IDEC

Miniature Photoelectric Sensors
(Built-In Amplifier)
SA2E-EX (Intrinsically Safe, Explosion-Proof)
Sensor Barriers
EB3S (Intrinsically Safe, Explosion-Proof)



Explosion-proof photoelectric sensors

Intrinsically safe design, suitable for use in environments with dust and gas hazards

IDEC CORPORATION

An Intrinsically Safe Compact Sensor with Environmental Resilience

Installing sensors in hazardous areas poses several challenges: limited space, the ambient environment, and strict safety compliance requirements.

The SA2E-EX series of miniature photoelectric sensors has been certified for use in Zone 0 (Class 1, Division 1). Their compact size facilitates simple installation in tight spaces. A wide operating temperature range (–30 to +50°C) helps keep the sensors accurate and reliable in harsh environments.

The SA2E-EX lineup adds global certification for explosion protection, and can be paired with the EB3S sensor barrier for added peace of mind.

Compact for use in tight spaces



Global EX certification, safe operation in hazardous environments



Explosion Protection Performance

Explosion protection	Global certification
Ex ia IIB T4 Ga	Certification number IECEx (International) :IECEx CML 24.0007 ATEX (Europe) :CML 24ATEX2012 FM (U.S.A.) :FM24US0235X JPEx (JAPAN) :CML 24JPN2074 Ex-CCC (China) :2024012315701270 TS (Taiwan) :TD04010Z
Hazardous location	
Gas/steam: Zone 0, 1, 2	

Applicable Areas

Part No.	SA2E	SA2E-EX
Explosion-proof area	No	Yes (*1)

*1: Be sure to connect the EB3S sensor barrier in explosion-proof areas.

Demonstrates reliable functionality in tough conditions

Wide operating temperature range

All versions have an ambient operating temperature range of -30 to +55°C.
They remain highly functional under tough conditions, such as in cold storage warehouses.



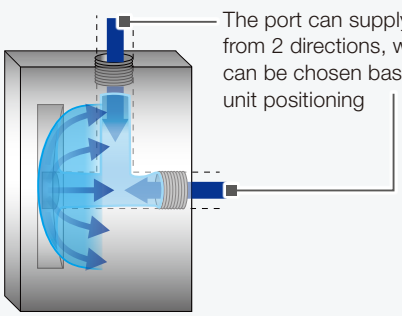
Air purge unit for stable detection in dusty environments

An air purge unit is available as an option. It supports the sensor in maintaining detection performance in dusty environments, and helps to keep the detection surface clean.



SA9Z-A02

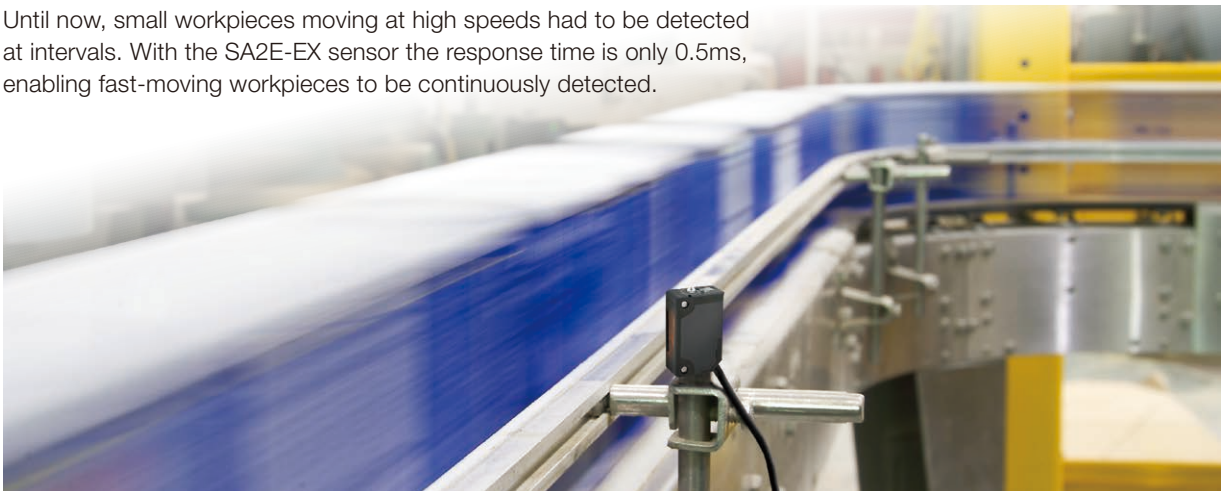
Designed to blow air over the entire lens at the optimum pressure



• SA2E-EX is not certified for dust explosion protection.

0.5ms response time, continuous detection of fast-moving objects

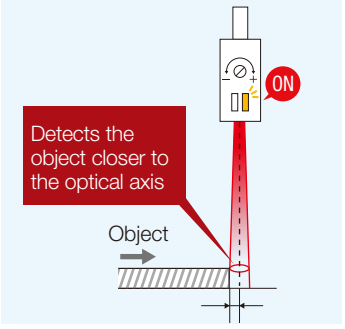
Until now, small workpieces moving at high speeds had to be detected at intervals. With the SA2E-EX sensor the response time is only 0.5ms, enabling fast-moving workpieces to be continuously detected.



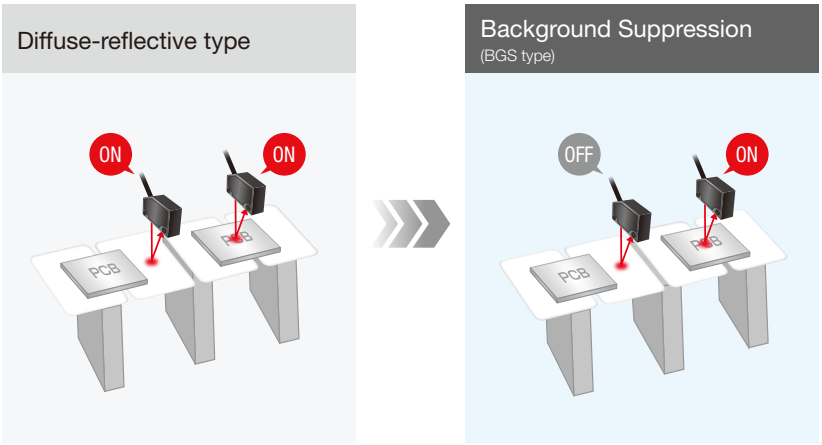
Beam diameter enables accurate detection (BGS type only)

By reducing the light beam diameter by 30-40% compared to conventional photoelectric sensors, the accuracy of the detecting position is improved.

Detection near the optical axis is possible

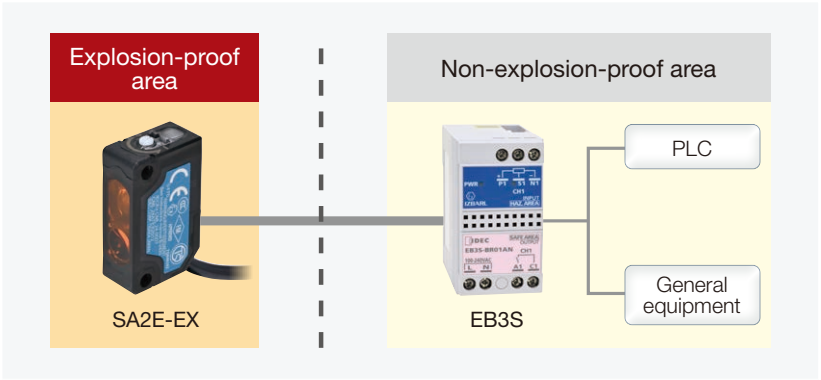


The Background Suppression-type sensor reliably detects only workpieces on a conveyor, ignoring backgrounds. Workpiece colors do not adversely affect sensing, and the narrow beam ensures accurate detection of edges.



Sensor barrier integration for safe operation

The SA2E-EX can be used in connection with the EB3S sensor barrier to enable safe use in explosion-proof areas.



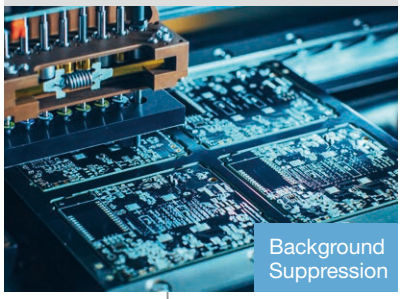
Applications and product lineup

Explosion-proof areas of automated warehouses



Through-beam

Parts inspections (circuit boards, etc.)



Background Suppression

Filling machines



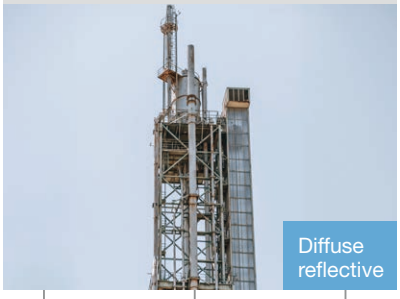
Small-beam reflective

Filling machines (alcoholic beverages, fuel)



Polarized retro-reflective

Explosion-proof elevators



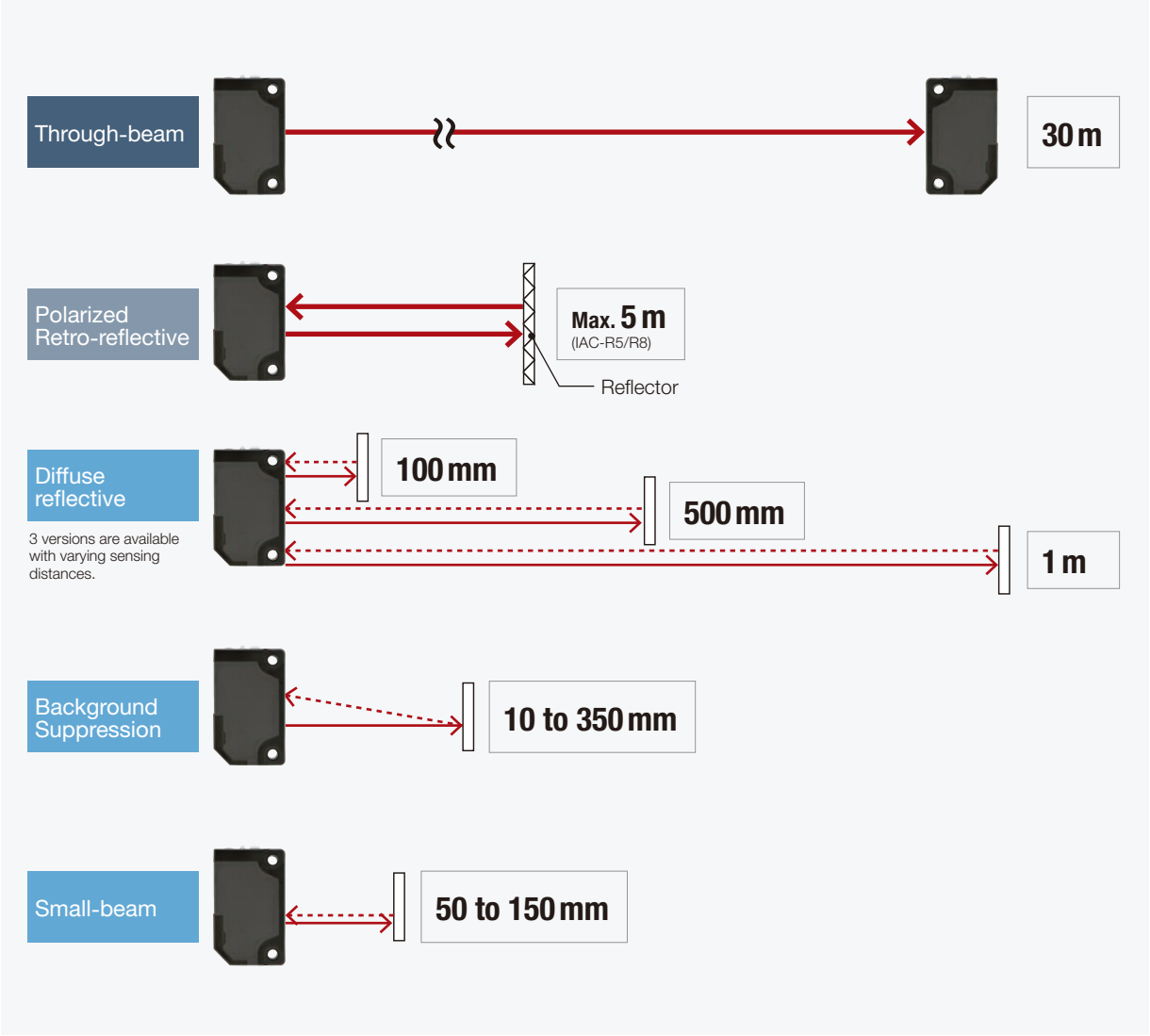
Diffuse reflective



Sensing Method	Through-beam	Retro-reflective	Reflective				
		Polarized Retro-reflective	Background Suppression (BGS)	Diffuse-reflective			Small-beam Reflective
Part No.	SA2E-T□-EX	SA2E-P□-EX	SA2E-B□-EX	SA2E-D□-EX			SA2E-N□-EX
Sensing Range	30m	5m (Depends on the reflector)	10 to 350mm Adjustable sensing range 20 to 350mm	100mm	500mm	1m	50 to 150mm
Light Source Element	Red LED	Red LED	Red LED	Infrared LED	Red LED	Infrared LED	Red LED
Detectable Object	Opaque (*1)			Opaque/Transparent (*1)			
Response Time	0.5ms						
Sensitivity Adjustment/ Sensing Range Adjustment (BGS only)	Single-turn control (approx. 240°)		Approx. 7-turn endless control	Single-turn control (approx. 240°)			
Operation Mode	Light ON/Dark ON (selectable) (select using the operation mode switch)						
Control Output	NPN open collector (*2)						
Current Draw	Max. 185mW (restricted by the barrier connected)						
Degree of Protection	IP65, IP67						
Operating Temperature (no freezing)	–30 to +55°C						
Dimensions	W10.8 × D19.5 × H31.5 (excluding indicator light and volume)						

