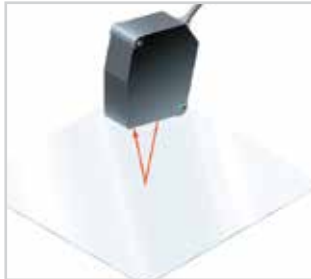
Detecting the presence of a resin coating

The HL-C1 series detects translucent resin coating.
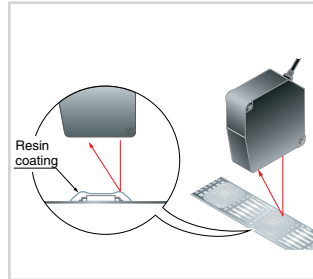
Measuring the eccentricity of a metal shaft

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

Resin coating

HL-C105B-BK

Technical specifications

■ Sensor heads

Type	Diffuse reflective			Specular reflective	
Model no.	HLC135CBK10	HL-C108BBK	HL-C105BBK	HL-C108B	HL-C105B
Sensing range	350±200mm	85±20mm	50±5mm	81.4±16mm	46±4mm
Emission spot size	400x200µm	100x140µm	70x120µm	100x140µm	70x120µm
Resolution	10µm	2µm	1µm	2µm	1µm
Linearity	± 0.02% F.S.				
Emitting element	Red laser diode, 658nm (class 3B)	Red laser diode, 658nm (class 2)			
Protection	IP67 (IEC)				
Ambient temperature	0 to +45°C				
Material	Enclosure: Die-cast aluminum / Front cover: glass				
Connection method	Cable with connector, 0.5m				
Dimensions (HxWxD)	82x87x26.6mm				
Accessories	Warning label (English): 1 set				

■ Controller

Type		Standard	Long sensing range
Model no.		HL-C1-M	HL-C1-M-WL
Applicable sensor heads		HL-C108B(BK), HL-C105B(BK)	HL-C135C-BK10
Power supply voltage		24V DC ±10%	
Sampling rate		Selectable: 100µs, 144µs, 200µs, 255µs, 332µs, 498µs, 1000µs	
Output		PhotoMOS relay	
Analog voltage output	Output voltage	±5V/F.S. (Note)	
	Output current	4 to 20mA	
Protection		IP67 (IEC)	
Ambient temperature		0 to +50°C	
Dimensions (HxWxD)		120x40x74mm	120x60x74mm
Connection method		Connector (sensors), terminal block	
Accessories		–	Keys, 2 pcs.

Note: At factory setting.

HL-C2

Ultra high-speed, precision laser displacement sensors

Features

■ Excellent basic performance

■ Sampling rate 100kHz

The HDLC-CMOS sensors were developed especially for the **HL-C2** series. The high-resolution chip together with a very short processing time enables maximum resolution and speed.

■ Resolution up to 0.01µm, linearity up to ±0.02%F.S.

Superior resolution of 0.01µm. Linearity of ±0.02%F.S. enabled by latest high resolution lens technology.
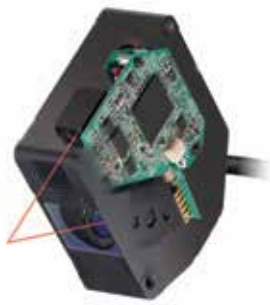
■ Touch panel simplifies operation

Measurement values and light intensity are displayed. Via the menu, you can set the sensor head function and output conditions.

■ Compact sensor head saves space

The volume ratio has been reduced by 23% compared to the previous model, minimizing installation space.

■ Compact but with a wide array of functions

You can connect two sensor heads and a variety of devices to the ultra compact controller. Measurement values can be analyzed and displayed while the sensors are being controlled.

Typical applications

Photoelectric Sensors

Fiber Optic Sensors

Standard Fibers

Fiber Sensor Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Index

HL-C2

Measurement of the position of patterned glass
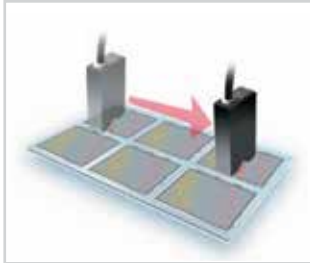
Control of the camera focus

Measurement of the shape of a camshaft

Measurement of the heights of chip parts

Technical specifications

■ Sensor heads

Type	Specular reflective	Diffuse reflective		
Model no.	HL-C201F(-E)(-MK) (Note)	HL-C203F(-E)(-MK)	HL-C211F(-E)(-MK)	HL-C211F5(-E)(-MK)
Sensing range	10±1mm	30±5mm	110±15mm	
Emission spot size	Ø20µm, -MK: 20x700µm	Ø30µm, -MK: 30x1200µm	Ø80µm, -MK: 80x1700µm	
Linearity	± 0.02% F.S.	± 0.03% F.S.		
Emitting element	Red laser diode, 658nm			
Laser class	1 (IEC)	2 (IEC)		3R (IEC)
Protection	IP67 (IEC)			
Ambient temperature	0 to +45°C			
Material	Enclosure: Die-cast aluminum / Front cover: glass			
Connection method	Cable, 0.5m with attached connector			
Dimensions (HxWxD)	54x20x95mm	80x26x70mm	95x26x74mm	
Accessories	Warning label (English): 1 set			

Notes:
Suffix -E = Reduced resolution types.
Suffix -MK = Line spot type.

