Ultra-compact Photoelectric Sensor Amplifier Built-in
EX-20 SERIES

Related Information
■ General terms and conditions..... P.1
■ Sensor selection guide.....P.11~ / P.229~
■ Glossary of terms / General precautions .... P.983~ / P.986~
■ Korea's S-mark..... P.1034~

Conforming to EMC Directive

UL Recognition (Excluding 5 m cable length type)

Certified (Some models only)

PNP output type available

Light intensity monitor

Miniature-sized and still mountable with M3 screws

Miniaturization by using single chip optical IC

The beam-receiving photodiode and the A/D conversion circuit have been fabricated on a single chip optical IC (full custom). Hence, in spite of its miniature size, it has a performance and reliability which is equal to or better than the conventional product.

Incorporates a sensitivity adjuster even in this size

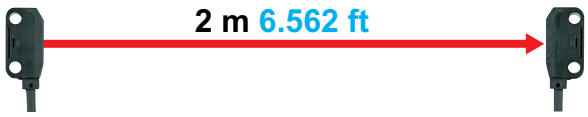
The sensor incorporates a sensitivity adjuster in spite of its miniature size. It is convenient when you need fine adjustment. Further, the receiver of the thru-beam, side sensing type sensor incorporates an operation mode switch which can change the output operation.

BASIC PERFORMANCE

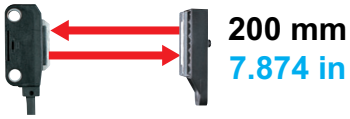
Long sensing range

The **EX-20** series achieves long distance sensing [thru-beam type: 2 m 6.562 ft, retroreflective type: 200 mm 7.874 in (when using the attached reflector), diffuse reflective type: 160 mm 6.299 in], despite its miniature size.
Hence, it is usable even on a wide conveyor.

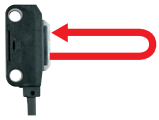
Thru-beam type



Retroreflective type

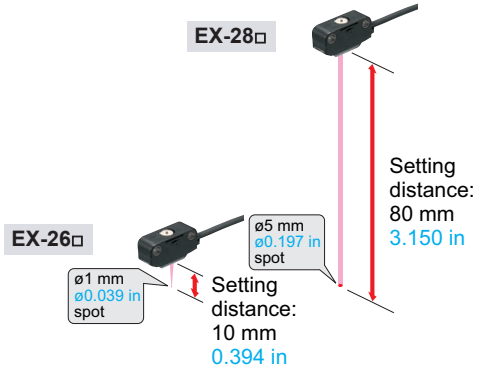


Diffuse reflective type



Clear beam spot using red LED dot light source

The emission area of a dot light source is smaller than that of a conventional LED flat light source, and it is possible to design a high power, narrow beam. Since a red LED dot light source is used, the red beam spot is clear even at a far place, so that alignment and confirmation of sensing position is easy. Further, since the thru-beam type, too, incorporates a visible narrow beam, it can also reliably detect small parts, such as, chip components, lead frames, etc.

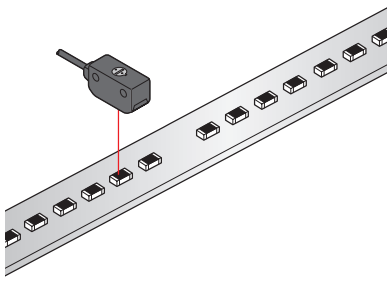


FIBER SENSORS
LASER SENSORS
PHOTOELECTRIC SENSORS
MICRO PHOTOELECTRIC SENSORS
AREA SENSORS
SAFETY COMPONENTS
PRESSURE SENSORS
INDUCTIVE PROXIMITY SENSORS
PARTICULAR USE SENSORS
SENSOR OPTIONS
WIRE-SAVING SYSTEMS
MEASUREMENT SENSORS
STATIC CONTROL DEVICES
LASER MARKERS

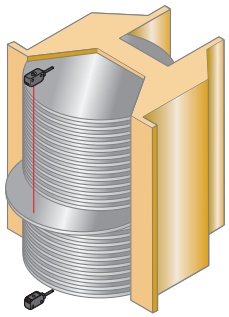
Selection Guide
Amplifier Built-in
CX-400
EX-10
EX-20
EX-30
EX-40
EQ-30
EQ-500
MQ-W
RX-LS200
RX
CY
PX-2
RT-610
Power Supply Built-in
NX5
VF
Amplifier-separated
SU-7 / SH
SS-A5 / SH
Other Products

APPLICATIONS

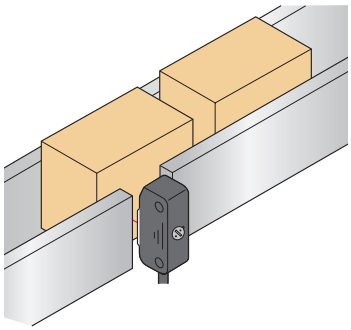
Detecting chip components



Checking protrusion of wafer



Sensing objects from an opening



ENVIRONMENTAL RESISTANCE

Waterproof IP67 (IEC)

The sensor can be hosed down because of its IP67 construction. Further, the sensor mounting bracket is also made of stainless steel.

