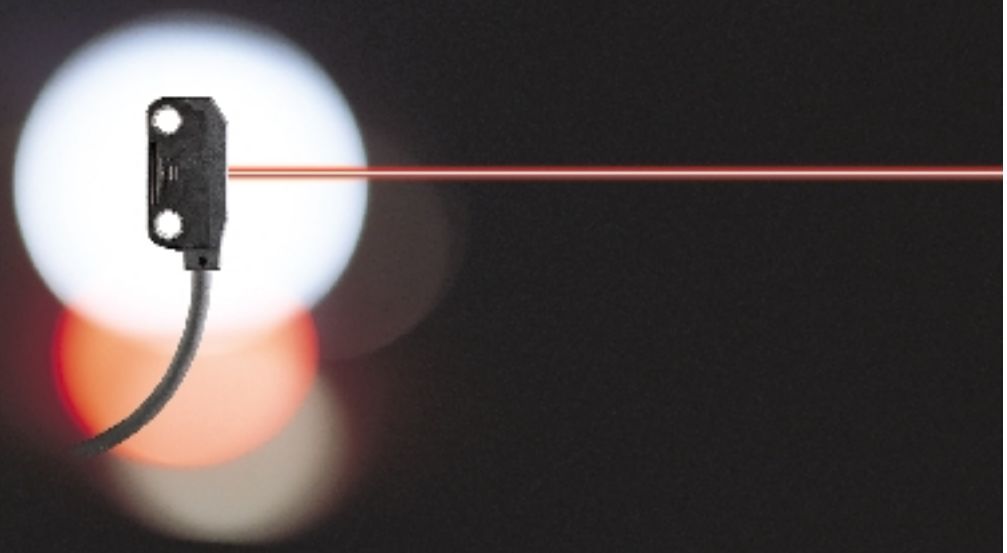
SUNX

ULTRA-COMPACT PHOTOELECTRIC SENSOR

EX-20 SERIES

Mountable with M3 screws!



Isn't this what you wanted?

Conforming to EMC Directive

UL Recognition

Downloaded from Arrow.com.

The Solution to Your Requirements!

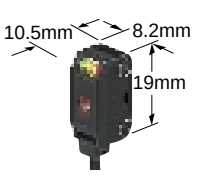
Ultra-compact Photoelectric Sensor

EX-20 SERIES

Requirement 1 The sensor should be smaller.

Solution 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.



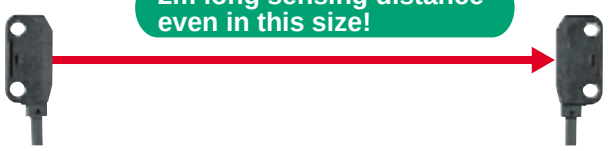
Requirement 2 Even though the sensor is small, it should have enough sensing range.

Solution Long sensing range realized!

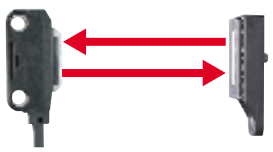
The **EX-20** series achieves long distance sensing [thru-beam type: 2m, retroreflective type: 200mm (when using the attached reflector), diffuse reflective type: 160mm], despite its miniature size.
Hence, it is usable even on a wide conveyor.

Thru-beam type

2m long sensing distance even in this size!

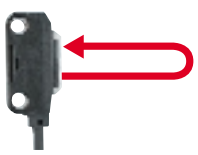


Retroreflective type



200mm long sensing distance even in this size!

Diffuse reflective type



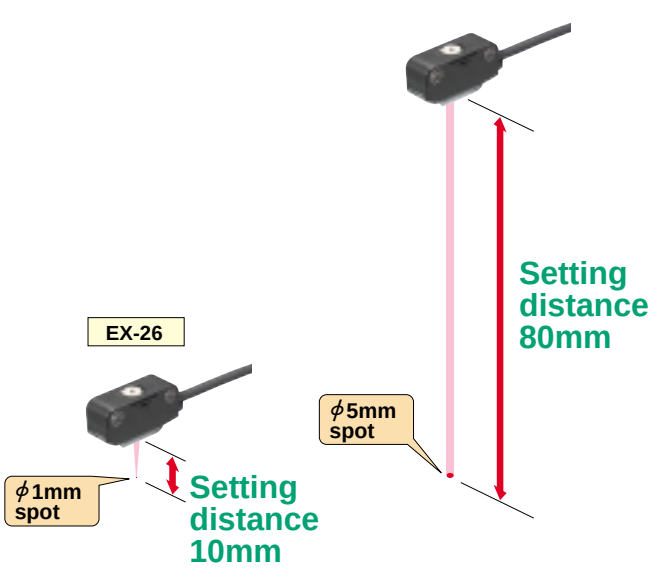
160mm long sensing distance even in this size!

Requirement 3 The beam spot should be clearly visible.

Solution Clear beam spot by using a 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.

EX-28



Requirement 4 Sensitivity should be adjustable, even though the sensor is small.

Solution 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.

Downloaded from Arrow.com.

Ease of Use Pursued by Designing from the User's Viewpoint!

2 types for suitable mounting

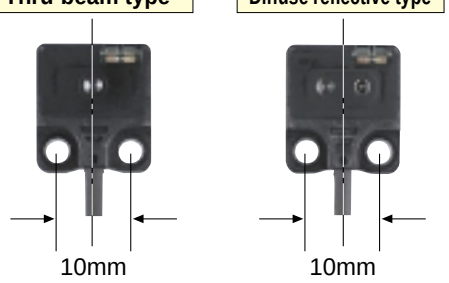
Two types, side sensing type and front sensing type are available. Select depending on the place of mounting.

Side sensing type **Front sensing type**

Identical size

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

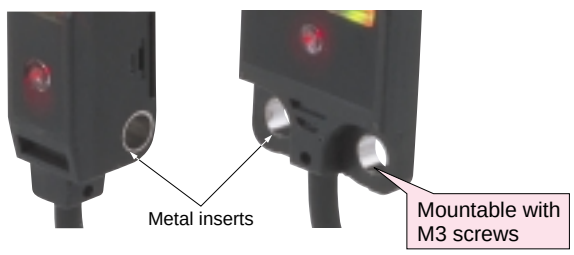
Thru-beam type **Diffuse reflective type**



Mounting section reinforced

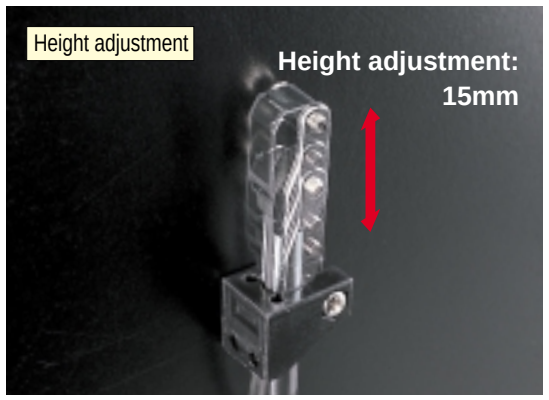
It can be tightened with M3 screws. Moreover, metal inserts have been provided in the mounting holes so that the product is not damaged even in case of excess tightening.