■ Controller

Type	NPN	PNP
Model no.	HL-C2C	HL-C2C-P
Power supply voltage	24V DC ±10%	
Analog voltage output	±5V / F.S., 4-20mA F.S.	
Output	NPN or PNP open-collector transistor, 100mA or less	
Inputs	Timer, zero set, remote interlock, reset	
USB interface	USB 2.0	
Serial input/output	RS232C (9.6-115.2kbit /s)	
Current consumption	With 1 sensor head: 350mA With 2 sensor heads: 500mA	
Ambient temperature	0 to +50°C	
Material	Polycarbonate	
Connection method	Connector (sensors), terminal block	
Dimensions (HxWxD)	130x59x105.5mm	

HL-T1

A high-functionality intelligent controller

Features

■ 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 sampling 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.

■ 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.

Calculation unit HL-AC1-CL

Sheet width measurement
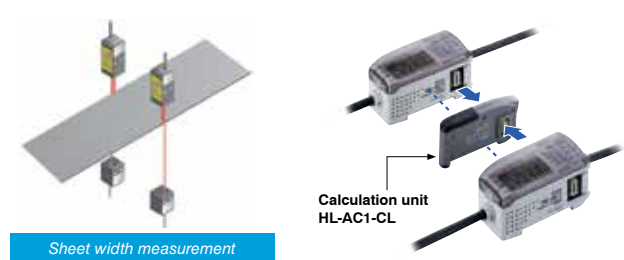
■ FDA standards conforming types are available

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

Typical applications

Distinguishing opacity of glass
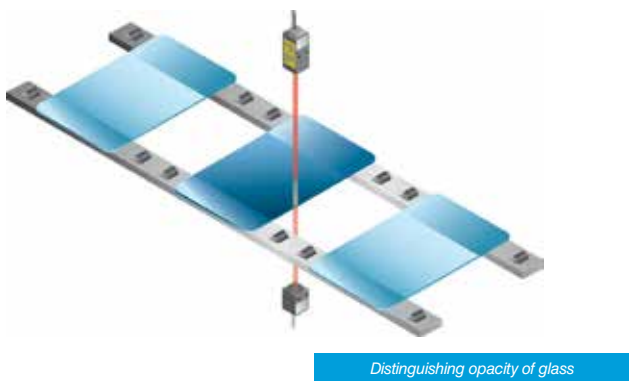
Technical specifications

■ Sensor heads

Type	Beam diameter ø1mm		Sensing width 5mm	Sensing width 10mm
Model no.	HL-T1001A(F) (Note)		HL-T1005A(F)	HL-T1010A(F)
Sensing width/Diameter	ø1mm	ø1 to 2.5mm	5mm	10mm
Rated pressure	0 to 500mm	500 to 2,000mm	500mm	
Minimum 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	–	4µm	
Linear output resolution	4µm	–	4µm	
Ambient temperature	0 to +50°C			
Emitting element	Infrared semiconductor laser, Class 1 (IEC/JIS)			

Notes:
HL-T10A is a IEC/JIS standards conforming type.
HL-T10F is a FDA standards conforming type.

■ Controller

Type	NPN	PNP
Model no.	HL-AC1	HL-AC1P
Power supply voltage	12 to 24V DC ± 10%	
Measuring cycle	150µs	
Analog voltage output	Current / voltage output switchable Current output: 4 to 20mA/F.S., max. load resistance 300Ω Voltage output: ±5V, Output impedance 100 Ω	
Temperature characteristics	±0.2% F.S. °C	
Output	3 x NPN or PNP open-collector transistors, 50mA or less	
Ambient temperature	0 to +50°C	
Dimensions (HxWxD)	34.3x30x64.3mm	

Photoelectric Sensors

Fiber Optic Sensors

Standard Fibers

Fiber Sensor Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers/ Electrostatic Sensors

Accessories

Index

HL-T1

GP-X

Eddy current analog sensor for high-speed sampling

Features

■ Ultra high-speed response time of 25µs

■ Extremely low temperature deviations (0,07% F.S.°C)

■ Predefined material characteristics

The sensor exhibits ±0.3% F.S. linearity deviation when used on iron and stainless steel. Furthermore, characteristics for other materials are already programmed in the controller, making selection easy. Of course, the settings can also be customized.

■ Serial interface

The controller can be connected with a personal computer via an RS-232 interface. GP-XAiME, the software included, simplifies data visualization and analysis. Moreover, several systems can be combined and then easily configured at the same time.

■ 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 setting 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.

Out of setting range
(upper threshold)
(Orange)

Sensing values within
setting range
(Green)

Out of setting range
(lower threshold)
(Orange)
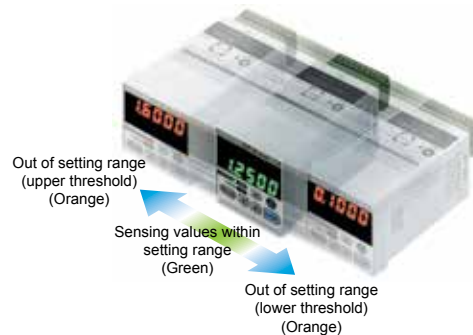
Typical applications

Stroke end sensing

GP-X12ML

Eccentricity sensing

GP-X3SE

Height sensing

GP-X10M

Technical specifications

Photoelectric Sensors

Fiber Optic Sensors

Standard Fibers

Fiber Sensor Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers / Electrostatic Sensors