Note: However, take care that if it is exposed to water splashes during operation, it may detect a water drop itself.

FUNCTIONS

Bright 2-color indicator

A bright 2-color indicator has been incorporated in all types.
(Orange LED: Operation indicator, Green LED: Stability indicator)

VARIETIES

Two types for suitable mounting

Two types, side sensing type and front sensing type sensors are available. Select depending on the place of mounting.

Side sensing type

(With sensitivity adjuster)

Front sensing type

(Without sensitivity adjuster)

MOUNTING

Identical size

Front sensing type of thru-beam type and diffuse reflective type sensors have identical appearance. Moreover, since the mounting holes are symmetrical with respect to the beam axis center, the design becomes easy.

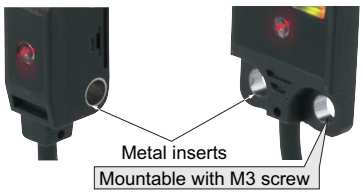
Thru-beam type

Diffuse reflective type

Mounting section reinforced

It can be tightened with M3 screws. Moreover, metal inserts have been provided in the mounting holes so that the product is not damaged even in case of excess tightening.

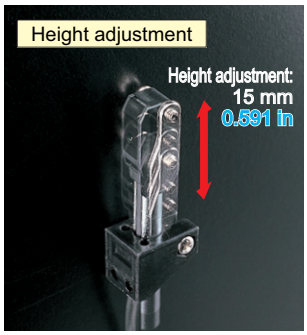
Side sensing type **Front sensing type**

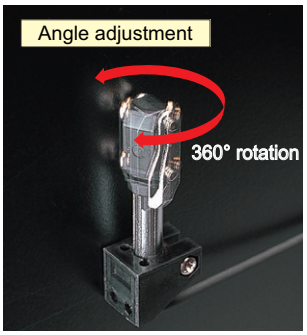


OPTIONS

Universal sensor mounting bracket is available

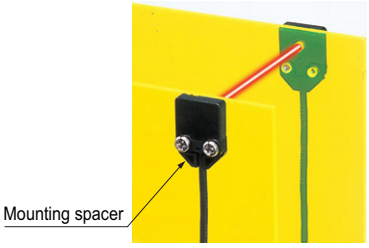
Universal sensor mounting bracket (for thru-beam side sensing type **EX-23**□ only) which can freely adjust the height and the angle of the sensor is available.





Mounting spacer for front sensing type is available

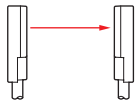
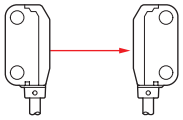
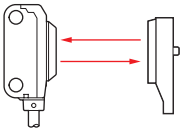
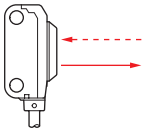
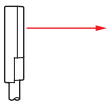
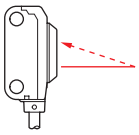
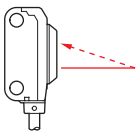
Mounting of the front sensing type is possible from the rear side by using the mounting spacer.



Slit mask is available

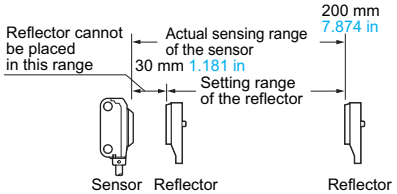
ø0.5 mm ø0.020 in round slit mask and 0.5 × 3 mm 0.020 × 0.118 in rectangular slit mask are available for both side sensing type and front sensing type sensors.