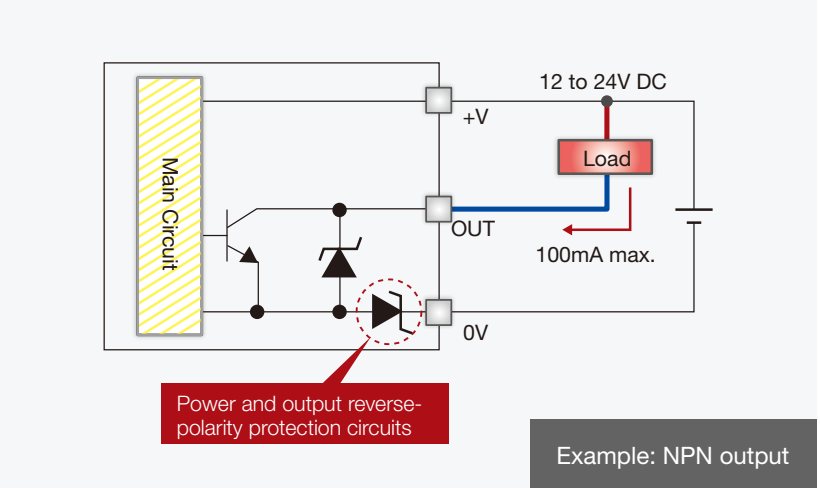
*1: Confirm the actual operation of the equipment before use.
*2: The output of the SA2E-EX main unit is NPN, while the output of the EB3S barrier can be used for both sink and source connections.

Sensing range variations



Output reverse-polarity protection circuit

In addition to reverse-polarity protection for the power voltage, a built-in output reverse-polarity protection circuit prevents damage to the sensor in the event of incorrect wiring.



SA2E-EX

SA2E-EX

Quantity: 1

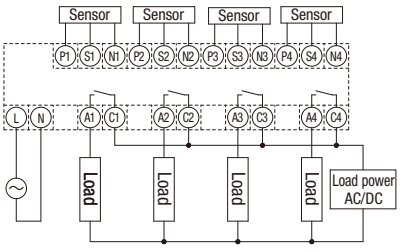
Sensing method			Sensing Range (*1)	Connection type	Cable length (m)	Operation mode	Part No. NPN output	Part No. PNP output
Through-beam	Red LED	With sensitivity adjustment	30m	Cable	2	Light ON/ Dark ON (selectable)	SA2E-TN3-2M-EX	None (*3)
				Connector	–		SA2E-TN3C-EX (*2)	
Polarized retro-reflective	Red LED	With sensitivity adjustment	5.0m (50mm) When using IAC-R5/R8 3.0m (50mm) When using IAC-R6 2.0m (150mm) When using IAC-RS2 1.3m (150mm) When using IAC-RS1 1.6m (100mm) When using IAC-R7☐	Cable	2	Light ON/ Dark ON (selectable)	SA2E-PN3-2M-EX	
				Connector	–		SA2E-PN3C-EX (*2)	
Diffuse-reflective	Infrared LED	With sensitivity adjustment	1m	Cable	2	Light ON/ Dark ON (selectable)	SA2E-DN3L-2M-EX	
				Connector	–		SA2E-DN3LC-EX (*2)	
	Red LED		500mm	Cable	2		SA2E-DN3M-2M-EX	
				Connector	–		SA2E-DN3MC-EX (*2)	
	Infrared LED		100mm	Cable	2		SA2E-DN3S-2M-EX	
				Connector	–		SA2E-DN3SC-EX (*2)	
Background suppression (BGS)	Red LED	With sensing range adjustment	10 to 350mm Adjustable Sensing Range 20 to 350mm	Cable	2	Light ON/ Dark ON (selectable)	SA2E-BN3-2M-EX	
				Connector	–		SA2E-BN3C-EX (*2)	
Small-beam reflective	Red LED	With sensitivity adjustment	50 to 150mm	Cable	2	Light ON/ Dark ON (selectable)	SA2E-NN3-2M-EX	
				Connector	–		SA2E-NN3C-EX (*2)	

• Explosion-proof products have "EX" at the end of the part number. In explosion-proof areas, be sure to use intrinsically safe explosion-proof SA2E-EX sensors.
*1: See the characteristics on P11 to P13.
*2: When using SA2E-EX models with a connector, maintain a distance of 2mm or more between the metal part of the connector and the grounded metal.
An accessory (SA9Z-EX01) is available to ensure the clearance distance is maintained.
*3: PNP is available on the output side of the EB3S sensor barrier.

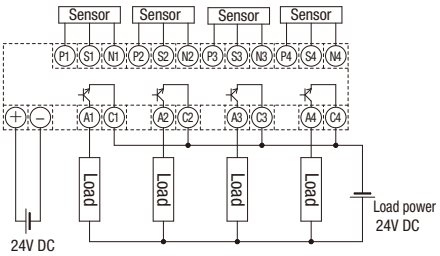
Output circuits/wiring diagrams (wiring examples using EB3S)

The SA2E-EX has only a NPN output, but sink/source output is available on the output side of the EB3S.

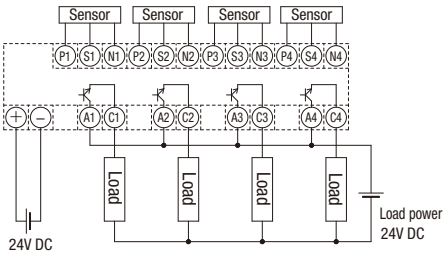
Relay output
(Example: EB3S-BR04AN)



Transistor sink output
(Example: EB3S-BT04DN)



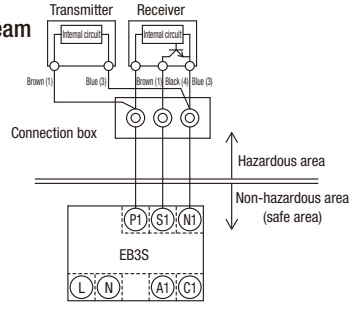
Transistor source output
(Example: EB3S-BT04DN)



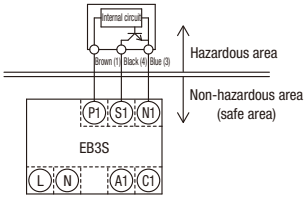
Sensor connection diagrams

Connect one set of sensors per barrier channel.
For the through-beam, the transmitter and receiver are considered as one unit.

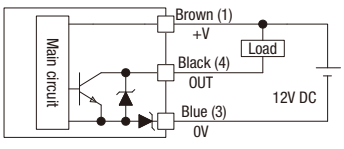
Through-beam sensor



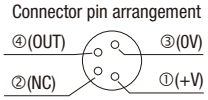
Polarized retro-reflective / Diffuse-reflective / Background Suppression / Small-beam reflective



NPN output type



Connector pin arrangement



*For details on wiring connections, see the instruction manual.
The wiring connections for the photoelectric sensor should be in accordance with the specifications of the photoelectric sensor.

Explosion-proof specifications and ratings

Explosion-proof standard		International Explosion Protection Guidelines 2020Ex (Part 1) International Explosion Protection Guidelines 2015Ex (Part 6)
Explosion-proof rating	Classification of equipment and glue	Ex ia IIB T4 Ga
	Intrinsically safe circuit allowable voltage (Ui)	13.2V
	Intrinsic safety allowable current (Ii)	56mA
	Intrinsically safe circuit allowable power (Pi)	185mW
	Intrinsically safe circuit internal capacitance (Ci)	5.4µF max.
	Intrinsically safe circuit internal inductance (Li)	10µH max.
	Ambient temperature (Ta)	-30 to +55°C

General specifications

		Through-beam	Polarized retro-reflective	Diffuse-reflective			Background Suppression (BGS)	Small-beam reflective
				Short distance	Middle-distance	Long distance		
Part No.	Cable (2m)	SA2E-TN3-2M-EX	SA2E-PN3-2M-EX	SA2E-DN3S-2M-EX	SA2E-DN3M-2M-EX	SA2E-DN3L-2M-EX	SA2E-BN3-2M-EX	SA2E-NN3-2M-EX
	Connector	SA2E-TN3C-EX	SA2E-PN3C-EX	SA2E-DN3SC-EX	SA2E-DN3MC-EX	SA2E-DN3LC-EX	SA2E-BN3C-EX	SA2E-NN3C-EX
Sensing range		30m	5.0m (when IAC-R5/R8 is used) 3.0m (when IAC-R6 is used) 2.0m (when IAC-RS2 is used) 1.3m (when IAC-RS1 is used) 1.6m (when IAC-R7☐ is used) (*1)	100mm (200 x 200mm White drawing paper)	500mm (200 x 200mm White drawing paper)	1m (200 x 200mm White drawing paper)	10 to 350mm (200 x 200mm White drawing paper)	50 to 150mm (200 x 200mm White drawing paper)
Setting distance		–		–			20 to 350mm (200 x 200mm White drawing paper)	–
Detectable object		Opaque (*2)	Opaque/specular (*2)	Opaque/transparent (*2)			Opaque (*2)	Opaque/ transparent (*2)
Hysteresis		–	20% max. above operating distance	20% max. above operating distance			5% max. above operating distance	20% max. above operating distance
Response time		0.5ms maximum						
Sensitivity adjustment		Single-turn control (approx. 240 degrees)					–	Single turn volume (approx. 240 degrees)
Setting distance adjustment		–		–			Approx. 7-turn endless control	–
Light source element		Red LED		Infrared LED	Red LED	Infrared LED	Red LED	
Operation mode		Light ON/Dark ON (selected using the operation mode switch)						
Output style		NPN open collector output 3-wire DC						
Indicator		Operation LED: orange, stability indicator LED: green, power LED: green (through-beam transmitter type)						
Mutual Interference Prevention Function		–	Two units can be installed in close proximity					
Protection circuit		Built-in power reverse-polarity protection circuit, output reverse-polarity protection circuit						
Degree of protection		IP65, IP67 (IEC 60529)						
Ambient Illuminance		Sunlight: 40,000 lux maximum, incandescent light: 10,000 lux maximum (at receiver)						
Operating temperature		-30 to +55°C (no freezing)						
Operating humidity		35 to 95% RH (no condensation)						
Storage temperature		-40 to +70°C (no freezing)						
Altitude or atmospheric pressure		800 to 1100 hPa (below 2000m)						
Insulation resistance		20MΩ min. (500V DC megger)						
Dielectric strength		500V AC, 1 minute						
Vibration resistance		10 to 55Hz, amplitude 1.5mm 55 to 500Hz Acceleration 90m/s^2 1 cycle 5 mins 30 mins in each of 3 axes						
Shock resistance		1000m/s^2 3 shocks in 6 directions on 3 axes						
Materials		Case: PBT / Lens: PMMA / Cover: PC						
Weight (approx.)	Cable	Transmitter: 50g Receiver: 50g	50g					
	Connector	Transmitter: 10g Receiver: 10g	20g					
Access method	Cable	Vinyl cabtyre cable, ø3.5mm, 3-core (though-beam transmitter: 2-core), 0.2mm^2						
	Connector	M8 connector (4-pin)						

*1: Be sure to maintain the distance shown below between the sensor and reflector.
IAC-R5/R6/R8: 50mm, IAC-R7: 100mm, IAC-RS1/RS2: 150mm
The sensing distance is not guaranteed if the reflector is deformed or the reflector tape is attached on an uneven surface.

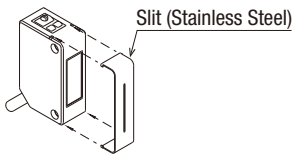
*2: Confirm the actual operation of the equipment before use.

• The SA2E-T-EX through-beam sensor is a set of two units: a transmitter and a receiver. SA2E-T☐3P (transmitter) and SA2E-T☐3R (receiver) are engraved with the part number.

(Using a slit) Sensing range and minimum detectable object width (typical) [Through-beam SA2E-T☐-EX]

Slit		Sensor Types with Sensitivity Adjustment			
		Sensing Range (m)		Minimum Detectable Object Width (mm) (*1)	
Part No.	Slit Width: A (See P17)	Attached on: Receiver	Attached on: Receiver/Transmitter	Attached on: Receiver	Attached on: Receiver/Transmitter
SA9Z-S06	0.5mm	2.5	1.0	0.5	0.5
SA9Z-S07	1.0mm	3.5	1.5	1.0	1.0
SA9Z-S08	2.0mm	6.0	3.5	2.0	2.0
SA9Z-S09	0.5mm	2.0	0.7	0.5	0.5
SA9Z-S10	1.0mm	3.0	1.5	1.0	1.0
SA9Z-S11	2.0mm	5.5	3.0	2.0	2.0
SA9Z-S12	0.5mm	0.8	0.08	0.5	0.5
SA9Z-S13	1.0mm	1.5	0.3	1.0	1.0
SA9Z-S14	2.0mm	2.5	1.2	2.0	2.0

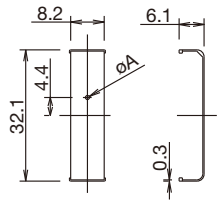
*1: At 1mm from receiver surface.
- The slit easily snaps onto the front of the sensor. (See the figure below.)
- To order, see Ordering Part No. on P14.