Accessories

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GP-X

| Type		Cylindrical heads			Heads with thread		
Model no.	NPN output	GP-XC3SE (Note 2)	GP-XC5SE	GP-XC8S	GP-XC10M	GP-XC12ML	GP-XC22KL
	PNP output	GP-XC3SEP	GP-XC5SEP	GP-XC8SP	GP-XC10MP	GP-XC12MLP	GP-XC22KLP
Rated pressure		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, cold rolled carbon steel (SPCC) 60x60x1mm					
Power supply voltage		24V DC ±10%					
Analog voltage output		–5V to +5V (Note 1)					
Sampling rate		40kHz (25µs)					
Resolution		**GP-XC3SE / GP-XC5SE**: 0.04% F.S. (64 times average processing) **GP-XC8S / GP-XC10M / GP-XC12ML / GP-XC22KL**: 0.02% F.S. (64 times average processing)					
Output		3x NPN or PNP open-collector transistor, 100mA or less					
Protection		Sensor head: IP67 (IEC)					
Ambient temperature		Sensor head: –10 to +55°C, Controller: 0 to +50°C					
Material		Sensor head: stainless steel (SUS303), **GP-XC12ML❏**, **GP-XC22KL❏**: brass (nickel plated), Switch part: PC					
Connection method		Terminal block					
Dimensions	Sensor head (ØxD)	3.8x17mm	5.4x17mm	8x17mm	M10x17mm	M12x21mm	M12x35mm
	Controller (HxWxD)	48x48x83mm					
Accessories		Controller mounting frame, 1 pc.					

Notes:
1) Factory setting: 0 to +5V
2) Model no. for one set (sensor head and controller)

ER-Q

Miniature ionizer with fan

Features

■ **Small dimensions**

Simple and space-saving installation on production lines and manual workstations.

■ **Adjustable**

A continuously variable adjuster ensures the production of the required air volume.

■ **Unit for demanding industrial environments**

The LED displays the required maintenance steps or failures; this also can be queried via the outputs of a PLC. Parts for maintenance are easy to get at and replace.

Technical specifications

Type	Standard type
Model no.	ER-Q
Charge removal time (+-1000 > +-100V)	Approx. 1.5s
Discharge output voltage	± 2kV
Ion balance	Max. ± 10V
Discharge method	High frequency AC method
Power supply voltage	24V DC ±10%
Power consumption	200mA or less
Fan rotation speed	Continuously variable adjustable (potentiometer)
Outputs	ERROR and CHECK NPN open-collector transistor, max. 50mA
Status indicator / Monitoring function	Ready/Discharging (DSC/green), Discharge error (red), Fan error (blinking red)
Ambient temperature	0 to +50°C
Ambient humidity	35 to 65%RH
Material	Enclosure: PBT, Discharge needles: tungsten
Dimensions (HxWxD)	60x33x65mm
Accessories	I/O connector set manufactured by MOLEX, Inc.: Housing 5557-08P, terminal 5556T

ER-F

Photoelectric Sensors

Fiber Optic Sensors

Standard fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers / Electrostatic Sensors

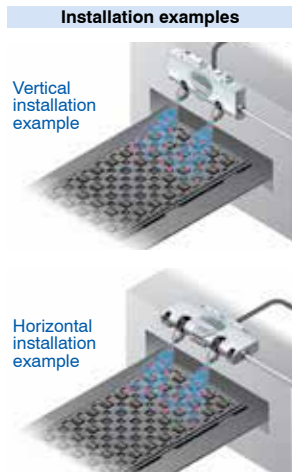Accessories

Index

ER-F

Fan type ionizer

Features

■ Two types

Low volume fan type. This type generates only the half of the air volume as the standard type, which is required for small components and thin film. Four different speeds can be selected for the fan.

■ Easy maintenance

Because the discharge needle unit is attached to the louver, exchange or maintenance of the needles is made easy without touching the main unit. A safe design: once the louver is removed, the high-voltage circuit is broken and the fan halts. Simply replace the louver to change configuration between long distance and wide area ionization. The two louvers come with the ionizer main body.

Standard fan type ER-F12	Low-volume fan type ER-F12S
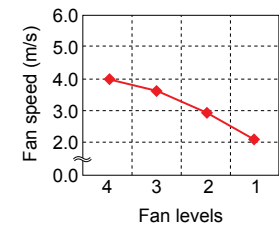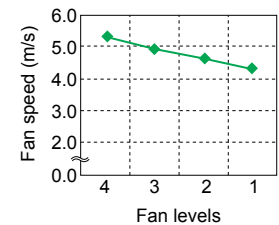
Straight louver removes charges at great distances	Angled louver removes charges over wide area

Neutralizes static charges quickly from a great distance

Neutralizes static charges; wide area ionizer
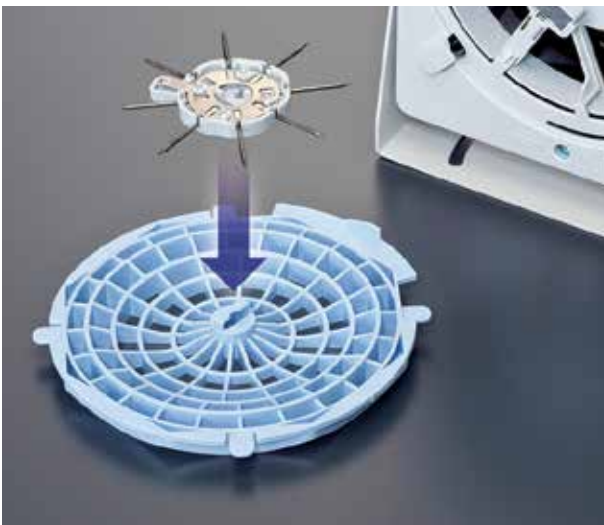
Technical specifications