ORDER GUIDE

Type		Appearance	Sensing range	Model No. (Note 3)	Output	Output operation
Thru-beam	Front sensing		1 m 3.281 ft	**EX-21A**	NPN open-collector transistor	Light-ON
				EX-21A-PN	PNP open-collector transistor	
				EX-21B	NPN open-collector transistor	Dark-ON
				EX-21B-PN	PNP open-collector transistor	
	Side sensing		2 m 6.562 ft	**EX-23**	NPN open-collector transistor	Switchable either Light-ON or Dark-ON
				EX-23-PN	PNP open-collector transistor	
Retroreflective	Side sensing		30 to 200 mm 1.181 to 7.874 in (Note 1)	**EX-29A**	NPN open-collector transistor	Light-ON
				EX-29A-PN	PNP open-collector transistor	
				EX-29B	NPN open-collector transistor	Dark-ON
				EX-29B-PN	PNP open-collector transistor	
Diffuse reflective	Side sensing		5 to 160 mm 0.197 to 6.299 in (Note 2)	**EX-22A**	NPN open-collector transistor	Light-ON
				EX-22A-PN	PNP open-collector transistor	
				EX-22B	NPN open-collector transistor	Dark-ON
				EX-22B-PN	PNP open-collector transistor	
Convergent reflective	Diffused beam type / Front sensing		2 to 25 mm 0.079 to 0.984 in (Convergent point: 10 mm 0.394 in)	**EX-24A**	NPN open-collector transistor	Light-ON
				EX-24A-PN	PNP open-collector transistor	
				EX-24B	NPN open-collector transistor	Dark-ON
				EX-24B-PN	PNP open-collector transistor	
	Small spot beam type / Side sensing		6 to 14 mm 0.236 to 0.551 in (Convergent point: 10 mm 0.394 in)	**EX-26A**	NPN open-collector transistor	Light-ON
				EX-26A-PN	PNP open-collector transistor	
				EX-26B	NPN open-collector transistor	Dark-ON
				EX-26B-PN	PNP open-collector transistor	
Narrow-view reflective	Long distance spot beam type / Side sensing		45 to 115 mm 1.772 to 4.528 in	**EX-28A**	NPN open-collector transistor	Light-ON
				EX-28A-PN	PNP open-collector transistor	
				EX-28B	NPN open-collector transistor	Dark-ON
				EX-28B-PN	PNP open-collector transistor	

NOTE: Mounting bracket is not supplied with the sensor. Please select from the range of optional sensor mounting brackets (four types) or universal sensor mounting bracket (for **EX-23**□ only). (Refer to p.273)

Notes: 1) The sensing range of the retroreflective type sensor is specified for the **RF-200** reflector.
Further, the sensing range is the possible setting range for the reflector.
The sensor can detect an object less than 30 mm 1.181 in away.
However, if the reflector is set 100 mm 3.937 in or less away, the sensing object should be opaque.
2) In case of using this product at a sensing range of 50 mm 1.969 in or less, take care that the sensitivity adjustment range becomes extremely narrow.
3) The model No. with suffix "**P**" shown on the label affixed to the thru-beam type sensor is the emitter, "**D**" shown on the label is the receiver.
(e.g.) Emitter of **EX-21A**: **EX-21P**, Receiver of **EX-21A**: **EX-21AD**