Horizontal slits and round slits have an orientation.
Make sure that the TOP (marked on the slit) is positioned on the top of the sensor (LED side).

Dimensions

All dimensions in mm



Material: Stainless Steel

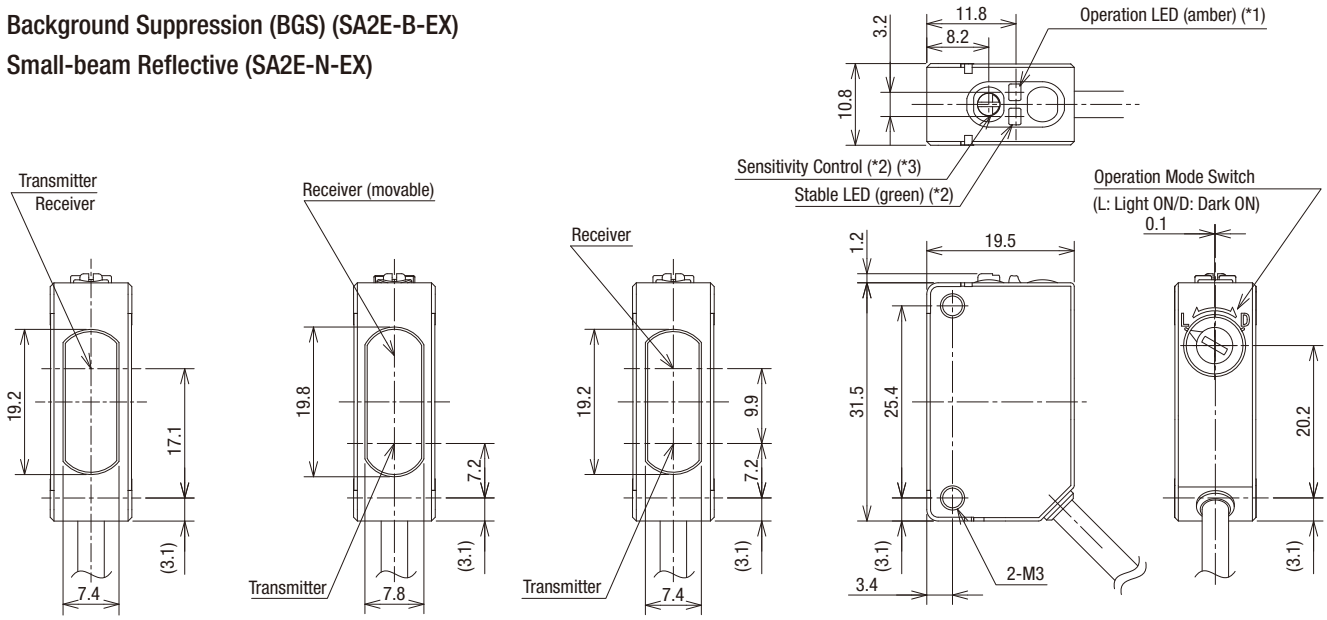
Dimensions

All dimensions in mm.

Cable Type

Through-beam (SA2E-T-EX)
Polarized Retro-reflective (SA2E-P-EX)
Diffuse-reflective (SA2E-D-EX)
Background Suppression (BGS) (SA2E-B-EX)
Small-beam Reflective (SA2E-N-EX)

*1: LED power indicator (green) for SA2E-T-EX through-beam.
*2: The SA2E-T-EX through-beam does not have a sensitivity control, operation mode switch, or stable LED.
*3: SA2E-B-EX has a knob for setting sensing range (7-turn endless control).



Through-beam (SA2E-T-EX)

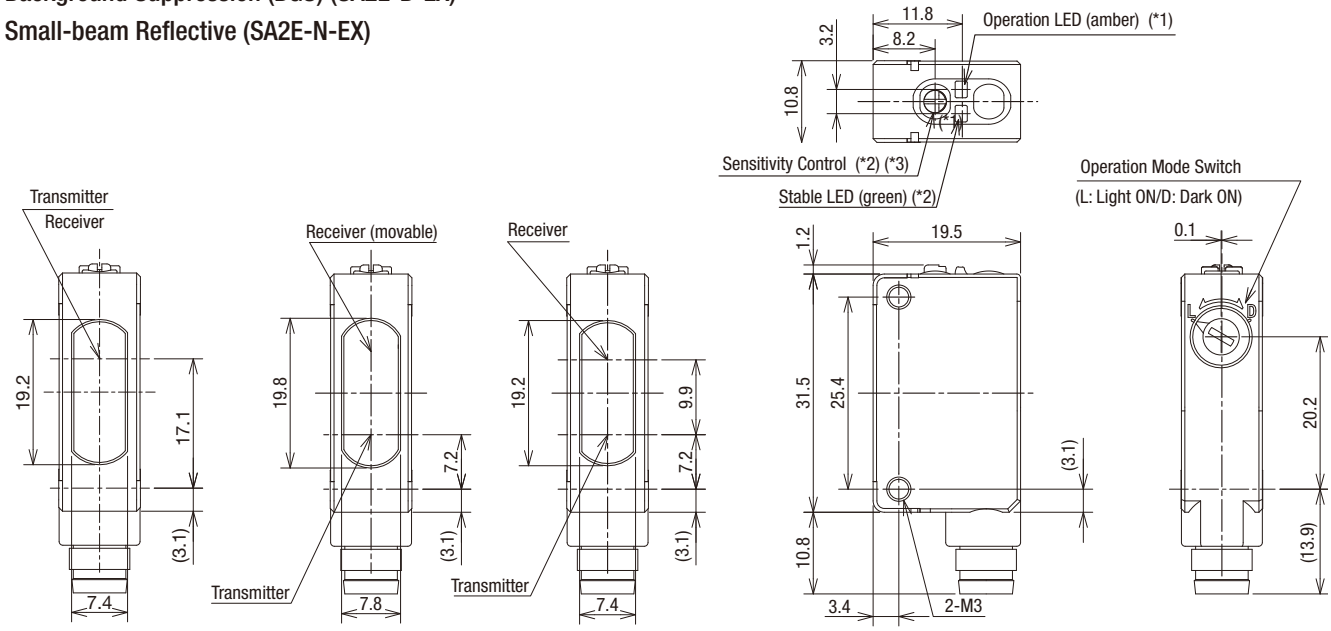
Background Suppression (BGS) (SA2E-B-EX)

Polarized Retro-reflective (SA2E-P-EX)
Diffuse-reflective (SA2E-D-EX)
Small-beam Reflective (SA2E-N-EX)

Connector Type

Through-beam (SA2E-T-EX)
Polarized Retro-reflective (SA2E-P-EX)
Diffuse-reflective (SA2E-D-EX)
Background Suppression (BGS) (SA2E-B-EX)
Small-beam Reflective (SA2E-N-EX)

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Through-beam (SA2E-T-EX)

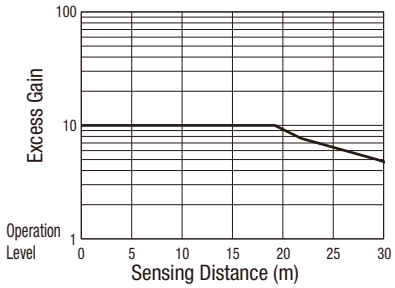
Background Suppression (BGS) (SA2E-B-EX)

Polarized Retro-reflective (SA2E-P-EX)
Diffuse-reflective (SA2E-D-EX)
Small-beam Reflective (SA2E-N-EX)

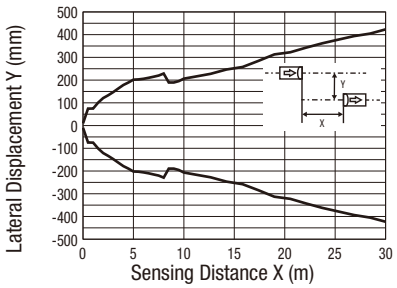
Characteristics (Typical)

(1) Through-Beam SA2E-T□-EX

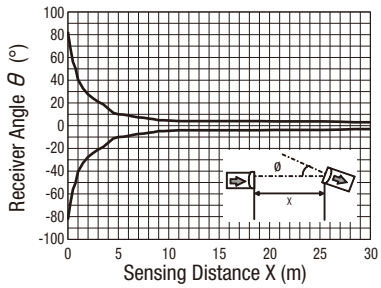
Excess Gain vs. Sensing Distance (Without slit)



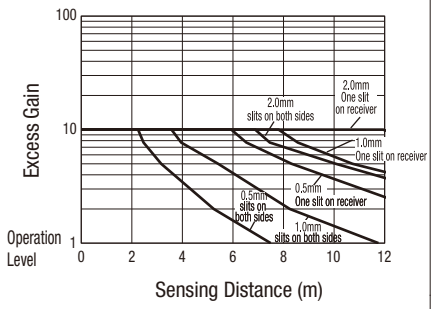
Lateral Displacement (Without slit)



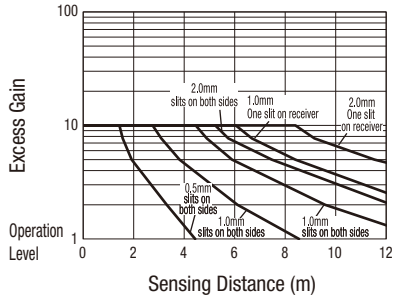
Angle (Without slit)



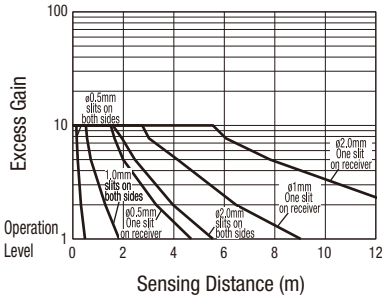
Excess Gain vs. Sensing Distance (With vertical slit)



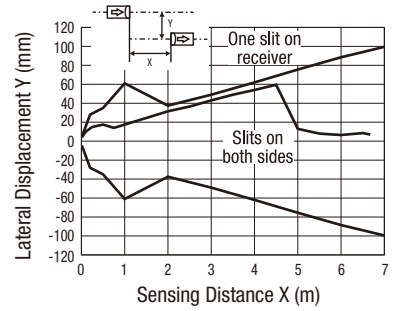
Excess Gain vs. Sensing Distance (With horizontal slit)



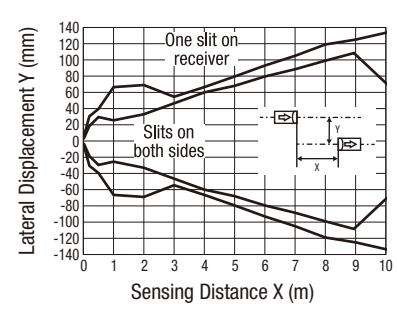
Excess Gain vs. Sensing Distance (With round slit)



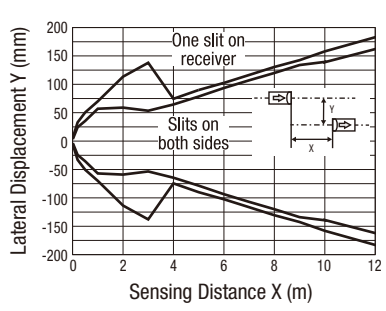
Lateral Displacement (With 0.5-mm vertical slit)



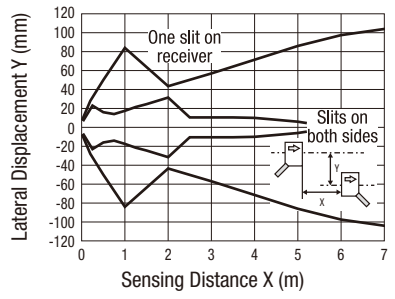
Lateral Displacement (With 1.0-mm vertical slit)



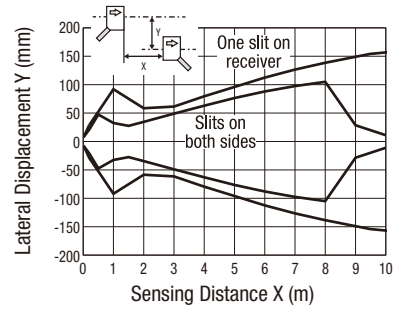
Lateral Displacement (With 2.0-mm vertical slit)



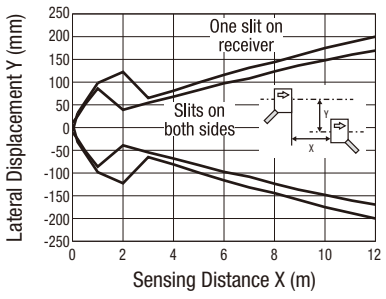
Lateral Displacement (With 0.5-mm horizontal slit)