Type	Standard type	Low-volume fan type
Model no.	ER-F12	ER-F12S
Discharge time (+-1000 > +-100V)	Approx. 1s	Approx. 1.5s
Discharge output voltage	±2kV	
Ion balance	±10V or less	
Discharge method	High-frequency AC	
Power supply voltage	24V DC ±10%	
Power consumption	700mA or less	400mA or less
Fan rotation speed	Adjustable at 4 levels	
Output	ERROR, NPN open-collector transistor, 50mA or less	
Input terminal	Discharge stop = connected to 0V / Start= open	
Status indicators / Monitoring functions	Power supply voltage (Power / green), Discharging (DSC / green), Discharge error (DSC red), Fan error (FAN red)	
Ambient temperature	0 to +50°C	
Ambient humidity	35 to 65%RH	
Material	Enclosure / Louver: ABS, Fitting of discharge needles: PBT, Discharge needles: tungsten, Mounting bracket: DC03	
Dimensions (HxWxD)	166x161x60mm	
Accessories	Straight louver (Note): 1 pc. Angle louver: 1 pc.; Caution label: 1 set; Rubber cushion: 1 pc.	

Note: The discharge needle set is mounted at the louver.

ER-X

Photoelectric Sensors

Fiber Optic Sensors

Standard fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers / Electrostatic Sensors

Accessories

Index

ER-X

Area ionizer for fast applications

Features

■ Quick charge removal

Thanks to the pulse AC method, the **ER-X** series is well suited for high-speed applications as found in the packaging and semiconductor industries, where charge removal time is directly linked to productivity. In addition, discharge frequencies can be adjusted from between 1 and 100Hz, maximizing flexibility. Thanks to a built-in feedback system, the ionizer can even adjust the discharge frequency automatically during operation.

■ Feedback system

Individual displays for discharge, error messages and needle control are provided on the controller. Furthermore, you can activate settings for frequency, ion balance or limits directly via a potentiometer and DIP switches.

■ Airless operation

The area ionizer of the ER-X series ionizers can be operated with or without air pressure. This technology opens up applications in fields such as the coating industry, as well as the production and packaging of microelectronic components that otherwise are blown around by whirling air.

■ Flexible system configuration

The system consists of a sensor head and a controller. The sensor head is available in different sizes. You can connect parallel up to 2 heads to the controller. This enlarges the working area of the system up to 1.2m.

Typical applications

Neutralization of foils

Charge removal from ICs

Charge removal from miniaturized electronic components
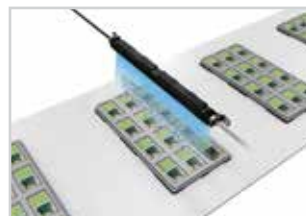
Photoelectric
Sensors

Fiber Optic
Sensors

Standard fibers

Fiber Sensors
Communication
Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow
Sensors

Inductive Proximity
Sensors

Measurement
Sensors

Ionizers /
Electrostatic
Sensors

Accessories

Index

ER-X

Technical specifications

■ Sensor heads

Model no.	ER-X016	ER-X032	ER-X048	ER-X064
Effective charge removal width	160mm	320mm	480mm	640mm
Charge removal time (+-1000 > +-100V)	Approx. 1s			
Discharge output voltage	±7kV			
Ion balance	Max. ±30V			
Discharge method	Pulse AC method			
Maximum air pressure	5bar (0.5MPa)			
Ambient temperature	0 to +50°C			
Ambient humidity	35 to 65%RH			
Material	Enclosure: PPS, Stainless steel; Mounting bracket, Stainless steel; Needle: tungsten			

■ Controller

Model no.	ER-XC02
Power supply	24V DC ±10%
Power consumption	1 head: max. 450mA; 2 heads: 800mA or less
Outputs	Alarm, Error; PhotoMOS, 50mA or less
Status display / Monitor functions of discharge unit	Discharge (DSC)
Ambient temperature	0 to +50°C
Ambient humidity	35 to 65%RH
Material	ABS
Dimensions (HxWxD)	90x53x64mm
Accessories	MOLEX-plug (Housing 5557-10R, Terminal 5556TL) 1 pc., Ground wire 1pc.

ER-TF

Photoelectric Sensors

Fiber Optic Sensors

Standard fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers / Electrostatic Sensors

Accessories

Index

ER-TF

Wide-area ionizer

Features

■ High function volume

Wide-area ionizer **ER-TF** effectively neutralizes electrostatic charge between different stages of production. The series is designed for stable operation and easy maintenance. The device is available in different lengths. Moreover, there is no need for compressed air, which makes installation easy and keeps costs under control.

■ Air flow can be set to 4 different speeds

The MAX setting quickly removes static charge over a wide area.

■ Flexible layout

The direction of the air output can be adjusted after mounting.

Blowing direction adjustment mechanism
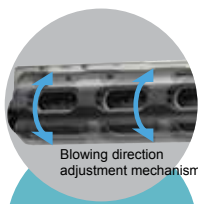
■ Safe design

Detection of entry to the discharger interrupts the high voltage circuit.