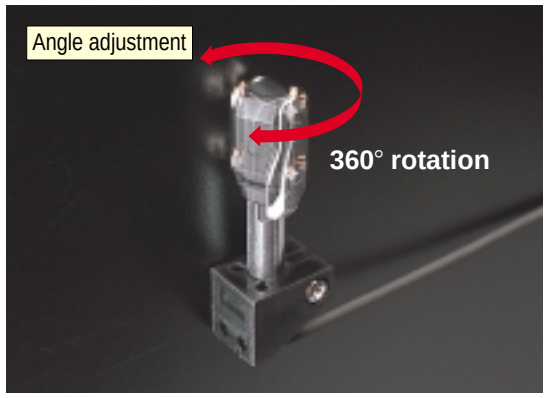
Side sensing type **Front sensing type**



Universal sensor mounting bracket is available

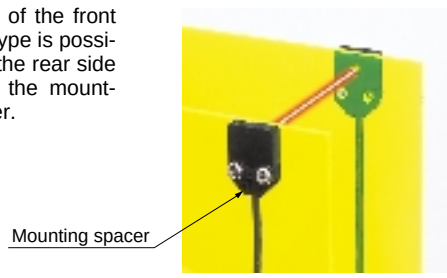
Universal sensor mounting bracket (for thru-beam side sensing type **EX-23**□ only) which can freely adjust the height and the angle of the sensor is available.





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.



Globally Usable!

PNP output type which is much in demand in Europe is now available. Of course, it conforms to the EMC directive.

Bright Two-color Indicator

Bright two-color indicator has been incorporated in all types.

Waterproof IP67

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

Slit Mask Is Available

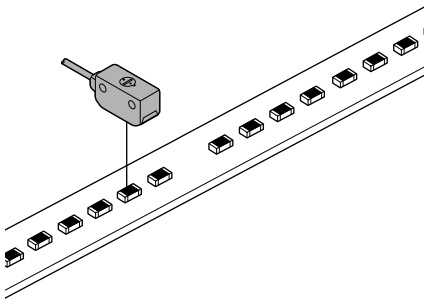
ϕ0.5mm round slit mask and 0.5 × 3mm rectangular slit mask are available for both side sensing type and front sensing type.

Downloaded from Arrow.com.

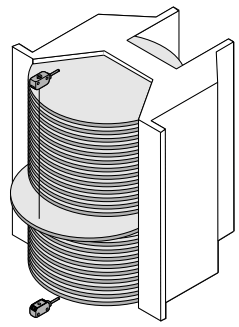
EX-20

APPLICATIONS

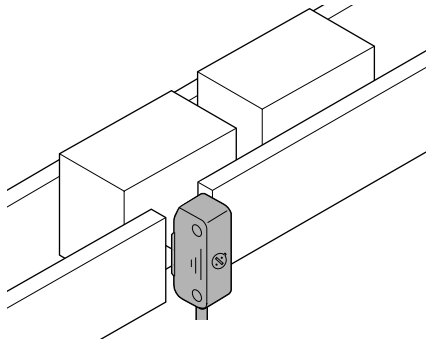
Detecting chip components



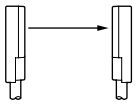
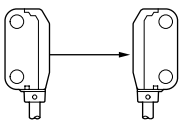
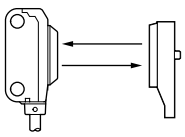
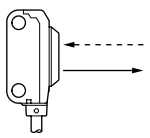
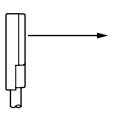
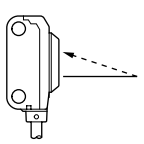
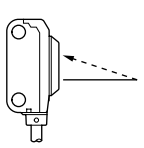
Checking protrusion of wafer



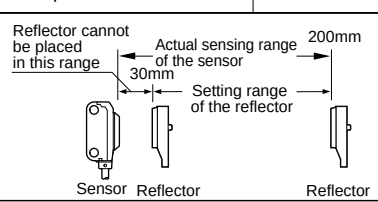
Sensing objects from an opening



ORDER GUIDE

Type		Appearance	Sensing range	Model No.	Output	Output operation
Thru-beam	Front sensing		1m	**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		2m	**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 200mm (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 160mm (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 light type		2 to 25mm (Convergent point: 10mm)	**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 light type		6 to 14mm (Convergent point: 10mm)	**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 light type		45 to 115mm	**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	

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 30mm away. However, if the reflector is set 100mm or less away, the sensing object should be opaque.
2) In case of using this product at a sensing range of 50mm or less, take care that the sensitivity adjustment range becomes extremely narrow.



Downloaded from Arrow.com.

EX-20

ORDER GUIDE

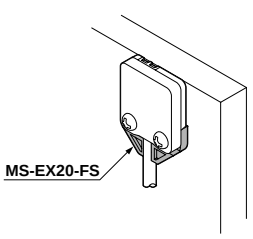
Package without reflector

EX-29□ is also available without the reflector **RF-200** when ordering this type, add suffix '**-Y**' at the end of the model No.
EX.: **EX-29**□**-Y** is **EX-29**□ without the reflector.