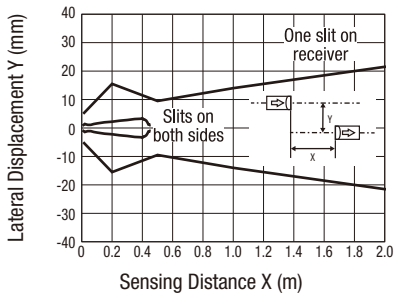
Lateral Displacement (With 1.0-mm horizontal slit)



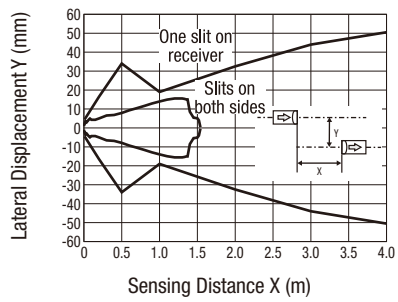
Lateral Displacement (With 2.0-mm horizontal slit)



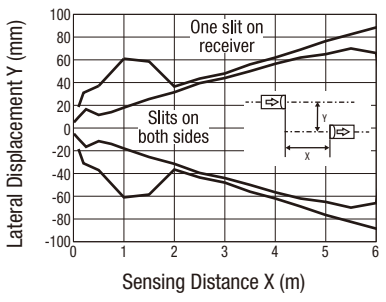
Lateral Displacement (With ø0.5-mm round slit)



Lateral Displacement (With ø1.0-mm round slit)



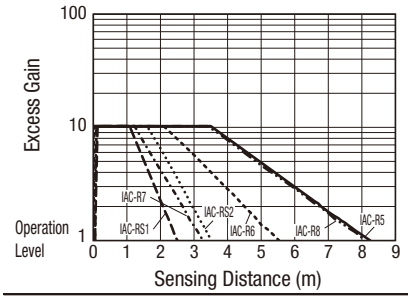
Lateral Displacement (With ø2.0-mm round slit)



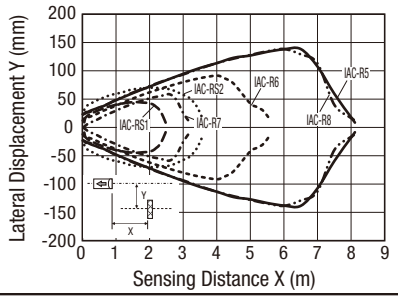
Characteristics (Typical)

(2) Polarized Retro-reflective SA2E-P□-EX

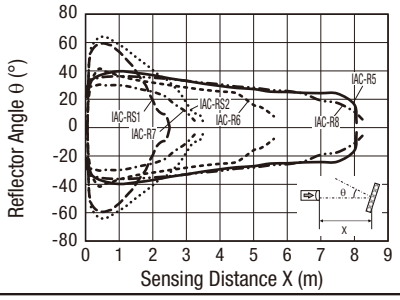
Excess Gain vs. Sensing Distance



Operating Area

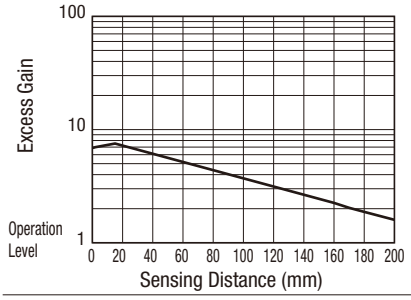


Angle

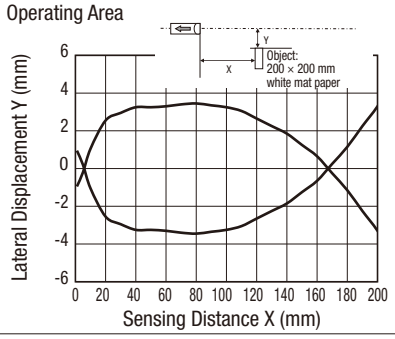


(3) Diffuse-reflective SA2E-DS□-EX((100mm)

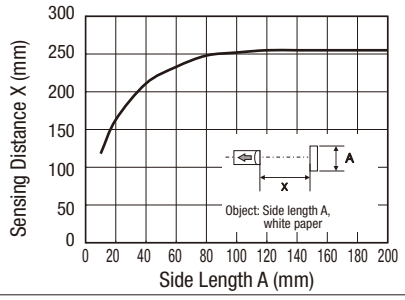
Excess Gain vs. Sensing Distance



Operating Area

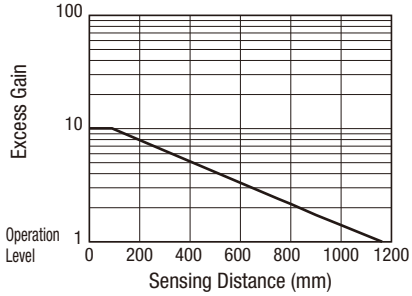


Sensing Distance vs. Object Size

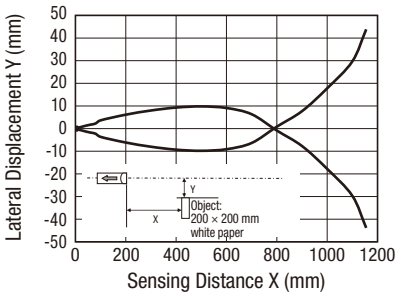


(4) Diffuse-reflective SA2E-DM□-EX (500mm)

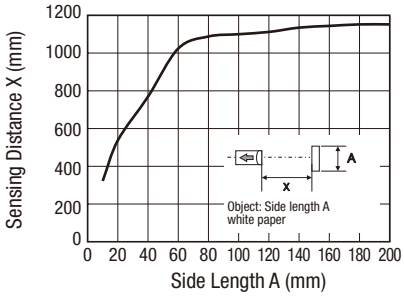
Excess Gain vs. Sensing Distance



Operating Area

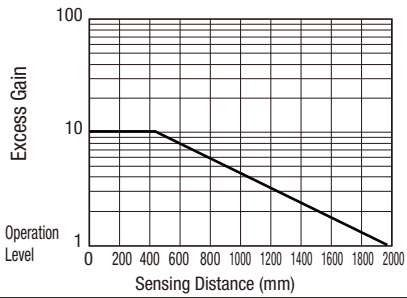


Sensing Distance vs. Object Size

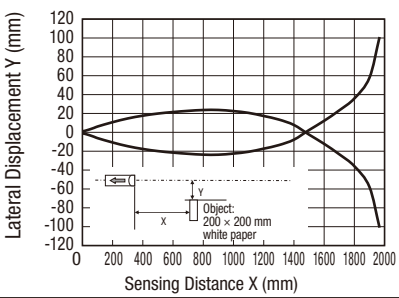


(5) Diffuse-reflective SA2E-DL□-EX (1m)

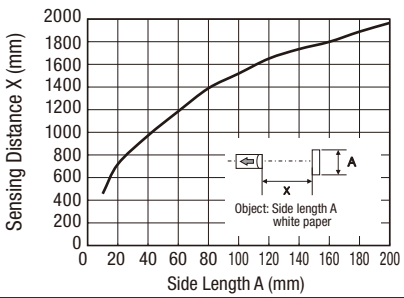
Excess Gain vs. Sensing Distance



Operating Area

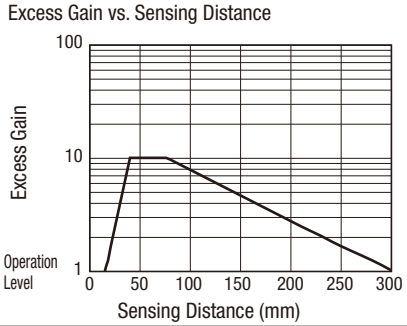


Sensing Distance

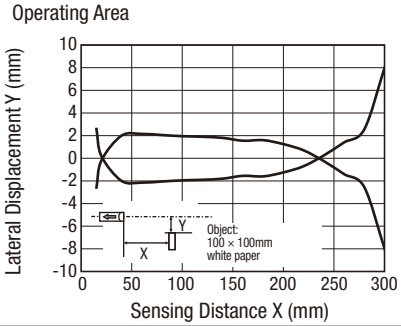


(6) Small-beam Reflective SA2E-N□-EX

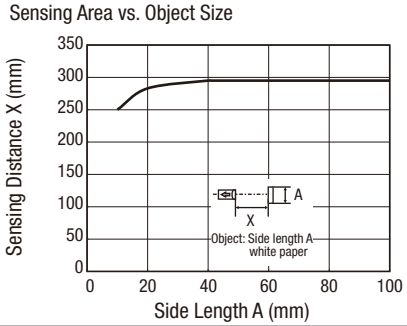
Excess Gain vs. Sensing Distance



Operating Area



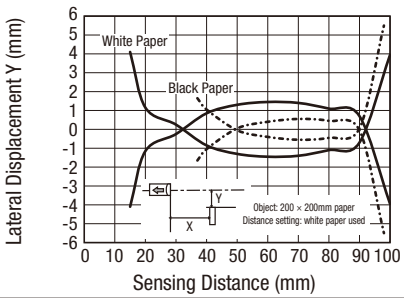
Sensing Area vs. Object Size



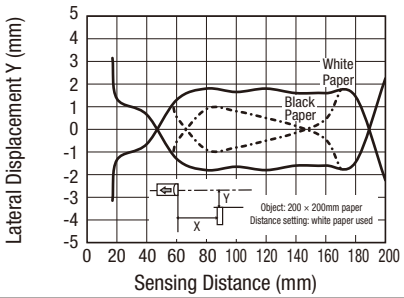
Characteristics (Typical)

(7) Background Suppression (BGS) SA2E-B☐-EX

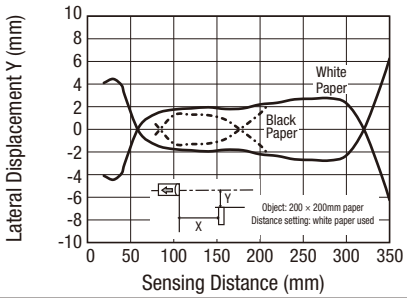
Operating Area (Preset 100 mm)



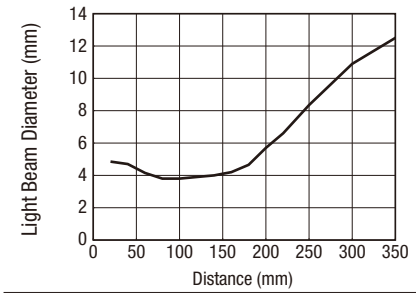
Operating Area (Preset 200 mm)



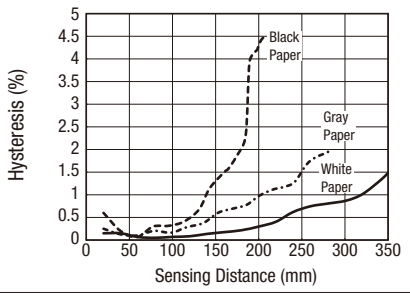
Operating Area (Preset 350 mm)



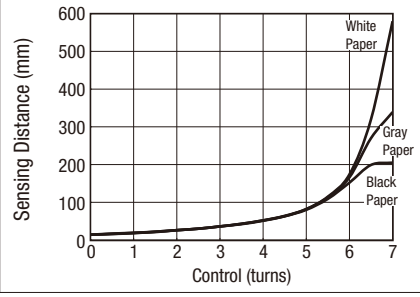
Light Beam Diameter vs. Sensing Distance



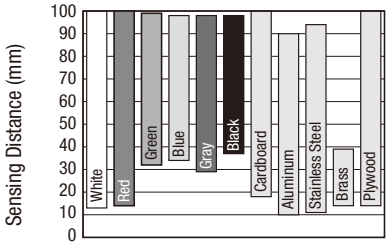
Hysteresis vs. Sensing Distance



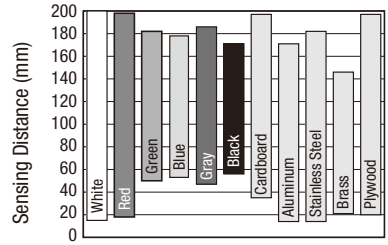
Sensing Distance vs. Control (turns)



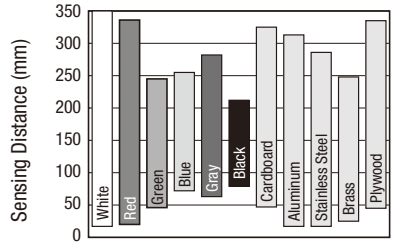
Color (200×200mm paper), material vs. Sensing Distance (Preset 100mm)



Color (200×200mm paper), material vs. Sensing Distance (Preset 200mm)



Color (200×200mm paper), material vs. Sensing Distance (Preset 350mm)



Accessories (optional)

Slits (for through-beam)

When ordering, specify the Ordering No.