Entry detection function
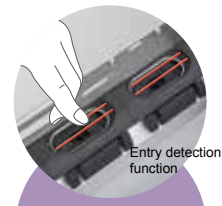
■ Easy maintenance

Discharge needle units can be removed and attached quickly.

Discharge needle unit
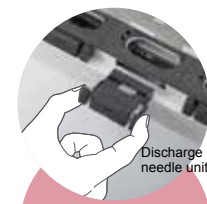
The fan air intake filter can be easily removed. This greatly reduces the time needed for cleaning.

Ionizers / Electrostatic Sensors

■ Characteristics of ER-TF series

The layout of this ionizer allows it to be installed in a number of ways not possible for common, commercially available ionizers.

Flexible layout

Safe design   Easy maintenance
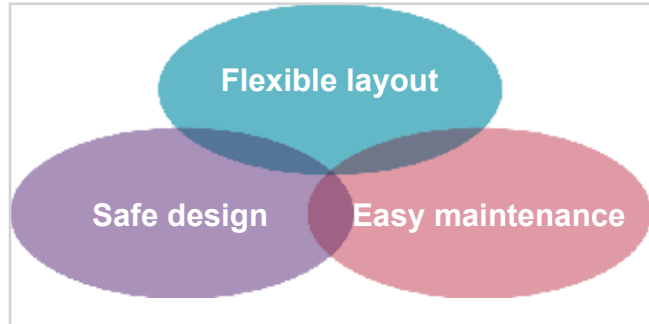
Typical applications

Desktop setup, 800mm type to accommodate wide workstation

400mm type for electrostatical discharge at a single workstation

Overhead setup to cover cell production
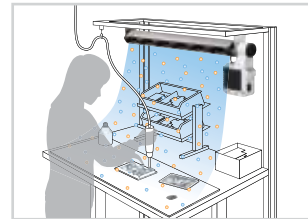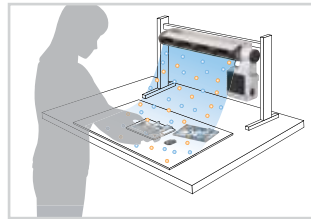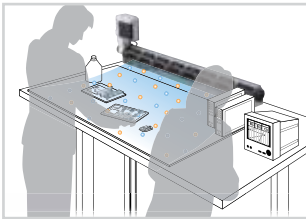
Technical specifications

| Type	Area type		
Model no.	ER-TF04-EX	ER-TF06-EX	ER-TF08-EX
Charge removal time (+-1000 > +-100V)	Approx. 1s		
Discharge output voltage	±6kV		
Ion balance	max. ± 10V		
Discharge method	DC		
Power supply unit	Input voltage: 100 to 240 V AC, output voltage: 24V DC ±10%		
Power consumption	80VA or less		
Fan rotation speed	Adjustable at 4 levels		
Output	ERROR, NPN open-collector transistor, 50mA or less		
Status display / Monitor functions of discharge unit	Supply voltage (Power / green), Discharge or fan error (Error / red), Maintenance (Check / orange)		
Status display on fan	Discharge unit error or maintenance (BAR / yellow), Fan error or maintenance (FAN / yellow)		
Ambient temperature	0 to +50°C, power supply unit 0 to +40°C		
Ambient humidity	35 to 65% RH		
Material	Housing discharge unit / Fan: ABS, Discharge needles: tungsten, Mounting bracket: DD11		
Discharge unit dimensions (HxWxD)	65x414x60mm	65x574x60mm	65x734x60mm
Dimensions (HxWxD)	123x100x44mm		
Accessories	Power supply unit, Ground wire, Filter 5 pcs., Caution labels 2 pcs.		

ER-VW

Photoelectric Sensors

Fiber Optic Sensors

Standard fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

Measurement Sensors

Ionizers / Electrostatic Sensors

Accessories

Index

ER-VW

Nozzle angle adjustment

Features

◾ Nozzle angle adjustment

The angles of the two nozzles can be adjusted within a range of approximately 190° by screwing down the ends of the nozzles.

Installation examples

Vertical installation example

Horizontal installation example

◾ Compact and ultrathin design

The thickness of the unit is 18.9mm. Since the nozzle angles can be adjusted, they can be installed in tight spaces, such as when other equipment is present.

Includes angle adjustment scale

◾ Minimum air consumption 15ℓ/min.

The **ER-VW** series can utilize air flow levels starting from a minimum of 15 l/min. Because the amount of air consumed is so low, the loads placed on air supply equipment can be reduced.

Comparison of air consumption

Previous spot type
Minimum 100l/min. (ANR)
Maximum 300l/min. (ANR)

ER-VW
Minimum 15l/min. (ANR)
Maximum 60l/min. (ANR)

0   100   200   300
Air consumption
l/min. (ANR)

◾ 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.

Air supply

Air supply

Discharge

Discharge halt
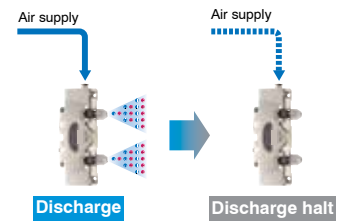
◾ Easy connection possible

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

End connector

Joint kit

❶ **Cable with connector on both ends**
Used to connect power supply, input / output and ground.

❷ **Air joint**
Used to supply air.