SPECIFICATIONS

Item \ Type		Thru-beam		Retroreflective	Diffuse reflective	Convergent reflective		Narrow-view reflective
						Diffused beam type	Small spot beam type	Long distance spot beam type
		Front sensing	Side sensing	Side sensing	Side sensing	Front sensing	Side sensing	Side sensing
Model No. (Note 2)	Light-ON	**EX-21A(-PN)**	**EX-23(-PN)** (Note 3)	**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		1 m 3.281 ft	2 m 6.562 ft	30 to 200 mm 1.181 to 7.874 in (Note 4)	5 to 160 mm 0.197 to 6.299 in (Note 5) with white non-glossy paper (200 × 200 mm) (7.874 × 7.874 in)	2 to 25 mm 0.079 to 0.984 in (Conv. point: 10 mm 0.394 in) with white non-glossy paper (50 × 50 mm) (1.969 × 1.969 in)	6 to 14 mm 0.236 to 0.551 in (Conv. point: 10 mm 0.394 in) with white non-glossy paper (50 × 50 mm 1.969 × 1.969 in), spot diameter ø1 mm ø0.039 in with setting distance 10 mm 0.394 in	45 to 115 mm 1.772 to 4.528 in with white non-glossy paper (100 × 100 mm 3.937 × 3.937 in), spot diameter ø5 mm ø0.197 in with setting distance 80 mm 3.150 in
Sensing object		Min. ø2.6 mm ø0.102 in opaque object (Setting distance between emitter and receiver: 1 m 3.281 ft)	Min. ø3 mm ø0.118 in opaque object (Setting distance between emitter and receiver: 2 m 6.562 ft)	ø15 mm ø0.591 in or more opaque or translucent object (Note 4, 6)	Opaque, translucent or transparent object (Note 6)	Min. ø0.1 mm ø0.004 in copper wire (Setting distance: 10 mm 0.394 in)	Min. ø0.1 mm ø0.004 in copper wire (Setting distance: 10 mm 0.394 in)	Opaque, translucent or transparent object (Note 6) (Min. ø1 mm ø0.039 in copper wire at setting distance 80 mm 3.150 in)
Hysteresis		———			15 % or less of operation distance [50 × 50 mm 1.969 × 1.969 in (**EX-22**□: 200 × 200 mm 7.874 × 7.874 in, **EX-28**□: 100 × 100 mm 3.937 × 3.937 in) (with white non-glossy paper)]			
Repeatability (perpendicular to sensing axis)		0.05 mm 0.002 in or less		0.5 mm 0.020 in or less	0.3 mm 0.012 in or less	0.1 mm 0.004 in or less (Setting distance: 10 mm 0.394 in)	0.05 mm 0.002 in or less (Setting distance: 10 mm 0.394 in)	0.3 mm 0.012 in or less
Supply voltage		12 to 24 V DC ± 10 % Ripple P-P 10 % or less						
Current consumption		Emitter: 10 mA or less, Receiver: 15 mA or less		20 mA or less				
Output		<NPN output type> NPN open-collector transistor • Maximum sink current: 50 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1 V or less (at 50 mA sink current) 0.4 V or less (at 16 mA sink current)			<PNP output type> PNP open-collector transistor • Maximum source current: 50 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 1 V or less (at 50 mA source current) 0.4 V or less (at 16 mA source current)			
	Utilization category	DC-12 or DC-13						
	Short-circuit protection	Incorporated						
Response time		0.5 ms or less						
Operation indicator		Orange LED (lights up when the output is ON) (thru-beam type: located on the receiver)						
Stability indicator		Green LED (lights up under stable light received condition or stable dark condition), located on the receiver		Green LED (lights up under stable light received condition or stable dark condition)				
Sensitivity adjuster		———	Continuously variable adjuster, located on the emitter	Continuously variable adjuster		———	Continuously variable adjuster	
Operation mode switch		———	Located on the receiver	———				
Environmental resistance	Pollution degree	3 (Industrial environment)						
	Protection	IP67 (IEC) (Refer to p.984 for details of standards.)						
	Ambient temperature	–25 to +55 °C –13 to +131 °F (No dew condensation or icing allowed), Storage: –30 to +70 °C –22 to +158 °F						
	Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH						
	Ambient illuminance	Incandescent light: 3,000 ℓx at the light-receiving face						
	EMC	EN 60947-5-2						
	Voltage withstandability	1,000 V AC for one min. between all supply terminals connected together and enclosure						
	Insulation resistance	20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure						
	Vibration resistance	10 to 500 Hz frequency, 3 mm 0.118 in amplitude (20 G max.) in X, Y and Z directions for two hours each						
	Shock resistance	500 m/s² acceleration (50 G approx.) in X, Y and Z directions for three times each						
Emitting element		Red LED (modulated)						
	Peak emission wavelength	640 nm 0.025 mil	650 nm 0.026 mil	680 nm 0.027 mil	680 nm 0.027 mil	680 nm 0.027 mil	650 nm 0.026 mil	650 nm 0.026 mil
Material		Enclosure: Polyethylene terephthalate, Lens: Polyalylate						
Cable		0.1 mm² 3-core (thru-beam type sensor emitter: 2-core) cabtyre cable, 2 m 6.562 ft long						
Cable extension		Extension up to total 50 m 164.042 ft is possible with 0.3 mm², or more, cable (thru-beam type: both emitter and receiver).						
Weight		Net weight (each emitter and receiver): 20 g approx. Gross weight: 60 g approx.		Net weight: 20 g approx., Gross weight: 45 g approx.				
Accessories		———	Adjusting screwdriver: 1 pc.	**RF-200** (Reflector): 1 pc. Adjusting screwdriver: 1 pc.	Adjusting screwdriver: 1 pc.	———	Adjusting screwdriver: 1 pc.	

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) Model Nos. having the suffix "**-PN**" are PNP output type.
3) Either Light-ON or Dark-ON can be selected by the operation mode switch (located on the receiver).
4) The sensing range and the sensing object of the retroreflective type sensor are specified for the **RF-200** reflector. Further, the sensing range is the possible setting range for the reflector. The sensor can detect an object less than 30 mm 1.181 in away. However, if the reflector is set 100 mm 3.937 in or less away, the sensing object should be opaque.
5) In case of using this product at a sensing range of 50 mm 1.969 in or less, take care that the sensitivity adjustment range becomes extremely narrow.
6) Make sure to confirm detection with an actual sensor before use.