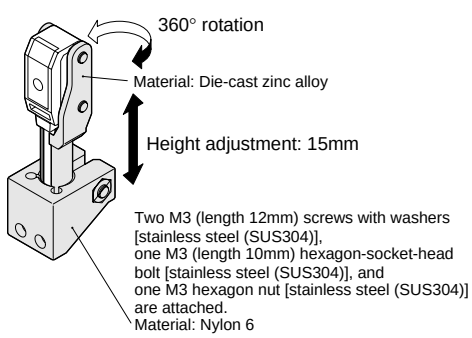
OPTIONS

Designation		Model No.	Description	
Round slit mask (For thru-beam type sensor only)	For front sensing type	**OS-EX20-05** (Slit size ϕ0.5mm)	Slit on one side	• Sensing range: 200mm • Min. sensing object: ϕ2.6mm
			Slit on both sides	• Sensing range: 40mm • Min. sensing object: ϕ0.5mm
	For side sensing type	**OS-EX20E-05** (Slit size ϕ0.5mm)	Slit on one side	• Sensing range: 350mm • Min. sensing object: ϕ3mm
			Slit on both sides	• Sensing range: 70mm • Min. sensing object: ϕ0.5mm
Rectangular slit mask (For thru-beam type sensor only)	For front sensing type	**OS-EX20-05×3** (Slit size 0.5×3mm)	Slit on one side	• Sensing range: 600mm • Min. sensing object: ϕ2.6mm
			Slit on both sides	• Sensing range: 300mm • Min. sensing object: 0.5×3mm
	For side sensing type	**OS-EX20E-05×3** (Slit size 0.5×3mm)	Slit on one side	• Sensing range: 800mm • Min. sensing object: ϕ3mm
			Slit on both sides	• Sensing range: 400mm • Min. sensing object: 0.5×3mm
Reflector (For retroreflective type sensor only)		**RF-210**	• Sensing range: 50 to 400mm • Min. sensing object: ϕ30mm	
Reflector mounting bracket		**MS-RF21-1**	Protective mounting bracket for **RF-210** Protects the reflector from damage and maintains alignment.	
Reflective tape (For retroreflective type sensor only)		**RF-11**	• Ambient temperature: −25 to +50°C • Ambient humidity: 35 to 85% RH Notes: i) Keep the tape free from stress. If it is pressed too much, its capability may deteriorate. ii) Do not cut the tape. It will deteriorate the sensing performance.	• Sensing range: 70 to 200mm
		RF-12		• Sensing range: 60 to 280mm
Sensor mounting bracket		**MS-EX20-1**	Back angled mounting bracket for front sensing type (The thru-beam type sensor needs two brackets.)	
		MS-EX20-2	Foot angled mounting bracket for side sensing type (The thru-beam type sensor needs two brackets.)	
		MS-EX20-3	L-shaped mounting bracket for front sensing type (The thru-beam type sensor needs two brackets.)	
		MS-EX20-4	Back angled mounting bracket for side sensing type (The thru-beam type sensor needs two brackets.)	
Universal sensor mounting bracket [For **EX-23**(**-PN**) only]		**MS-EX20-5**	It can adjust the height and the angle of the sensor. (Two brackets are needed.)	
Mounting spacer (For front sensing type only)		**MS-EX20-FS**	It is used when mounting the front sensing type from the rear side. (One set consists of 10 Nos.)	

Mounting spacer
• **MS-EX20-FS**

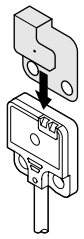


Universal sensor mounting bracket
• **MS-EX20-5**

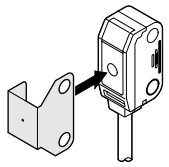


Round slit mask
Fitted on the front face of the sensor with one-touch.

• **OS-EX20-05**

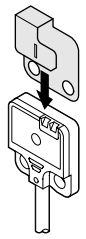


• **OS-EX20E-05**

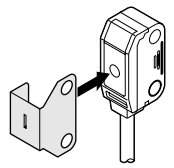


Rectangular slit mask
Fitted on the front face of the sensor with one-touch.

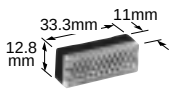
• **OS-EX20-05×3**



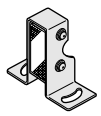
• **OS-EX20E-05×3**



Reflector
• **RF-210**

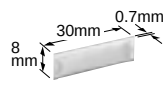


Reflector mounting bracket
• **MS-RF-21-1**

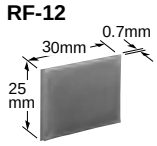


Two M3 (length 12mm) screws with washers are attached.

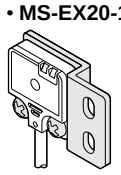
Reflective tape
• **RF-11**



• **RF-12**

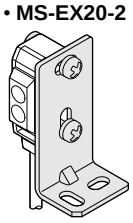


Sensor mounting bracket
• **MS-EX20-1**



Material: Stainless steel (SUS304)
Two M3 (length 5mm) pan head screws [stainless steel (SUS304)] are attached.

• **MS-EX20-2**

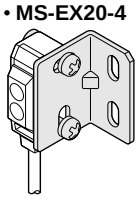


Material: Stainless steel (SUS304)
Two M3 (length 14mm) screws with washers [stainless steel (SUS304)] are attached.

• **MS-EX20-3**

Material: Stainless steel (SUS304)
Two M3 (length 5mm) pan head screws [stainless steel (SUS304)] are attached.

• **MS-EX20-4**



Material: Stainless steel (SUS304)
Two M3 (length 14mm) screws with washers [stainless steel (SUS304)] are attached.

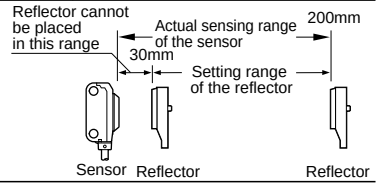
Downloaded from Arrow.com.

EX-20

SPECIFICATIONS

Item \ Type		Thru-beam		Retroreflective	Diffuse reflective	Convergent reflective		Narrow-view reflective
						Diffused light type	Small spot light type	Long distance spot light type
		Front sensing	Side sensing	Side sensing	Side sensing	Front sensing	Side sensing	Side sensing
Model No.	Light-ON	**EX-21A(-PN)**	**EX-23(-PN)** (Note 1)	**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 (Note 2)	5 to 160mm (Note 3) (with 200×200mm white non-glossy paper	2 to 25mm (Conv. point: 10mm) (with 50×50mm white non-glossy paper)	6 to 14mm (Conv. point: 10mm) (with 50×50mm white non-glossy paper, spot diameter φ1mm at setting distance 10mm)	45 to 115mm (with 100×100mm white non-glossy paper, spot diameter φ5mm at setting distance 80mm)
Sensing object		Min. φ2.6mm opaque object (Setting distance between emitter and receiver: 1m)	Min. φ3mm opaque object (Setting distance between emitter and receiver: 2m)	φ15mm or more opaque or translucent object (Note 2)	Opaque, translucent or transparent object	Min. φ0.1mm copper wire (Setting distance: 10mm)	Min. φ0.1mm copper wire (Setting distance: 10mm)	Opaque, translucent or transparent object (Min. φ1mm copper wire at setting distance 80mm)
Hysteresis		———			15% or less of operation distance			
Repeatability (Perpendicular to sensing axis)		0.05mm or less		0.5mm or less	0.3mm or less	0.1mm or less (Setting distance: 10mm)	0.05mm or less (Setting distance: 10mm)	0.3mm or less
Supply voltage		12 to 24V DC ± 10% Ripple P-P 10% or less						
Current consumption		Emitter: 10mA or less, Receiver: 15mA or less		20mA or less				
Output		〈NPN output type〉 NPN open-collector transistor • Maximum sink current: 50mA • Applied voltage: 30V DC or less (between output and 0V) • Residual voltage: 1V or less (at 50mA sink current) 0.4V or less (at 16mA sink current)			〈PNP output type〉 PNP open-collector transistor • Maximum source current: 50mA • Applied voltage: 30V DC or less (between output and +V) • Residual voltage: 1V or less (at 50mA source current) 0.4V or less (at 16mA source current)			
	Utilization category	DC-12 or DC-13						
	Short-circuit protection	Incorporated						
Response time		0.5ms 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)						
	Ambient temperature	−25 to +55°C (No dew condensation or icing allowed), Storage: −30 to +70°C						
	Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH						
	Ambient illuminance	Sunlight: 10,000ℓx at the light-receiving face, Incandescent light: 3,000ℓx at the light-receiving face						
	EMC	Emission: EN50081-2, Immunity: EN50082-2						
	Voltage withstandability	1,000V AC for one min. between all supply terminals connected together and enclosure						
	Insulation resistance	20MΩ or more with 250V DC megger between all supply terminals connected together and enclosure						
	Vibration resistance	10 to 500Hz frequency, 3mm amplitude (20G max.) in X, Y and Z directions for two hours each						
	Shock resistance	500m/s² acceleration (50G approx.) in X, Y and Z directions for three times each						
Emitting element		Red LED (modulated)						
Material		Enclosure: Polyethylene terephthalate, Lens: Polyalylate						
Cable		0.1mm² 3-core (thru-beam type sensor emitter: 2-core) cabtyre cable, 2m long						
Cable extension		Extension up to total 50m is possible with 0.3mm², or more, cable (thru-beam type: both emitter and receiver).						
Weight		Emitter: 20g approx., Receiver: 20g approx.		20g approx.				
Accessories		———	Adjusting screwdriver: 1 No.	**RF-200** (Reflector): 1 No. Adjusting screwdriver: 1 No.	Adjusting screwdriver: 1 No.	———	Adjusting screwdriver: 1 No.	