Cable with connector
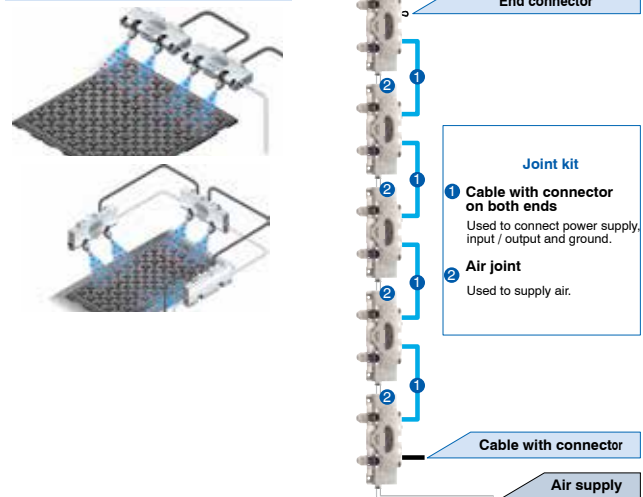
Air supply

■ 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.

Power supply
POWER

Discharge needle condition
CHECK

Air supply monitoring
AIR

Discharge
DSC

Abnormal discharge
ERROR

Typical applications

Charge removal of ICs
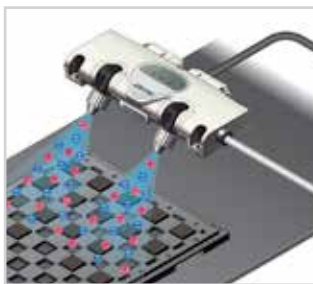
Removing charge during pickup from dicing type
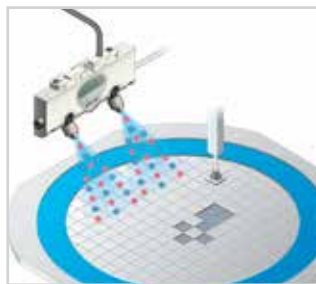
Parallel discharging on two assembly lines
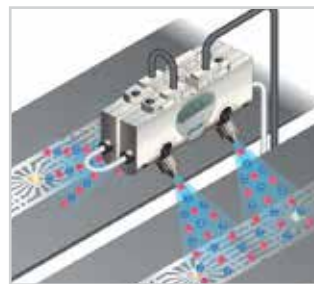
Removing charges from LCD transport brackets

Technical specifications

Type	Spot type
Model no.	ER-VW
Charge removal time (+-1000 > +-100V)	1s or less
Discharge output voltage	± 2kV
Ion balance	±10V or less
Discharge method	High frequency AC method
Power supply voltage	24V DC ±10%
Power consumption	120mA or less
Air pressure	0.5 to 5bar (0.05 to 0.50MPa)
Inputs	Reset and discharge stop = connected to 0V / Start= open
Outputs	Discharging (DSC), ERROR and CHECK; NPN open collector transistor; 50mA or less
Status indicators / Monitoring functions	Supply voltage (Power / green), Discharging (DSC / green), Checking needles (Check / orange), Monitoring air pressur (Air / orange), Failure (Error / red)
Ambient temperature	0 to +55°C
Ambient humidity	35 to 65%RH
Material	Enclosure: ABS (nickel plated), nozzles / nozzle mount, Screws: stainless steel, Discharge needles: tungsten
Dimensions (HxWxD)	19x133x65mm
Accessories	Connector cable with 8 pins, 0.5m, Terminating plug with 9 pins, Ground wire

ER-V

Photoelectric Sensors

Fiber Optic Sensors

Standard fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

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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 but 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**

Shower nozzle	Straight bar nozzle	Shape-preserving tube	Conductive tube
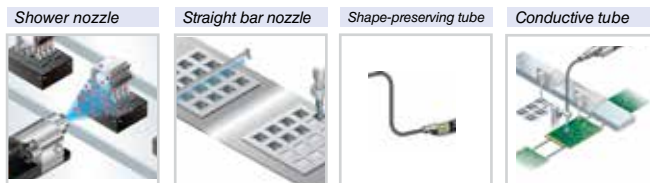
■ **Ultra compact design accurately removes charges of objects even from narrow spaces**

The main unit is merely 28x27x111.6mm 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.

27mm

28mm

111.6mm
(With shower nozzle attached)
109mm (Main unit only)

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.

Typical applications

Change removal and dust removal of lenses

Prevent discharge damage in circuit board LEDs

Charge removal glass surfaces

Technical specifications

Type	Spot type
Model no.	ER-VS02
Charge removal time (+-1000 > +-100V)	1s or less
Discharge output voltage	±2kV
Ion balance	±10V or less
Discharge method	High frequency AC method
Power supply voltage	24V DC ±10%
Power consumption	70mA or less
Maximum air pressure	0.5 to 7bar (0,05 to 0.7MPa)
Inputs	Reset and discharge stop = connected to 0V / Start= open
Outputs	Error (ERROR) and check (CHECK) NPN open-collector transistor, 50mA or less
Status indicators / Monitoring functions	Supply voltage (Power / green), Discharging (DSC / green), Checking needles (Check / orange), Error (Error / red)
Ambient temperature	0 to +55°C
Ambient humidity	35 to 65%RH
Material	Enclosure: PPS, Cover: stainless steel, Discharge needles: tungsten
Dimensions (HxWxD)	28x27x111.6mm
Accessories	I/O connector set manufactured by MOLEX, Inc.: Housing 5557-08P, terminal 5556TL

EC-G

Photoelectric Sensors

Fiber Optic Sensors

Standard fibers

Fiber Sensors Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

Inductive Proximity Sensors

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EC-G

Pulse air-gun ionizer

Features

■ **Direct ionized air emission from air gun**

With the new pulse air-gun ionizer operators can comfortably neutralize static electricity while manually cleaning.
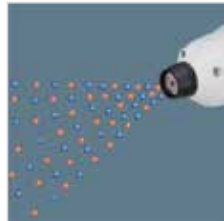
■ **Pulsed ionized air**

Instant pulse air emission with high air pressure removes dust all at once. Its lightweight construction, ergonomic design and 2m cable make the air gun the perfect ionizer for manual jobs.