Item	Slit Size	Part No.	Ordering No.	Quantity
Vertical Slit	0.5mm × 18mm	SA9Z-S06	SA9Z-S06PN02	2
	1.0mm × 18mm	SA9Z-S07	SA9Z-S07PN02	
	2.0mm × 18mm	SA9Z-S08	SA9Z-S08PN02	
Horizontal Slit	0.5mm × 6.5mm	SA9Z-S09	SA9Z-S09PN02	
	1.0mm × 6.5mm	SA9Z-S10	SA9Z-S10PN02	
	2.0mm × 6.5mm	SA9Z-S11	SA9Z-S11PN02	
Round Slit	ø0.5mm	SA9Z-S12	SA9Z-S12PN02	
	ø1.0mm	SA9Z-S13	SA9Z-S13PN02	
	ø2.0mm	SA9Z-S14	SA9Z-S14PN02	

Reflectors (for polarized retro-reflective)

Quantity: 1

Item		Part No.
Reflector	Standard	IAC-R5
	Small	IAC-R6
	Large	IAC-R8
	Narrow (rear/side mounting)	IAC-R7M
	Narrow (rear mounting)	IAC-R7B
	Narrow (side mounting)	IAC-R7S
	Tape Type (40 × 35mm)	IAC-RS1
	Tape Type (80 × 70mm)	IAC-RS2
Reflector Mounting Bracket	For IAC-R5	IAC-L2
	For IAC-R6	IAC-L3
	For IAC-R8	IAC-L5

- **IAC-L2** is not supplied with mounting screws and nuts. Use commercially available M4 screws and nuts for mounting the IAC-R5 reflector.
- **IAC-L3** is supplied with two mounting screws (M3 × 8mm sems screws).
- **IAC-L5** is supplied with two mounting screws (M4 × 10mm sems screws).
- **IAC-R7M** and **IAC-R7S** are supplied with two M3 × 8mm self-tapping screws, two flat washers, and two spring washers.
  IAC-R7B is supplied with an M3 × 8mm self-tapping screw, a flat washer, and a spring washer.

Separator for explosion-proof SA2E-EX connector type (SA2E-☐C-EX)

Quantity: 1

Item	Part No.
Separator	SA9Z-EX01

- A separator is used to ensure a clearance distance of 2mm or more between the metal part of the connector and the grounded metal part, which is required for explosion protection when using SA2E-EX connector types.
  The separator can be inserted between the SA9Z-K mounting bracket and the SA2E-EX connector type.
- When using the SA9Z-A02, ensure that the clearance distance is maintained.
- The SA9Z-K04 does not require a separator and can maintain the clearance distance.

Mounting Brackets

Quantity: 1

Item		Part No.
Main Unit Mounting Bracket	Vertical Mounting	SA9Z-K01
	Horizontal Mounting	SA9Z-K02
	Back Mounting	SA9Z-K04

- Two mounting screws (M3 × 12mm sems screws) are supplied with the **SA9Z-K01**, **SA9Z-K02** and **SA9Z-K04**.
- The through-beam model requires two mounting brackets, one each for the transmitter and the receiver.
- **SA9Z-K02** cannot be used for the connector types.
- Contact IDEC for mounting brackets for the connector.
- When using the SA9Z-K01 with the SA2E-EX connector type, the clearance between the mounting bracket and the metal part of the connector must be at least 2mm.
  The SA9Z-EX01 separator can be used to maintain the clearance distance.

Air Blower Mounting Block

Quantity: 1

Item	Part No.
Air Blower Mounting Block	SA9Z-A02

- Two mounting screws (M3 × 20mm sems screws), one M5 × 6mm screw for plugging the air supply port, and one gasket (0.5mm thick) are supplied.
  The air tube fitting and mounting bracket are not supplied and must be ordered separately. (Recommended mounting bracket: **SA9Z-K01**)
- Material: Anodized aluminum surface
- When using the SA9Z-A02 with the SA2E-EX connector type, ensure that there is a clearance distance of at least 2mm between the air purge mounting block and the metal parts of the connector. The SA9Z-EX01 separator can be used to maintain the clearance distance.

Connector Cable (for M8 connector type)

Quantity: 1

Number of Core Wires	Style & Length	Part No.
4	Straight, 2m	SA9Z-CM8K-4S2
	Straight, 5m	SA9Z-CM8K-4S5
	Right angle, 2m	SA9Z-CM8K-4L2
	Right angle, 5m	SA9Z-CM8K-4L5

Sensitivity Adjustment Screwdriver

Quantity: 1

Item	Part No.
Sensitivity Adjustment Screwdriver 	SA9Z-AD01

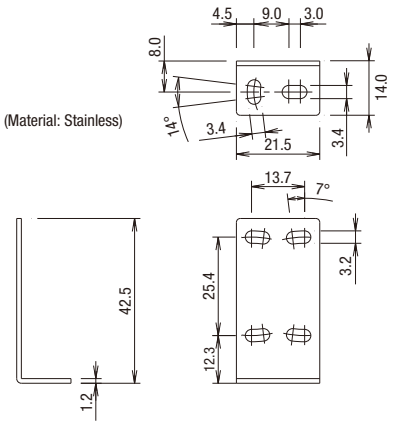
* See P15 to P18 for dimensions.

Accessory Dimensions (optional)

All dimensions in mm

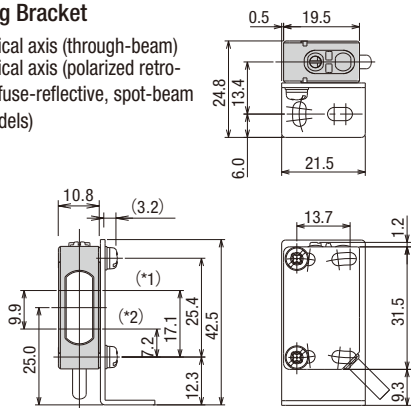
Mounting Brackets

SA9Z-K01

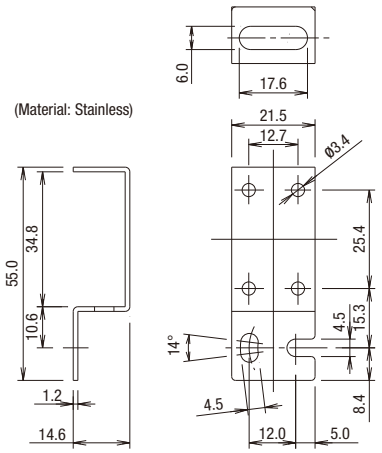


With Mounting Bracket

*1: Center of optical axis (through-beam)
*2: Center of optical axis (polarized retro-reflective, diffuse-reflective, spot-beam reflective models)

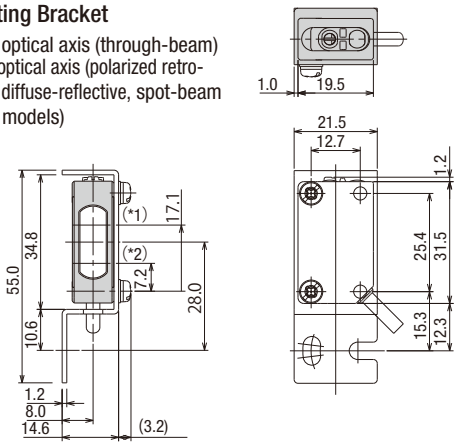


SA9Z-K02

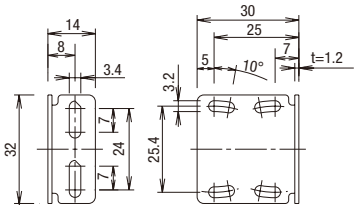


With Mounting Bracket

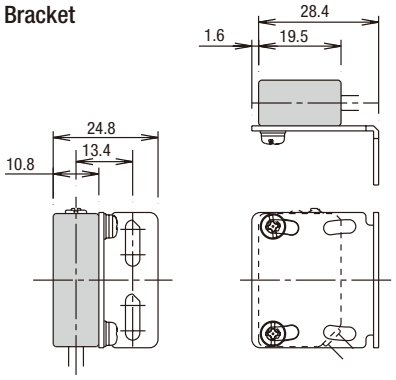
*1: Center of optical axis (through-beam)
*2: Center of optical axis (polarized retro-reflective, diffuse-reflective, spot-beam reflective models)



SA9Z-K04



With Mounting Bracket

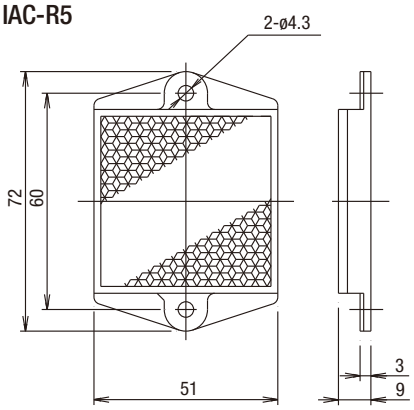


Accessory Dimensions (optional)

All dimensions in mm

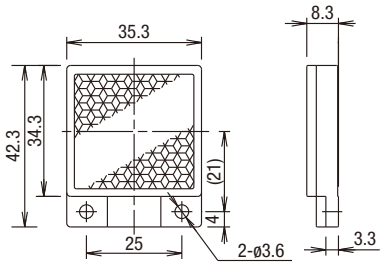
Reflectors

IAC-R5



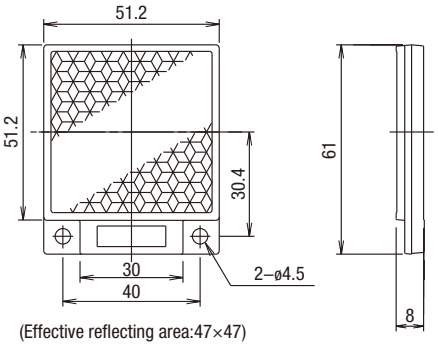
(Effective reflecting area: 47.2×47.2)

IAC-R6



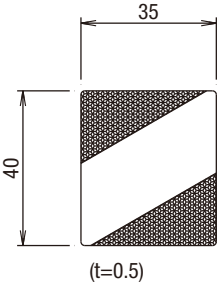
(Effective reflecting area: 30×31)

IAC-R8



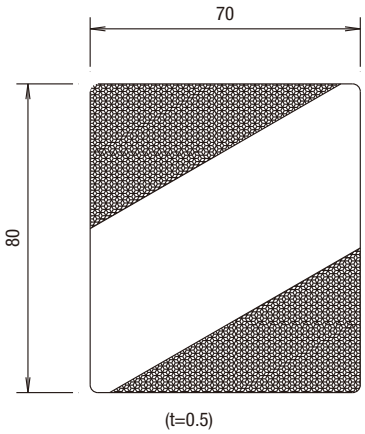
(Effective reflecting area:47×47)

IAC-RS1



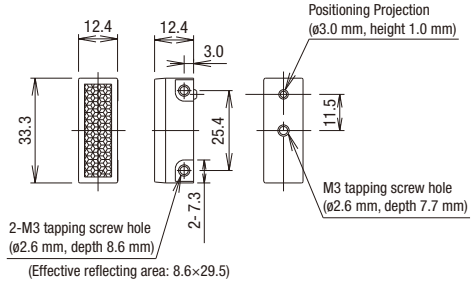
(t=0.5)

IAC-RS2



(t=0.5)

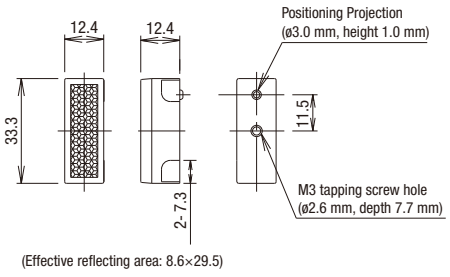
IAC-R7M (rear/side mounting)



(Effective reflecting area: 8.6×29.5)

Note: The mounting plate for reflector must be 0.8 to 2.5mm in thickness.

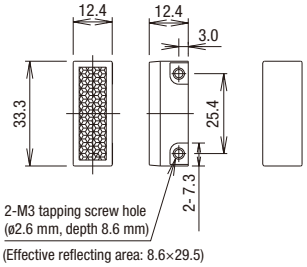
IAC-R7B (rear mounting)



(Effective reflecting area: 8.6×29.5)

Note: The mounting plate for reflector must be 0.8 to 2.5mm in thickness.

IAC-R7S (side mounting)



(Effective reflecting area: 8.6×29.5)

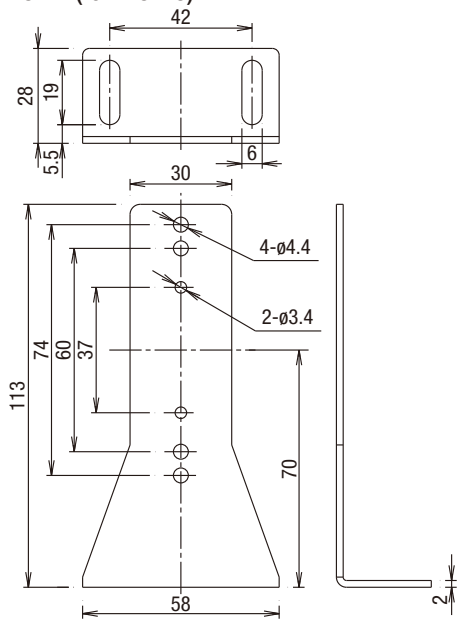
Note: The mounting plate for reflector must be 0.8 to 2.5mm in thickness.

Accessory Dimensions (optional)

All dimensions in mm.