Notes: 1) Either Light-ON or Dark-ON can be selected by the operation mode switch (located on the receiver).
2) The sensing range and the sensing object 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 30mm away. However, if the reflector is set 100mm or less away, the sensing object should be opaque.
3) In case of using this product at a sensing range of 50mm or less, take care that the sensitivity adjustment range becomes extremely narrow.



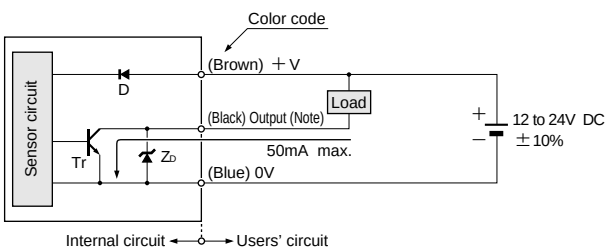
Downloaded from Arrow.com.

EX-20

I/O CIRCUIT AND WIRING DIAGRAMS

NPN output type

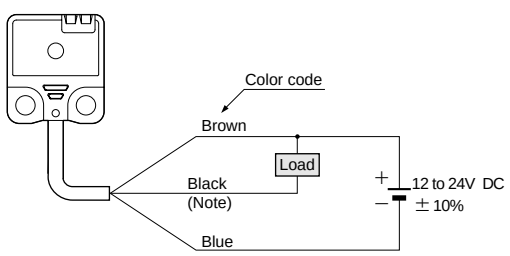
I/O circuit diagram



Note: The thru-beam type sensor emitter does not incorporate the output.

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

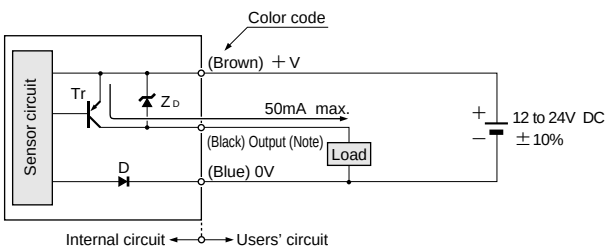
Wiring diagram



Note: The thru-beam type sensor emitter does not incorporate the black wire.

PNP output type

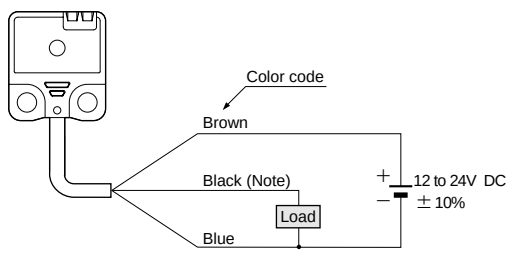
I/O circuit diagram



Note: The thru-beam type sensor emitter does not incorporate the output.

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

Wiring diagram

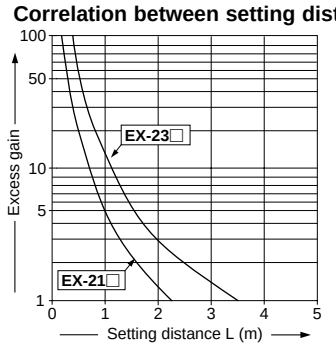


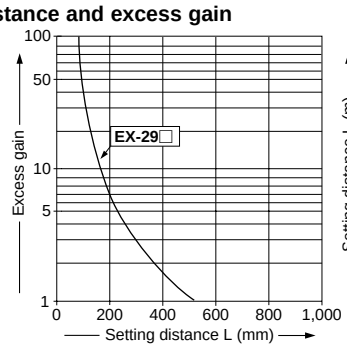
Note: The thru-beam type sensor emitter does not incorporate the black wire.

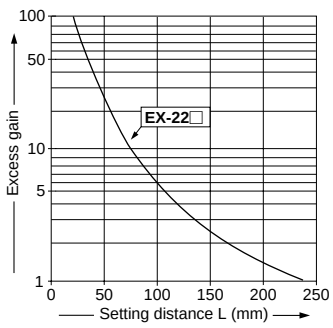
SENSING CHARACTERISTICS (TYPICAL)

EX-21□ EX-23□ EX-29□ EX-22□

Correlation between setting distance and excess gain

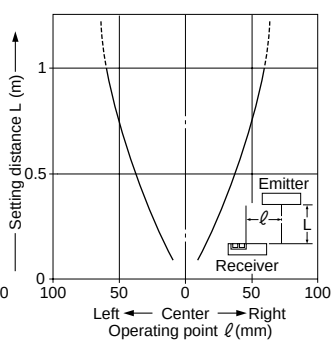




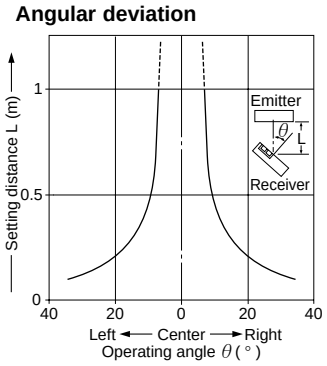


EX-21□ Thru-beam type

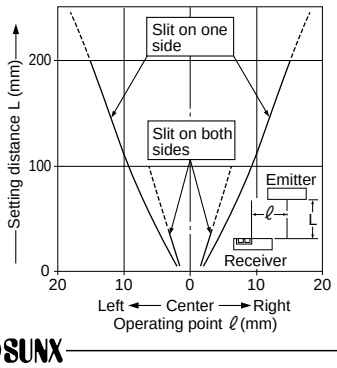
Parallel deviation



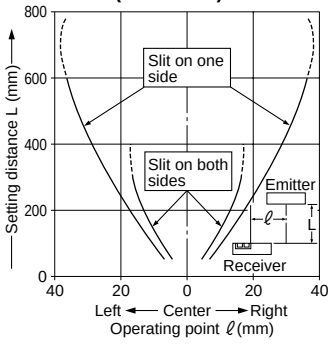
Angular deviation



Parallel deviation with round slit masks (ϕ0.5mm)



Parallel deviation with rectangular slit masks (0.5 × 3mm)



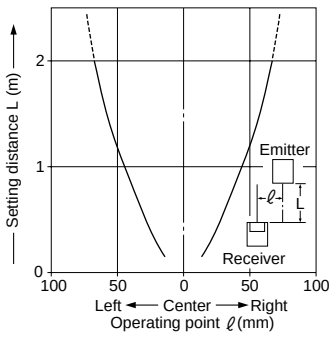
Downloaded from Arrow.com.