■ **White LED illumination**

A convenient white LED on the front of the gun illuminates target objects.

Technical specifications

Type	Air gun type
Model no.	EC-G02
Charge removal time (+-1000 > +-100V)	Average 0.5s
Discharge output voltage	±1kV
Ion balance	±10V or less
Discharge method	High frequency AC method
Power supply unit	Input voltage: 100 to 240VAC, output voltage: 24V DC ±10%
Power consumption	30VA or less
Maximum air pressure	0.5 to 5bar (0.05 to 0.50MPa)
Input terminal	Charge removal start = connected to 0V
Modes	Pulse 1 (long) and Pulse 2 (short) / CONT (continuous) selectable by switch
LED illumination mode	White LED
Status indicator / Monitoring function	Valve illumination (orange)
Ambient temperature	0 to +50°C
Ambient humidity	35 to 65% RH (no condensation allowed)
Material	Enclosure: ABS, Nozzle: Stainless steel, Nozzle guard: NBR, Discharge needle: tungsten
Weight	approx. 270g
Accessories	AC adapter, 1 pc.; Exclusive intermediate cable, 2m; Straight joints to couple air tubes ø 8-8mm (Note) and ø 8-6mm type, Connector connection terminal from MOLEX

Note: Straight joint to couple air tubes, ø 8mm, is attached at shipment.

Typical applications

Remove charge and dust on PCB

Remove charge and dust on flat screens

Remove dust before painting

EF-S1

Constant monitoring of static charges on production lines

Features

■ **Maintains and regulates product quality by preventing damage from static electric**

Static electricity that can build up in various places along a process line can be monitored constantly so that abnormalities can be prevented before they occur, ensuring quality.

■ **Reduces time 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 time required for inspection and testing.

Technical specifications

■ Sensor head

Type	Spot type
Model no.	EF-S1HS
Measuring range	8.0 to 20.5mm (±1kV) 21.0 to 100mm (±2kV)

■ Controller

Type	Spot type
Model no.	EF-S1C
Power supply voltage	24V DC ±10%
Display range (Measurement range)	-1000 to 1000 (±1kV) -1999 to 1999 (±2kV)
Judgment output	NPN open-collector transistor, 100mA or less
Analog voltage output	Output voltage 1 to 5V Output impedance approx. 100Ω

Typical applications

Measuring surface potential when removing BG sheets
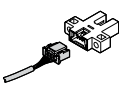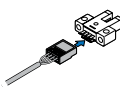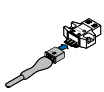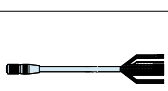
Measuring static electric charge in lead frames

Measuring frictional electrification of LCD modules

Accessories
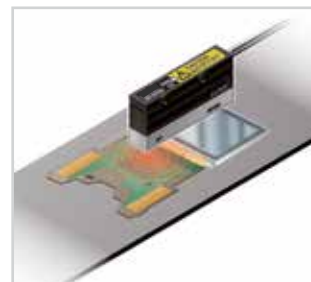
■ Cables

Picture	Description	Model no.	Applicable sensors
	4-pin M8 connector cable, 2m	**UZZ80820D**	CX-4□Z,FX101□Z, FX102□Z, DP11□EPJ
	4-pin M8 connector cable (elbow type 90°), 2m	**UZZ80821D**	CX-4□Z, FX101□Z, FX102□Z, DP11□EPJ
	4-pin M8 connector cable, 5m	**UZZ80850D**	CX-4□Z,FX101□Z, FX102□Z, DP11□EPJ
	4-pin M8 connector cable (elbow type 90°), 5m	**UZZ80851D**	CX-4□Z,FX101PZ, FX102□Z, DP11□EPJ
	4-pin M12 connector cable, 2m	**UZZ81220D**	LX-101□Z, CX-4□Z, EQ-30, CY-1□Z, GX-M□-Z
	4-pin M12 connector cable (elbow type 90°), 2m	**UZZ81221D**	LX-101□Z, CX-4□Z, EQ-30, CY-1□Z, GX-M□-Z
	4-pin M12 connector cable, 5m	**UZZ81250D**	LX-101□Z, CX-4□Z, EQ-30, CY-1□Z, GX-M□-Z
	4-pin M12 connector cable (elbow type 90°), 5m	**UZZ81251D**	LX-101□Z, CX-4□Z, EQ-30, CY-1□Z, GX-M□-Z
	4-wire cable with connector, 2m	**CN14AC2**	PM-□64, DP-100
	4-wire cable with connector, 5m	**CN14AC5**	PM-□64, DP-100
	4-wire cable with connector, 1m	**CN14HC1**	PM-□54
	4-wire cable with connector, 3m	**CN14HC3**	PM-□54
	3-wire cable with connector, 1m	**CN13C1**	PM2
	3-wire cable with connector, 3m	**CN13C3**	PM2
	3-wire main cable, 2m	**CN73C2**	FX-301□, FX311, FX-501□, FX-CH2□, SC-GU-1-485
	3-wire main cable, 5m	**CN73C5**	FX-301□, FX311, FX-501□, FX-CH2□, SC-GU-1-485
	1-wire sub cable, 2m	**CN71C2**	FX-301□, FX-311, FX-501□
	1-wire sub cable, 5m	**CN71C5**	FX-301□, FX-311, FX-501□
	4-wire main cable, 2m	**CN74C2**	FX-305□, FX-502□, LS-401□, LS-501□
	4-wire main cable, 5m	**CN74C5**	FX-305□, FX-502□, LS-401□, LS-501□
	2-wire sub cable, 2m	**CN72C2**	FX-305□, FX-502□, LS-401□, LS-501□
	2-wire sub cable, 5m	**CN72C5**	FX-305□, FX-502□, LS-401□, LS-501□
	14-wire connecting cable, 2m	**HL-G1CCJ2**	HL-G1□-S-J
	14-wire connecting cable, 5m	**HL-G1CCJ5**	HL-G1□-S-J