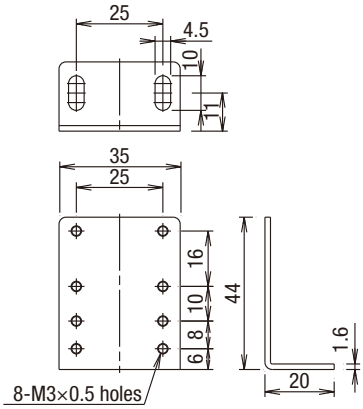
Reflector Mounting Brackets

IAC-L2 (for IAC-R5)



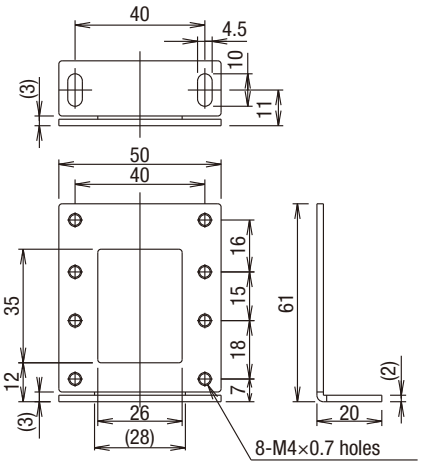
Material: SPCC

IAC-L3 (for IAC-R6)



Material: SPCC

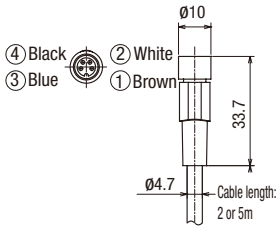
IAC-L5 (for IAC-R8)



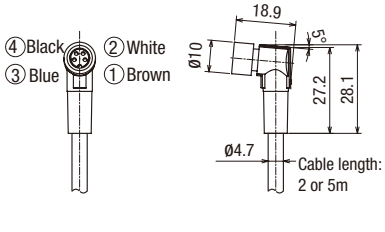
Material: SPCC

Connector Cable (M8 connector type)

Straight
SA9Z-CM8K-4S☐



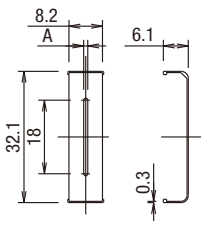
Right-angle
SA9Z-CM8K-4L☐



Note: Dielectric strength when installed on the unit: 1000V AC
(between live part and mounting bracket, except between live part and tightening ring)

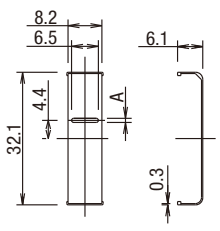
Slit Dimensions

Vertical Slit
SA9Z-S06
SA9Z-S07
SA9Z-S08



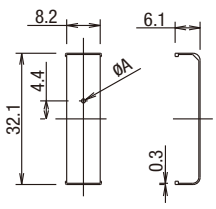
Material: Stainless Steel

Horizontal Slit
SA9Z-S09
SA9Z-S10
SA9Z-S11



Material: Stainless Steel

Round Slit
SA9Z-S12
SA9Z-S13
SA9Z-S14



Material: Stainless Steel

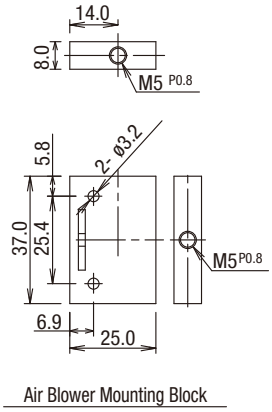
Note: For slit width A, see P9.

Accessory Dimensions (optional)

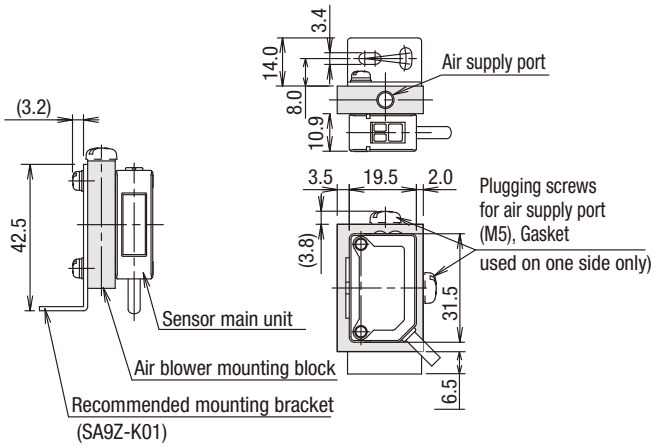
All dimensions in mm.

Air Blower Mounting Block

SA9Z-A02



With Mounting Bracket

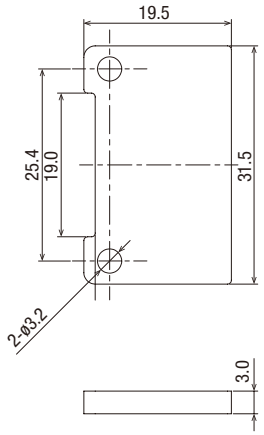


Material: Anodized aluminum surface

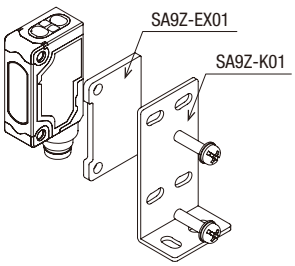
- The SA9Z-A02 air blower mounting block is supplied with two mounting screws (M3 × 20mm sems screws), one screw for plugging the air supply port (M5 × 6 mm), and one gasket for plugging the air supply port (1mm thick).
- An air tube fitting (M5) can be installed to either the top or side. Tighten the fitting to a torque of 0.5 N·m maximum.
- The air tube fitting and mounting bracket are not supplied and must be ordered separately. (Recommended mounting bracket: **SA9Z-K01**)

Separator
For Explosion-proof SA2E-EX Connector Type (SA2E-☐C-EX)

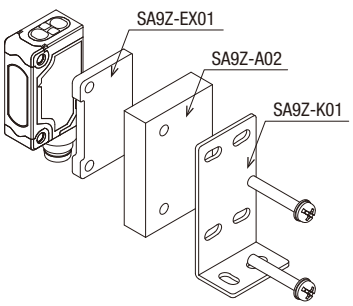
SA9Z-EX01



Installing mounting bracket SA9Z-K01



Installing mounting bracket SA9Z-K01 and air blower mounting block SA9Z-A02

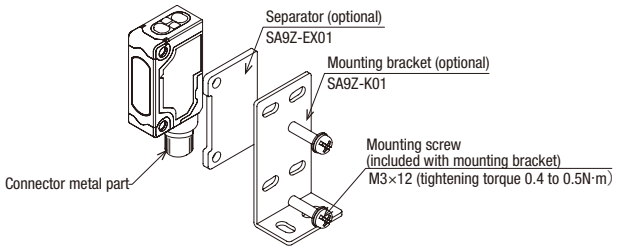


Safety Precautions

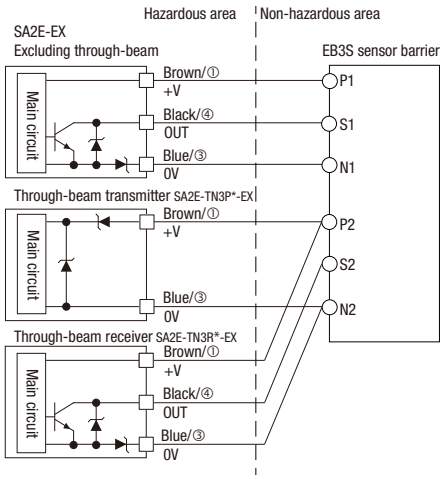
- Improper operation may cause severe injury or death.
- Turn off the power to the product before starting installation, removal, wiring, maintenance, and inspection of the products. Failure to turn power off may cause damage, electrical shocks or fire hazard.
- Installation, piping, operation, maintenance, and inspection should be performed by persons with knowledge and skills regarding explosion-proof, electrical installation, and related regulations. Otherwise injury may occur.
- Mounting brackets should be installed on grounded metal.
- Use the product in accordance with the intrinsically safe ratings and parameters, and observe the following inductance (Lc) and capacitance (Cc) of the intrinsically safe circuit external wiring.
  Lc ≤ Lo-Li, Cc ≤ Co-Ci (Li=10μH, Ci=5.4 μF: including mouth wire)
  *Co and Lo: Please check the description in the instruction manual of the barrier used.
- Slit covers and connectors are contactable metal parts. Do not apply shock or rub the product as there is a risk of ignition due to impact or friction or ignition due to electrostatic charge.
- Do not rub non-metallic parts as there is a risk of ignition due to electrostatic charge.
- When repair is required, return the product.
- When using the connector type, maintain a clearance distance of at least 2 mm between the metal part of the connector and the grounded metal.

Instructions

- Improper operation may cause injury or damage to equipment.
- This product must be used in accordance with the ratings, parameters, and descriptions for instrinsically safe performance.
- Applicable barrier: EB3S sensor barrier (manufactured by IDEC)
  Note that intrinsic safety performance may not be ensured if barriers other than EB3S are used.
- This product contains electronic components. When disposing of this product, do so according to the regulations of the country or region.
- When using a connector type sensor, use separator (SA9Z-EX01) and ensure a clearance distance of at least 2mm between the metal part of the connector and the grounded metal.



- See the wiring diagram below for connection to EB3S sensor barrier (IDEC product).



SA2E-EX terminal functions

Terminal Symbols	Terminal Functions
Brown/① +V	Sensor power wire (brown)
Black/④ OUT	Sensor output line (black)
Blue/③ 0V	Sensor GND line (blue)

EB3S sensor barrier terminal functions

Terminal Symbol	Terminal Functions
Pn	Sensor (+) power supply
Sn	Sensor Signal
Nn	Sensor (-) power supply

*1. n: Indicates channel No. 1 to No. 6 of the EB3S sensor barrier.
*2. Slits and connector cables are sold separately.

- When wiring, take into consideration to prevent electromagnetic and electrostatic charges on intrinsically safe circuits. Also, prevent intrinsically safe circuits from contacting with other circuits. The intrinsically safe circuits must be separated from non-intrinsically safe circuits.
- Enclose intrinsically safe circuits in a metallic tube or duct, or separate the intrinsically safe circuits referring to the table below.
- Reference: Cables with a magnetic shield, such as a metal sheath, prevent electromagnetic induction and electrostatic induction. However, a non-magnetic shield cannot prevent electromagnetic induction. Thin twisted pair cables is effective for preventing electromagnetic induction. Twisted pair cables with shields prevent electrostatic induction.
- When identifying intrinsically safe circuits by color, use light blue terminal blocks and cables.
- Connect one set of SA2E-EX sensors per barrier channel.

Minimum parallel distance between the intrinsically safe circuit and other circuits (mm)

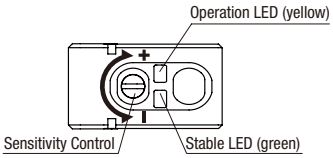
Voltage and current of other circuits	Over 100A	100A maximum	50A maximum	10A maximum
Over 440V	2000	2000	2000	2000
440V maximum	2000	600	600	600
220V maximum	2000	600	600	500
110V maximum	2000	600	500	300
60V maximum	2000	500	300	150

• See P20 and P22 for more instructions.

Operating Instructions

Indicator and Output Operation

The operation LED turns on (yellow) when the control output is on.



- The stable LED turns on (green) either at stable incident or stable interruption. Make sure to use the photoelectric sensor after the stable operation is ensured.
- In Light ON operation, the output turns on when the receiving light intensity level is 1.0 or over as shown on the right.
- In Dark ON operation, the output turns on when the receiving light intensity level is less than 1.0 as shown on the right.

Receiving Light Intensity Level		Light Receiving Status	Stable LED (green)	Operation LED (yellow)/ Control Output	
				Light ON	Dark ON
Operation Level	1.05 and over	Stable Incident	ON	ON	OFF
	1.0 and over Less than 1.0	Unstable Incident	OFF		
		Unstable Interruption		OFF	ON
	0.6 and below	Stable Interruption	ON		

Optical Axis Alignment (Light ON)

Through-beam

Fasten the receiver temporarily. Place the projector to face the receiver. Move the projector up, down, right and left to find the range where the operation LED turns on. Fasten the projector in the middle of the range. Next, move the receiver up, down, right and left in the same manner and fasten in the middle of the range where the operation LED turns on. Make sure that stable LED turns on at stable incident and stable interruption.

Polarized retro-reflective

Install the reflector perpendicularly to the optical axis. Move the SA2E-EX photoelectric sensor up, down, right and left to find the range where the operation LED turns on. Fasten the sensor in the middle of the range. Polarized retro-reflective model can be installed also by finding the position where the reflection of projected red light is most intense, while observing the reflection on the reflector from behind the sensor. Make sure that stable LED turns on at stable incident and stable interruption.

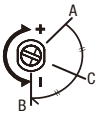
Diffuse-reflective/Small-beam reflective

Place the SA2E-EX photoelectric sensor where the sensor can detect the object. Move the sensor up, down, right and left to find the range where the operation LED tuns on. Fasten the sensor in the middle of the range. Make sure that stable LED turns on at stable incident and stable interruption. Because the light source element of diffuse-reflective model (Medium Distance) and small-beam reflective model is a red LED, visual inspection is possible as well.

Sensitivity Adjustment

Referring to the table at below, adjust the sensitivity of the SA2E-EX photoelectric sensor when necessary, in such cases as when the through-beam model is used to detect small or translucent objects or the reflective model is affected by background. The table explains the status of operation LED when the operation mode is set to light ON.