EX-20

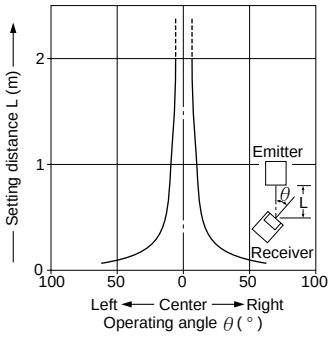
SENSING CHARACTERISTICS (TYPICAL)

EX-23□ Thru-beam type

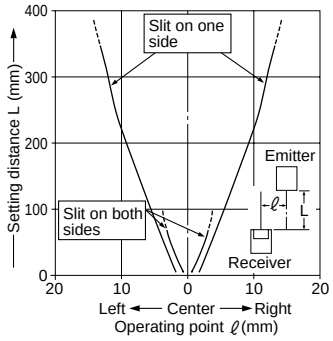
Parallel deviation



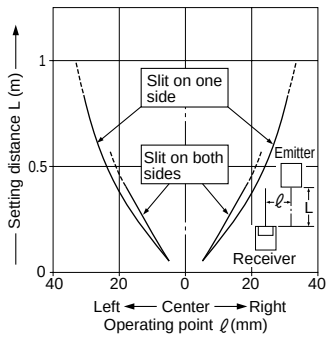
Angular deviation



Parallel deviation with round slit masks (ϕ0.5mm)

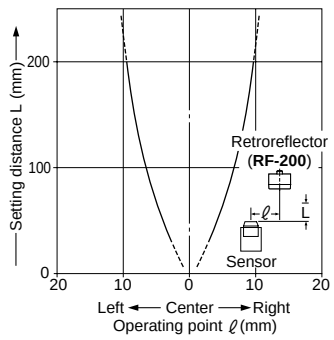


Parallel deviation with rectangular slit masks (0.5 × 3mm)

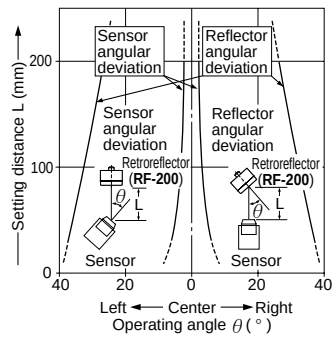


EX-29□ Retroreflective type

Parallel deviation

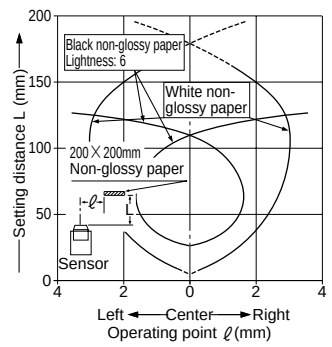


Angular deviation

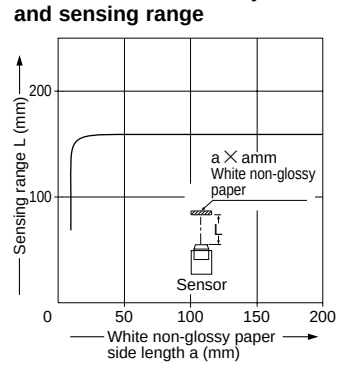


EX-22□ Diffuse reflective type

Sensing field



Correlation between object size and sensing range

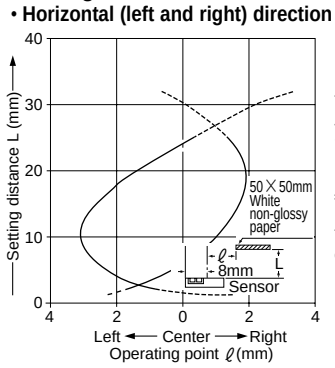


As the object size becomes smaller than the standard size (white non-glossy paper 200 × 200mm), the sensing range shortens, as shown in the left graph.

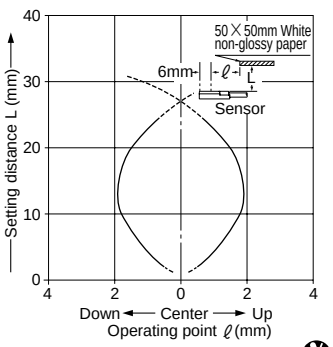
EX-24□ Convergent reflective type

Sensing field

• Horizontal (left and right) direction



• Vertical (up and down) direction



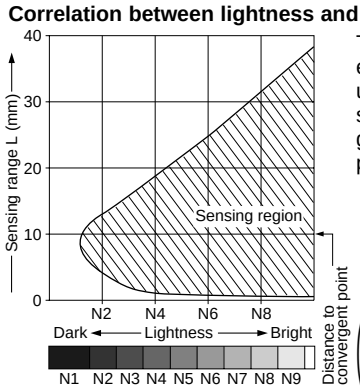
Downloaded from Arrow.com.

EX-20

SENSING CHARACTERISTICS (TYPICAL)

EX-24□ Convergent reflective type

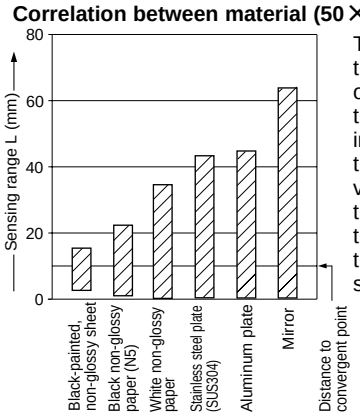
Correlation between lightness and sensing range



The sensing region is represented by oblique lines in the left figure. However, the sensitivity should be set with enough margin because of slight variation in products.

(Lightness shown on the left may differ slightly from the actual object condition.)

Correlation between material (50 × 50mm) and sensing range

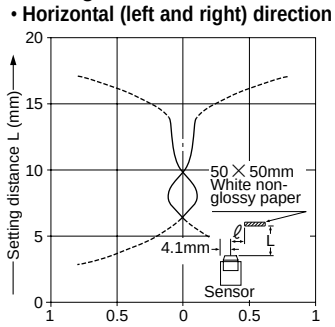


The bars on the graph indicate the sensing range with each object. However, there is a variation in the sensing range depending on the product. Further, if there is a reflective object (conveyor, etc.) in the background of the sensing object, since it affects the sensing, separate it by more than twice the sensing range shown in the left graph.