Accessories

■ Reflectors

Picture	Description	Model no.	Applicable reflectors
	Reflection foil: 8x30mm, thickness 0.7mm	**RF11**	CX-400, EX-20, NX5
	Reflection foil: 25x30mm, thickness 0.7mm	**RF12**	CX-400, EX-20, NX5
	Reflection foil: 30x30mm, thickness 0.5mm	**RF13**	CX-400
	Reflective area: 9.6x17.5mm	**RF200**	EX-20
	Reflective area: 12.8x33.3mm	**RF210**	CX-400, EX-L200, NX5
	Reflective area: 42.3x35.3mm	**RF220**	CX-400, NX5
	Reflective area: 59.3x50.3mm	**RF230**	CX-400, LS-H92❑, NX5
	Reflective area: 7x8mm	**RF310**	LS
	Reflection foil: 27.8 x25.2mm	**RF33**	LS
	Reflective area: 23x24mm	**RF330**	EX-L200, LS-H91❑, LS-H901
	Reflective area: 24x21mm	**RF-420**	CY-100
	Reflective area: 50x47mm	**RF-410**	CY-100
	Adhesive reflection tape: 22mm x 5m, thickness 0.4mm	**RF-40RL5**	CY-100

■ Mounting brackets

Picture	Description	Model no.	Applicable reflectors
	L-shaped mounting bracket	**MS-EX20-1**	EX-L200, LS-H102
	Mounting plate	**MSLX1**	LX-100
	Mounting bracket	**MSCX1**	CX-400, LS-400
	Mounting bracket	**MSCX21**	CX-400
	Mounting bracket	**MSNX51**	NX5
	Mounting bracket	**MSEX101**	EX-10
	Mounting bracket	**MSEX201**	EX-20 Top sensing
	Mounting bracket	**MSEX202**	EX-20 Side sensing
	Mounting set, 4 mounting brackets M4(l=15mm) 4pcs., M4 (l=18mm) 8pcs.	**MSNA11**	NA1-11
	Mounting bracket	**MSEQ501**	EQ-500
	Mounting bracket	**MSEQ31**	EQ-30
	Mounting bracket	**MSDIN4**	FX-100
	Mounting bracket	**MSDIN2**	FX-300, FX-500
	Mounting bracket	**MS-FM2-1**	FM-200
	Mounting bracket	**MSDP11**	DP-100
	Mounting bracket	**MS-DP1-6**	DPC-100, DPC-L100
	Mounting bracket	**MSDPX**	DP2
	Mountig bracket, stainless steel	**MS-CY1-1**	CY-100, CY-L100
	Mounting bracket for beam axis alignment, plastic	**MS-CY1-2**	CY-100, CY-L100

Photoelectric Sensors

Fiber Sensors

Standard Fibers

Fiber Sensor Communication Units

Mark Sensors

Laser Sensors

Safety Sensors

Pressure & Flow Sensors

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Mounting bracket

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Further Panasonic products

Panasonic Electric Works offers a wide product range from one source, from individual components to complete systems. Technology support for advice, design-in, installation and commissioning by our qualified application engineers round off the Panasonic service profile.

Laser markers

Laser markers are ideal for non-contact, permanent labelling of most materials, e.g. metal, plastics, glass, paper, wood and leather. Several CO_2 laser marking systems and the FAYb laser marking systems can be easily integrated into existing production systems for a great variety of labelling tasks.
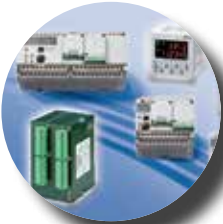
Programmable controllers

Programmable controllers from Panasonic represent "control advantages" that pay for themselves right from the start.

Servo drives

Panasonic servo drives enable high performance motion control to be applied to almost all types of machines, including chip mounting machines and general industrial machines.

UV curing system

Aicure UJ30/35 is an LED curing system that quickly hardens UV-sensitive resins such as adhesives, ink and coatings. Its cutting edge LED technology is especially suited for precise, high-intensity curing.

FA components

Components such as Eco-POWER METER, timers/counters, temperature controllers, limit switches and fans round off our wide Factory Automation product range.

Human Machine Interfaces

Our compact, bright and easy-to-read Human Machine Interfaces can be used to visualize inspection results. Touch panels can even replace the standard keypad if you so desire.

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