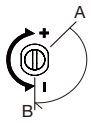
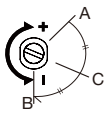
- After adjusting the sensitivity, make sure that stable LED turns on at stable incident and stable interruption. For detecting objects too small to turn on the stable LED, use an optional slit.
- Sensitivity is set to the maximum (+) at the factory before shipment. When adjusting the sensitivity, use the screwdriver supplied with the SA2E-EX photoelectric sensor to turn the control as shown below, to a torque of 0.05 N·m maximum.

Step	Photoelectric Switch Status	Sensitivity Control	Adjusting Procedure
1	**Receiving light** • Through-beam, polarized reflective: No object detected • Diffuse reflective, small-beam reflective: Object detected		Turn the control counter-clockwise to the minimum (–). Then turn clockwise (toward +) until the operation LED turns on (turns off with dark ON type) (point A).
2	**Light is interrupted** • Through-beam, polarized reflective: Object detected • Diffuse reflective, small-beam reflective: No object detected		At interruption status, turn the control clockwise (toward +) from point A, until the operation LED turns on (turns off with dark ON type) (point B). If the operation LED does not turn on (turn off with dark ON type) even though the control has reached the maximum (+), set the maximum position (+) as point B.
3	—		Set the middle point between point A and B as point C.

Operating Instructions

Adjustment of Sensing Range for Background Suppression (BGS) Model

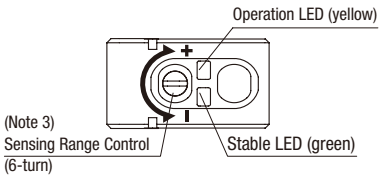
• When adjusting the sensing range, follow the instruction below.

Step	Distance Control	Adjusting Procedure
1		Install the photoelectric sensor and the object firmly. Turn the control counterclockwise until the operation LED turns off (turns on with dark ON type). From this point, turn the control clockwise until the operation LED turns on (turns off with dark ON type) (point A).
2		Remove the object, and confirm that the operation LED turns off (turns on with dark ON type). Turn the control clockwise until the operation LED turns on (detecting the background) (turns off with dark ON type) (point B). (Note 1)
3		Set the middle point between point A and B as point C. (Note 2)

Note 1: When the background is far off and not detected, turn the control 360°, and set the point as point C.

Note 2: Because the control is multi-turn, it may take more than one turn to move from point A to point B.

Note 3: Turning the control clockwise lengthens the sensing distance.



Power Supply and Wiring

- Do not use the SA2E-EX photoelectric sensor at the transient status immediately after turning on the power (approx. 100 ms). When the load and sensor use different power supplies, make sure to power up the sensor first.
- Use a power supply with little noise and inrush current, and use the photoelectric sensor within the rated voltage range. Make sure that ripple factor is within the allowable limit. Do not apply AC voltage, otherwise the sensor may blow out or burn.
- When using a switching power supply, make sure to ground the FG (frame ground) terminal, otherwise high-frequency noise may affect the photoelectric sensor.
- Turn power off before inserting/removing the cable wiring or connector on the connector model photoelectric sensor. Make sure that excessive mechanical force is not applied to the connector. Connect the connector cable to a tightening torque of 0.5 N·m maximum.
- To ensure the degree of protection, use the applicable connector cable for the connector model. Connector cables are ordered separately.
- Avoid parallel wiring with high-voltage or power lines in the same conduit, otherwise noise may cause malfunction and damage. When wiring is long, use a separate conduit for wiring.
- Use a cable of 0.3 mm^2 minimum core wires, then the cable can be extended up to 100m.

Operating Instructions

Installation

Installing the Photoelectric Sensor

- Do not install the SA2E-EX photoelectric sensors in an area where the sensors are subject to the following conditions, otherwise malfunction and damage may be caused.
  - ∗ Inductive devices or heat source
  - ∗ Extreme vibration or shock
  - ∗ Large amount of dust
  - ∗ Water, oil, chemicals
  - ∗ Outdoor
- Make sure to prevent sunlight, fluorescent light, and especially the fluorescent light of inverters from entering the receiver of the photoelectric sensor directly.
- Interference prevention allows two SA2E-EX sensors to be mounted in close proximity. However, the through-beam model is not equipped with interference prevention. Maintain appropriate distance between the sensors referring to the lateral displacement characteristics.
- SA2E-EX photoelectric sensors with an IP67 rating for water resistance can be exposed to water. However, wipe water drops and smears from the lens and slit using a soft cloth to make sure of the best detecting performance.
- Polycarbonate or acrylic resin is used for optical elements and will dissolve in organic solvents such as ammonia, sodium hydroxide, alcohol, and benzene. To remove dust and moisture build-up, use a soft dry cloth.
- Tighten the mounting screws (M3) to a torque of 0.5N·m. Do not tighten the mounting screws excessively or hit the switch with a hammer, otherwise the protection degree cannot be maintained and may cause damage.

Installing the Reflector

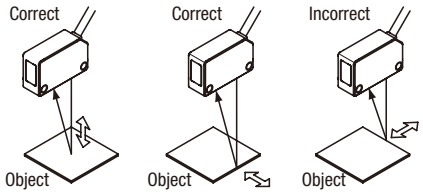
- Use M4 mounting screws for the IAC-R5 and IAC-R8 reflector, and M3 mounting screws for the IAC-R6 reflector. Tighten the mounting screws to a tightening torque of 0.5 N·m maximum. Mounting screws are not supplied with the switch.
- Use the M3 self-tapping screw, flat washer, and spring washer to tighten the IAC-R7 reflector to a torque of 0.5 to 0.6 N·m.
- Optional reflector mounting bracket IAC-L2 is not supplied with mounting screws or nuts.
- IAC-L3 and IAC-L5 are supplied with mounting screws for mounting the reflector on the bracket.
- Reflector IAC-RS1 and IAC-RS2 can be installed directly on a flat surface using the adhesive tape attached to the back of the reflector. Before attaching the reflector, clean the board surface to ensure secure attachment.

Installing the air blower mounting block SA9Z-A02

- When installing the SA9Z-A02 on the SA2E-EX photoelectric sensor, use the attached M3 × 20 mounting screws and tighten to a torque of 0.5 N·m maximum.
- Do not use the mounting screw (M3 × 12) supplied with the mounting bracket (SA9Z-K01) to mount the SA2E-EX photoelectric sensors.
- The SA9Z-A02 cannot be used with the through-beam slits (SA9Z-S06 to S14).
- The air tube fitting (M5) can be installed to either the top or side. The air tube is not supplied.
- Close the unused port using the air supply port plugging screw and gasket (supplied with SA2E-EX) to a tightening torque of 1 to 2 N·m maximum. The recommended air pressure is 0.1 to 0.3 MPa.

Installing the background suppression (BGS) model

- This sensor can detect objects correctly when the sensor head is installed perpendicular to the moving object. Install the sensor head as shown below to minimize sensing errors.



- If the sensor is used in a place subject to a large variations in the ambient temperature, the characteristics may change depending on the target object. Be sure to check the operation under the actual operating conditions.

Operating Instructions

Read the instruction manual carefully before performing installation, wiring, maintenance, and inspection work, and before operating this product. Be sure to use the product correctly.

EB3S Sensor Barrier (Intrinsically Safe Explosion-Proof)

User friendly sensor barriers.

Explosion protection	Sensor barrier: [Ex ia Ga] IIB

- IEC 60079 compliant.
- AC free power supply (100-240V AC)
- No grounding required for both AC/DC power models.
- IDEC's unique spring-up terminal blocks reduce wiring time.
- A wide variety of models
  16 models are available: Combination of channels (1, 2, 4, 6CH), input power (AC/DC power), and output specifications (relay/transistor).
- Mounting method: 35 mm DIN rail mounting or screw mounting.
- Global usage: International/IECEx, US/FM,
  Europe/CE and ATEX, UKCA,
  China/Ex-CCC, Korea/KCS,
  Taiwan/TS, Japan/DEKRA



See website for details on approvals and standards.

EB3S sensor barrier

Quantity: 1

Power voltage	Non-intrinsically safe circuit type	Number of channels	Part No.	Weight (g)
100 to 240V AC	Relay output	1	EB3S-BR01AN	145
		2	EB3S-BR02AN	185
		4	EB3S-BR04AN	260
		6	EB3S-BR06AN	355
	Transistor output (Sink/source common)	1	EB3S-BT01AN	145
		2	EB3S-BT02AN	180
		4	EB3S-BT04AN	250
		6	EB3S-BT06AN	340
24V DC	Relay output	1	EB3S-BR01DN	130
		2	EB3S-BR02DN	170
		4	EB3S-BR04DN	245
		6	EB3S-BR06DN	355
	Transistor output (Sink/source common)	1	EB3S-BT01DN	130
		2	EB3S-BT02DN	165
		4	EB3S-BT04DN	235
		6	EB3S-BT06DN	325

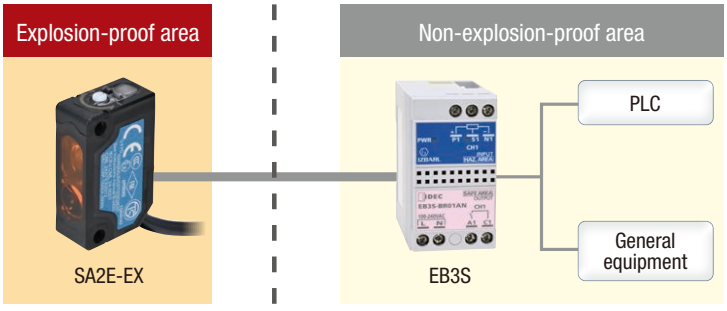
Accessories

When ordering, specify the Ordering No.

Name	Part No.	Ordering No.	Package quantity
35mm wide DIN rail (aluminum)	BAA1000	BAA1000PN10	10
End clip	BNL6	BNL6PN10	10

Connectable sensors

- SA2E-EX intrinsically safe explosion-proof miniature photoelectric sensors
- If connecting to other companies' intrinsically safe explosion-proof photoelectric sensors, please compare the explosion-proof parameters of the sensor and the barrier to confirm that the connection is possible. Be sure to confirm the actual operation.



Explosion protection specifications and ratings

Explosion protection structure			Intrinsically safe explosion-proof
Degree of protection			IP20 (IEC 60529)
Installation location	Sensor barrier		Indoor safe area (non-hazardous area)
	Sensors installed in hazardous locations		Zone 0, 1, 2
Non-intrinsically safe circuit max. voltage (Um)			250V
Intrinsically safe circuit side	Sensor power voltage		7V DC
	Sensor power current		14mA (at 6.4Vmin.)
	Sensor signal voltage		7V DC
	Sensor signal current		2mA (Open collector of sensor output NPN transistor)
	Max. output voltage (Uo)		13.2V
	Max. output current (Io)		56mA
	Max output power (Po)		185mW
	Max. external capacitance (Co)		5.8µF
	Max. external inductance (Lo)		0.453mH
Non-intrinsically safe circuit side	Relay output	Contact configuration	NO contacts
		Rated insulation voltage (Ui)	250V AC, 125V DC
		Rated current (Ith)	3A
		Contact allowable power: Res. load	750VA AC, 72W DC
		Contact allowable power: Ind. load	750VA AC (cosø=0.3 to 0.4) 72W DC (L/R=7ms)
		Rated load: Res. load	250V AC 3A, 24V DC 3A
		Rated load: Ind. load	250V AC 3A (cosø=0.3 to 0.4) 24V DC 3A (L/R=7ms)
		Min. applicable load	0.1V DC, 0.1mA (reference value)
		Contact resistance	50mΩ max. (initial value)
		Operating time	12ms max. (rated power voltage)
		Release time	10ms max. (rated power voltage)
		Mechanical durability	20 million operations minimum (18,000 operations/hour, without load)
		Electrical durability	100,000 operations minimum (1800 operations/hour, at rated resistance load)
		Short-circuit protection	None
	Transistor sink output	Rated power voltage	24V DC
		Max. allowable voltage	30V DC
		Max.current (res. load)	100mA
		Leakage current	0.1mA maximum
		Voltage drop	1.5V maximum (ambient temperature: 25°C)
		Inrush current	0.5A maximum (1s maximum)
		Operating time	1ms maximum (resistive load)
		Release time	1ms maximum (resistive load)
		Short-circuit protection	None

Explosion protection performance/certification no.