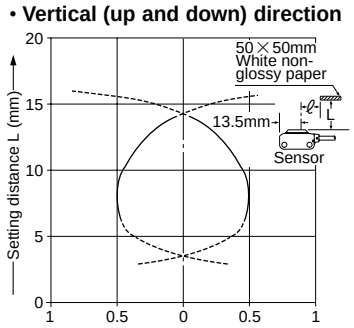
EX-26□ Convergent reflective type

Sensing field

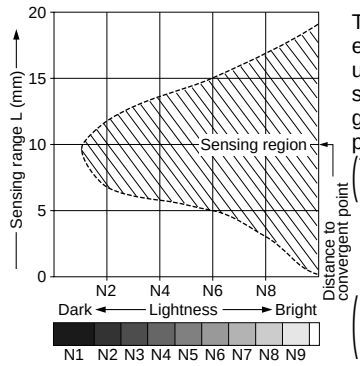
• Horizontal (left and right) direction



• Vertical (up and down) direction



Correlation between lightness and sensing range

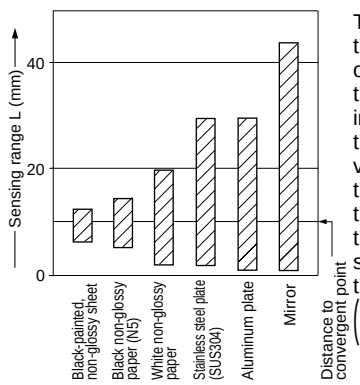


The sensing region is represented by oblique lines in the left figure. However, the sensitivity should be set with enough margin because of slight variation in products.

(The graph is drawn for the maximum sensitivity setting.)

(Lightness shown on the left may differ slightly from the actual object condition.)

Correlation between material (50 × 50mm) and sensing range

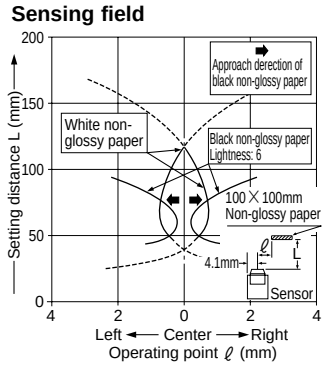


The bars on the graph indicate the sensing range with each object. However, there is a variation in the sensing range depending on the product. Further, if there is a reflective object (conveyor, etc.) in the background of the sensing object, since it affects the sensing, separate it by more than twice the sensing range shown in the left graph, or adjust the sensitivity adjuster.

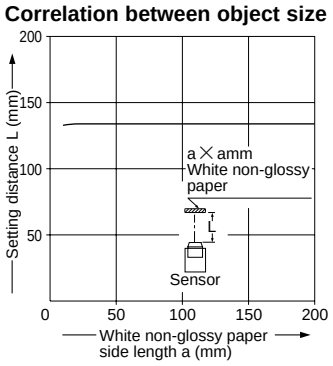
(The graph is drawn for the maximum sensitivity setting.)

EX-28□ Narrow-view reflective type

Sensing field



Correlation between object size and sensing range



As the object size becomes smaller than the standard size (white non-glossy paper 100 × 100mm), the sensing range shortens, as shown in the left graph.

Downloaded from Arrow.com.

EX-20

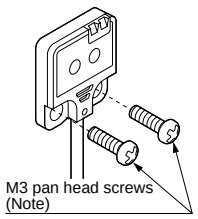
PRECAUTIONS FOR PROPER USE

This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

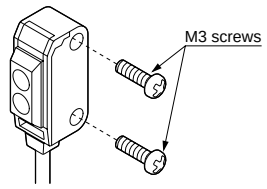
Mounting

• Mount using M3 screws. The tightening torque should be 0.5N·m or less.

Front sensing



Side sensing



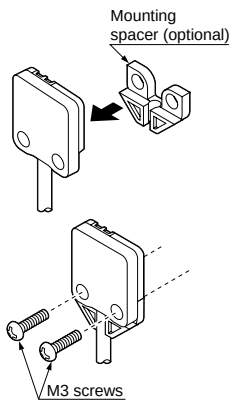
Note: When mounting the front sensing type sensor, use M3 pan head screws without washers, etc.

• When mounting the front sensing type from the backside, fit the mounting spacer **MS-EX20-FS** and fix with screws.

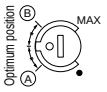
Mounting method

①Fit the mounting spacer on the sensor.

②Align the mounting holes of the mounting spacer and the sensor and mount with M3 screws. The tightening torque should be 0.5N·m or less.



Sensitivity adjustment (Side sensing type only)

Step	Sensitivity adjuster	Description
①		Turn the sensitivity adjuster fully counterclockwise to the minimum sensitivity position (• mark).
②		In the light received condition, turn the sensitivity adjuster slowly clockwise and confirm the point Ⓐ where the sensor enters the 'Light' state operation.
③		In the dark condition, turn the sensitivity adjuster further clockwise until the sensor enters the 'Light' state operation and then bring it back to confirm point Ⓑ where the sensor just returns to the 'Dark' state operation. (If the sensor does not enter the 'Light' state operation even when the sensitivity adjuster is turned fully clockwise, this extreme position is point Ⓑ.)
④		The position at the middle of points Ⓐ and Ⓑ is the optimum sensing position.

Notes: 1) Use the accessory adjusting screwdriver to turn the adjuster slowly. Turning with excessive strength will damage the adjuster.
2) In case of using **EX-22**□ at a sensing distance of 50mm or less, take care that the sensitivity adjustment range becomes extremely narrow.

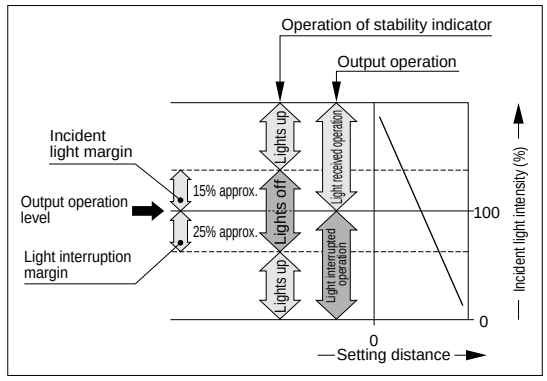
Operation mode switch (EX-23□ only)

Switch position	Description
	Light-ON mode is obtained when the operation mode switch (located on the receiver) is turned fully clockwise (L side).
	Dark-ON mode is obtained when the operation mode switch (located on the receiver) is turned fully counterclockwise (D side).

Note: Operation mode switch should be turned fully till it stops.

Stability indicator

• The stability indicator (green) lights up when the incident signal light intensity has sufficient margin with respect to the operation level.
If the incident light intensity level is such that the stability indicator lights up, stable sensing can be done without the light received operation and the light interrupted operation being affected by a change in ambient temperature or supply voltage.



Wiring

• Make sure to carry out the wiring in the power supply off condition.
• Verify that the supply voltage variation is within the rating.
• If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
• In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this sensor, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
• Do not run the wires together with high voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.

Others

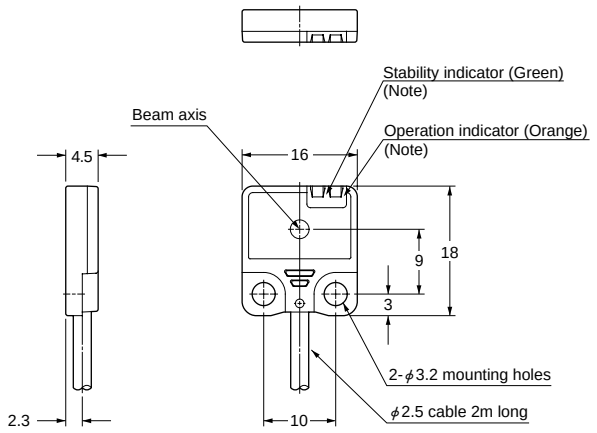
• Do not use during the initial transient time (50ms) after the power supply is switched on.
• Avoid dust, dirt, and steam.
• Take care that the sensor does not come in direct contact with water, oil, grease, or organic solvents, such as, thinner, etc.
• Take care that the sensor is not directly exposed to fluorescent light from a rapid-starter lamp or a high frequency lighting device, as it may affect the sensing performance.
• If sensors are mounted close together and the ambient temperature is near the maximum rated value, provide for enough heat radiation/ventilation.

Downloaded from Arrow.com.

EX-20

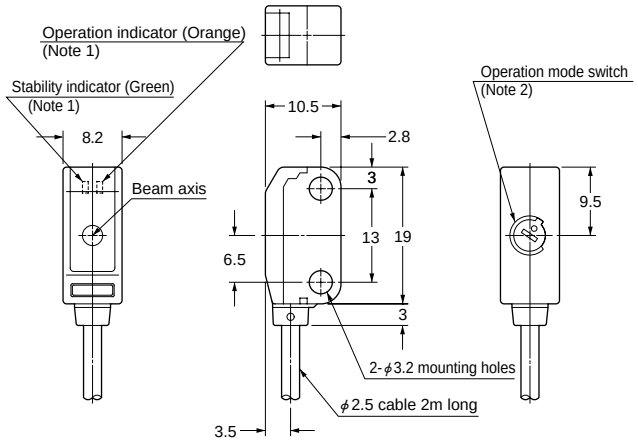
DIMENSIONS (Unit: mm)

EX-21□ Sensor



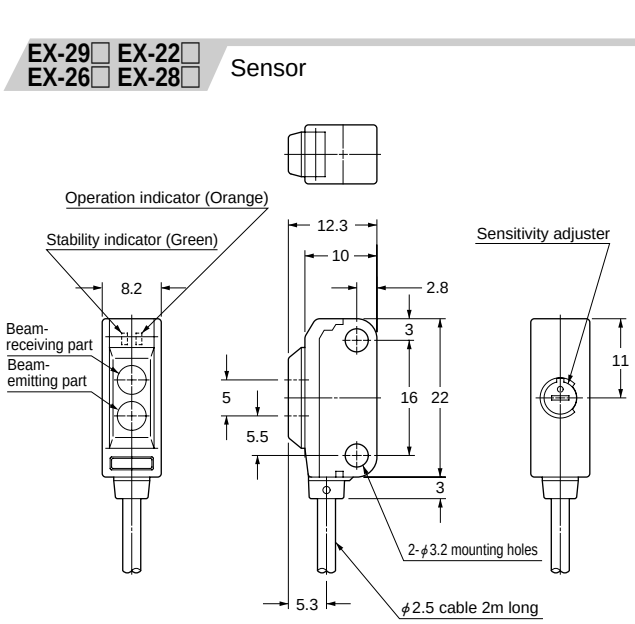
Note: Not incorporated on the emitter.

EX-23□ Sensor

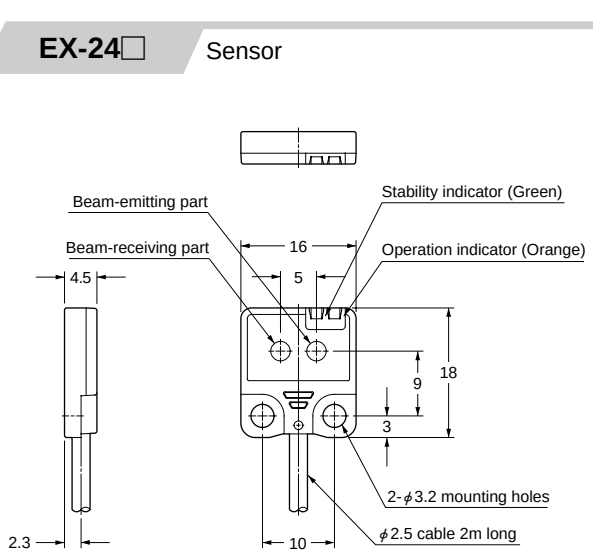


Note: 1) Not incorporated on the emitter.
2) It is the sensitivity adjuster on the emitter.

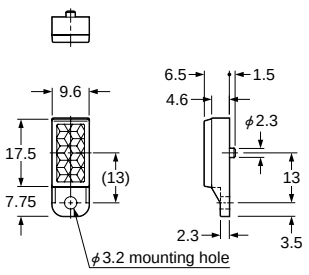
EX-29□ EX-22□ EX-26□ EX-28□ Sensor



EX-24□ Sensor

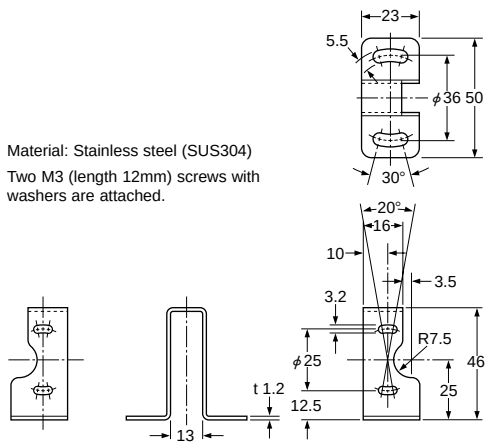


RF-200 Reflector (Accessory for the retroreflective type sensor)



Material: Acrylic (Reflector)
ABS (Base)

MS-RF21-1 Reflector mounting bracket for **RF-210** (Optional)

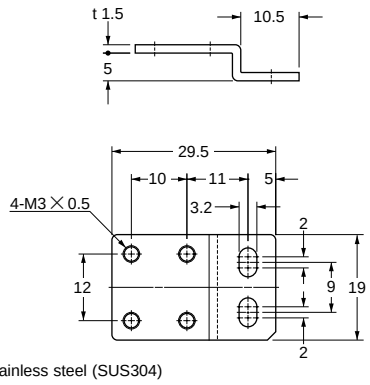


Material: Stainless steel (SUS304)
Two M3 (length 12mm) screws with washers are attached.

Downloaded from Arrow.com.

EX-20 SERIES ULTRA-COMPACT PHOTOELECTRIC SENSOR

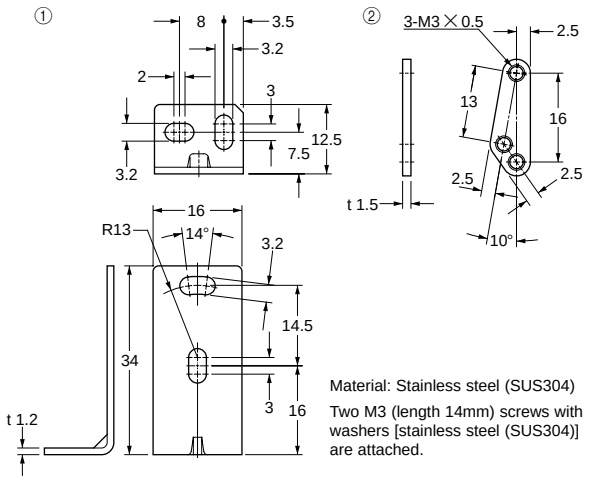
MS-EX20-1 Sensor mounting bracket (Optional)



Material: Stainless steel (SUS304)

Two M3 (length 5mm) pan head screws [stainless steel (SUS304)] are attached.

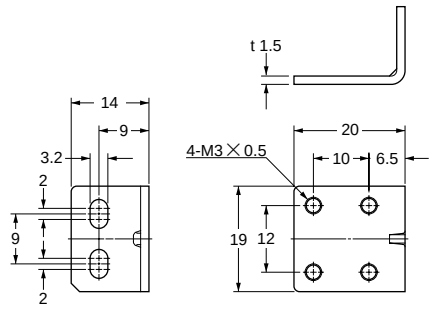
MS-EX20-2 Sensor mounting bracket (Optional)



Material: Stainless steel (SUS304)

Two M3 (length 14mm) screws with washers [stainless steel (SUS304)] are attached.

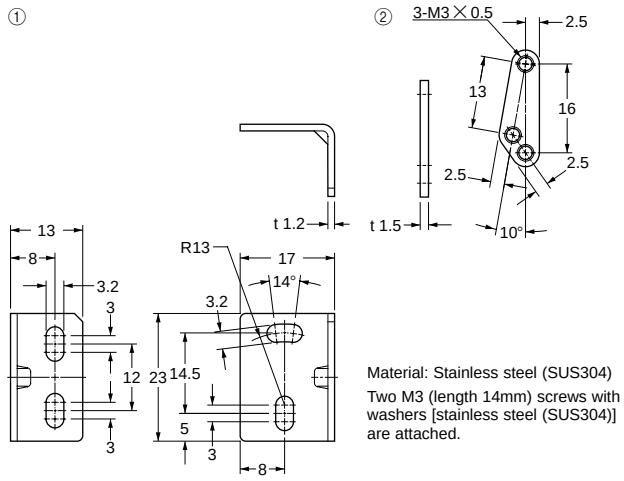
MS-EX20-3 Sensor mounting bracket (Optional)



Material: Stainless steel (SUS304)

Two M3 (length 5mm) pan head screws [stainless steel (SUS304)] are attached.

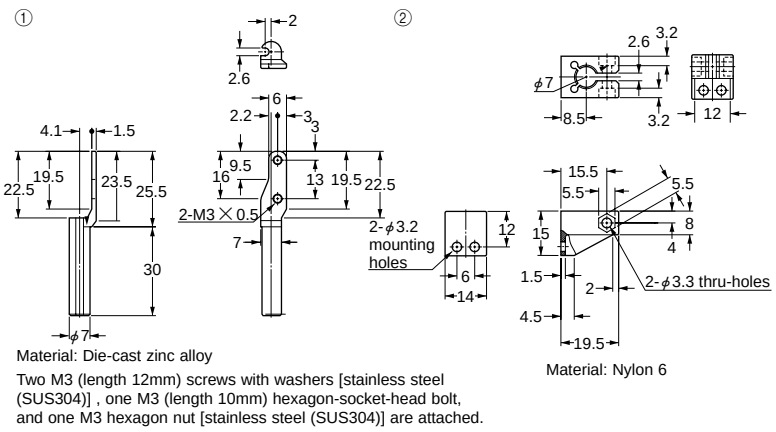
MS-EX20-4 Sensor mounting bracket (Optional)



Material: Stainless steel (SUS304)

Two M3 (length 14mm) screws with washers [stainless steel (SUS304)] are attached.

MS-EX20-5 Universal sensor mounting bracket (Optional)



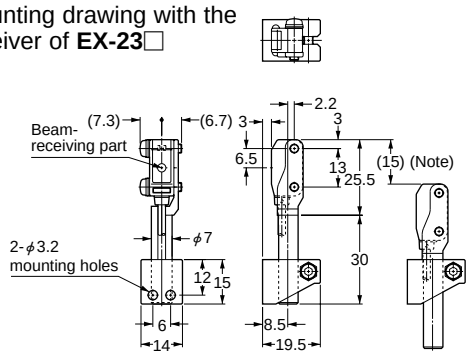
Material: Die-cast zinc alloy

Two M3 (length 12mm) screws with washers [stainless steel (SUS304)] , one M3 (length 10mm) hexagon-socket-head bolt, and one M3 hexagon nut [stainless steel (SUS304)] are attached.

Material: Nylon 6

Assembly dimensions

Mounting drawing with the receiver of **EX-23**□



Note: This is the adjustable range of the movable part.

Pioneer in Sensor Systems

SUNX

All information is subject to change without prior notice.

SUNX Limited

2431-1 Ushiyama-cho, Kasugai-shi,
Aichi, 486-0901, Japan
Phone: +81-(0)568-33-7211
FAX: +81-(0)568-33-2631

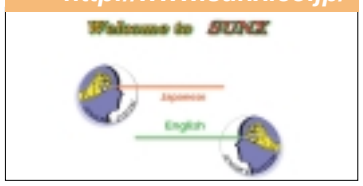
Overseas Sales Dept.

Phone: +81-(0)568-33-7861
FAX: +81-(0)568-33-8591

Printed on 100% recycled paper

PRINTED IN JAPAN

Internet home page
http://www.sunx.co.jp/



No. CE-EX20-A-3 November, 2000

Downloaded from Arrow.com.