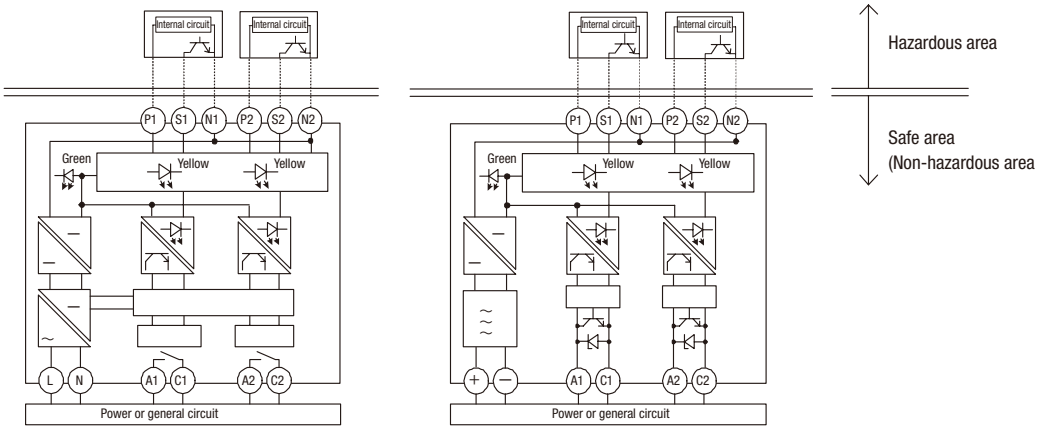
Certification organization	Explosion protection performance	Certification number
FM	AIS Class I,II,III Division 1, Groups A, B, C, D, E, F, G	FM22US0085X
	AIS Zone0,1 [AEx ia Ga] IIC, IIB, IIA	
DEKRA (IECEx)	[Ex ia Ga] IIC, IIB: Gas vapor [Ex ia Da] IIC, IIB: Dust	IECEx DEK 21.0070
DEKRA (ATEX)	II(1)G [Ex ia Ga] IIC, IIB: Gas vapor II(1)D [Ex ia Da] IIC, IIB: Dust	DEKRA 21ATEX0103
CSA (UKCA)	II(1)G [Ex ia Ga] IIC, IIB: Gas vapor II(1)D [Ex ia Da] IIIC, IIIB: Dust	CSAE 22UKEX1312
CQC (Ex-CCC)	[Ex ia Ga] IIC, IIB: Gas vapor [Ex ia Da] IIC, IIB: Dust	2020012316310984
KCs (Korea)	[Ex ia Ga] IIC, IIB: Gas vapor [Ex ia Da] IIC, IIB: Dust	22-AV4BO-0503X 22-AV4BO-0504X
DEKRA (Japan)	[Ex ia Ga] IIB: Gas vapor [Ex ia Da] IIIB: Dust	DEK21.0087
TS Mark (Taiwan)	[Ex ia Ga] IIC, IIB: Gas vapor [Ex ia Da] IIC, IIB: Dust	TD04010Z

- Certificaton bodies, explosion protection performance, and approval/certification numbers are subject to change due to revisions of standards or updates by certification bodies. For the latest information, contact IDEC.
- For FM certified models, add "-2" to the end of the part number.
  "-2" is not added to the ordering number
  Example of part numbers that represent FM certification: EB3C-R01AN-2
  Example of ordering part number: EB3C-R01AN

General specifications

	AC power	DC power
Rated power voltage	100 to 240V AC	24V DC
Allowable fluctuation rate	-15 to +10%	±10%
Rated frequency	50/60Hz (Fluctuation range: 47 to 63Hz)	–
Inrush current	10A (100V AC) 20A (200V AC)	10A (24V DC)
Dielectric strength (1 minute, 1 mA)	Between intrinsically safe circuit and non-intrinsically safe circuit: 1527V AC Between AC power and output terminal: 1500V AC Between DC power and relay output terminal: 1500V AC Between DC power and transistor output terminal: 1000V AC	
Operating temperature	-20 to +60°C (no freezing)	
Operating humidity	45 to 85%RH (no condensation)	
Storage temperature	-20 to +60°C (no freezing)	
Atmosphere	800 to 1100hPa	
Degree of pollution	2 (IEC 60664)	
Insulation resistance	10MΩ minimum (500V DC megger, between the same poles as the dielectric strength)	
Vibration resistance: Direct mount	Damage limits: amplitude 0.75mm, 10 to 55Hz	
Vibration resistance: DIN rail Direct mount	Damage limits: amplitude 0.35mm, 10 to 55Hz	
Shock resistance (damage limits)	Panel mounting: 500 m/s^2 (3 times each in 3 axes) DIN rail mounting: 300 m/s^2 (3 times each in 3 axes)	
Connection terminal	M3 screw terminal	
Installation	35mm-wide DIN rail or panel mounting (M4 screw)	
Power consumption (approx.)	12.4VA (EB3S-BR06AN at 200V AC) 3.7W (EB3S-BR06DN at 24V DC)	

Internal circuit block diagram (example)

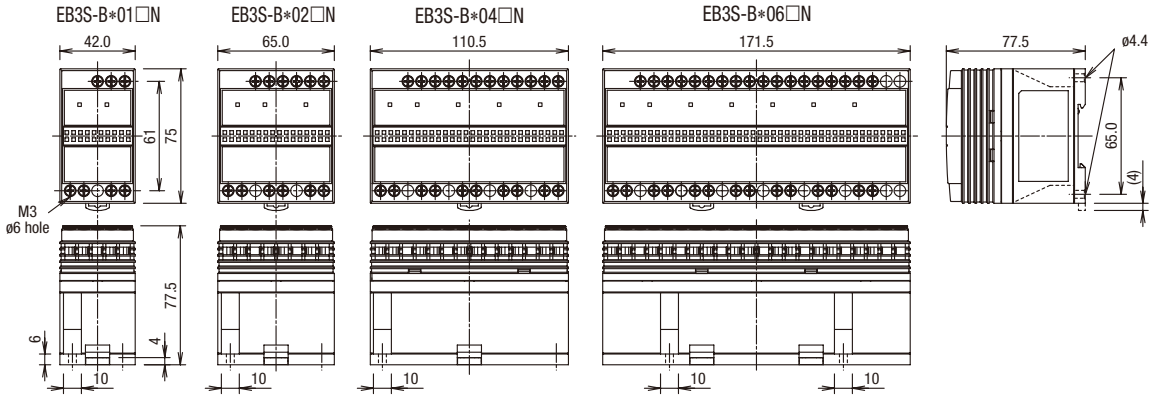


〈Example: AC power relay output type〉 〈Example: DC power transistor output type〉

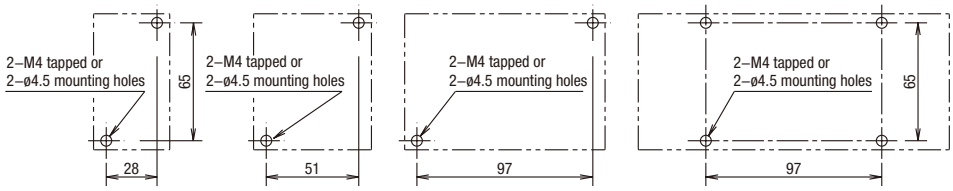
*Power LED lights up in green at normal status. If the power LED lights up in red, replace the product.

Dimensions

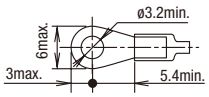
All dimensions in mm.



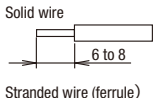
Mounting hole dimensions (for screw mounting)



Applicable crimping terminal

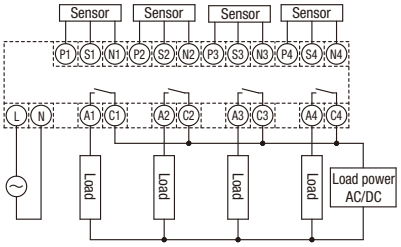


Wire end stripping

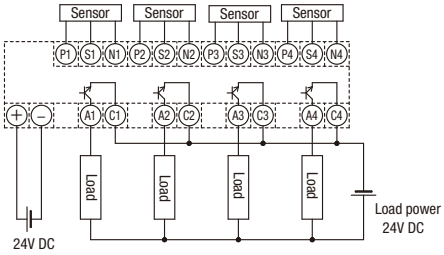


External wiring examples

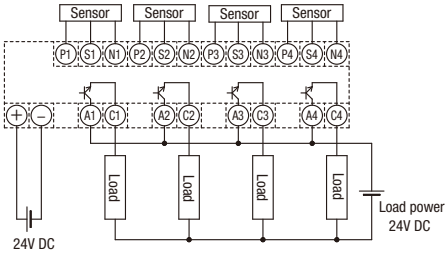
Relay output
(Example: EB3S-BR04AN)



Transistor sink output
(Example: EB3S-BT04DN)

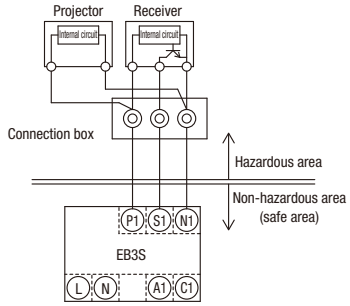


Transistor source output
(Example: EB3S-BT04DN)

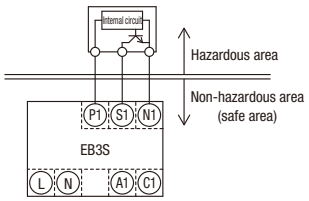


Sensor wiring

When using through-beam sensor



Diffuse reflective sensor
When a polarized reflector sensor is used

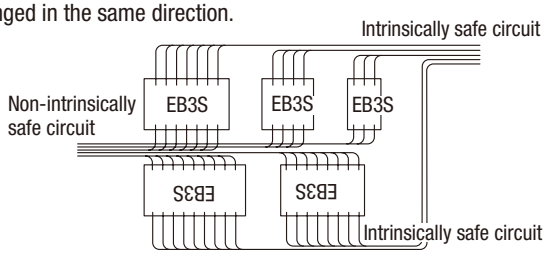


Note: See instructions for wiring.
For wiring photoelectric sensors,
follow according to the specifications of the sensor.

Operating Instructions

1. Installation and mounting

(1) The product can be mounted in any direction.
(2) Install the product in a safe area (non-hazardous area) in accordance with intrinsically safety ratings and parameters and install in an enclosure to prevent shock.
(3) When installing or wiring the product, prevent electromagnetic and electrostatic inductions in the intrinsically safe circuit and contact with other circuits.
(e.g.) Maintain at least 50mm clearance between the intrinsically safe circuit and non-intrinsically safety circuit. If less than 50mm, provide a metallic separating board with a gap of 1.5mm maximum between the intrinsically safe circuit and non-intrinsically safety circuit.
However, if there are power circuits or high-voltage circuits nearby, see references such as installation documents to ensure that the space between the intrinsically safe and non-intrinsically safe circuit is sufficient.
(4) To prevent contact between intrinsically safe circuits and non-intrinsically safe circuits inside the enclosure, install the products with the intrinsically safe circuit and non-intrinsically safe terminals arranged in the same direction.



(5) Maintain at least 3mm clearance between the terminal of the intrinsically safe circuit or the relay terminal block of the intrinsically safe circuit and the grounded metal part of a metal enclosure.
(6) When installing, mount on a 35mm-wide DIN rail or directly on a panel using screws. Make sure to install securely to withstand vibration. When installing on the DIN rail, push the hooks all the way in and secure them securely using the end clip.
(7) Excessive extraneous noise may cause malfunction and damage to the product. If the voltage limiting circuit (thyristor) inside the barrier activates due to noise, all LEDs turn off, and the output will turn off. When the voltage limit circuit activates, be sure to remove the noise source because it does not automatically reset after shutting off the power of the barrier. When the noise is removed, the barrier will return to normal operation before powering up again.
(8) The power LED on the barrier lights up in green at normal status. If the power LED lights up in red, replace the product.

2. Terminal wiring

(1) Use a ø5.5mm or smaller screw driver. The recommended tightening torque for screws (including unused wiring terminal screws) is 0.6 to 1.0 N·m.
(2) Make sure that IP20 is achieved when wiring. Use insulation tubes on bare crimping terminals.
(3) To prevent disengaged wires from contacting with other intrinsically safe circuits, bind together the wires of one intrinsically safe circuit.
(4) When the adjacent terminal is connected to another intrinsically safe circuit, provide an insulation distance of at least 6mm.

3. Sensors in hazardous areas

(1) Sensors that can be connected to the sensor barrier must pass the certification for the sensor itself. Make sure that the sensors satisfy the following conditions.
• Intrinsic safety ratings and parameters (Safety rating)

Intrinsically safe circuit allowable voltage: Ui	13.2V minimum
Intrinsically safe circuit allowable current: Ii	56mA minimum
Intrinsically safe circuit allowable power: Pi	185mW minimum

• Performance categories and groups
Performance Category: ia, ib Group: IIA, IIB
• Sensor maximum internal inductance (Li),
Sensor maximum internal capacitance (Ci)
Barrier maximum external inductance (Lo)
Barrier maximum external capacitance (Co)
Inductance (Lc) of the intrinsically safe circuit external wiring, and relationship between the capacitance (Cc) of the intrinsically safe circuit external wiring
Li≤Lo-Lc
Ci≤Co-Cc
(2) Use a 3-wire sensor with an NPN transistor open collector output.
(3) Sensors connected to the sensor barrier must have an insulation rating of at least 500V to hazardous location ground for both the charging part and the wiring.

Operating Instructions

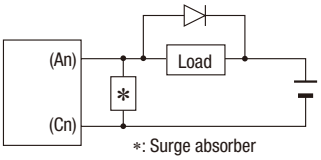
4. Output specifications

(1) When wiring to the non-intrinsically safe circuit side, connect to terminals A and C. The output circuit is not equipped with short-circuit protection. If required, provide a protection in the external circuit.

(2) Some types of loads generate reverse emf or cause a large inrush current, resulting in a shorter operation life of output relay contacts. The operation life of contacts can be extended by preventing the reverse emf using a diode, RC, or varistor, or by suppressing the inrush current using a resistor or RL. Contacts are made of gold-clad silver. When using at a small current and a low voltage (reference value: 0.1mA, 0.1V), test the contact on the actual circuit before use.

(3) Transistor output
When connecting a small load, the load may not turn off because of a leakage current, even though the transistor output is turned off. If this is the case, connect a resistor in parallel with the load to bypass the leakage current.
When an excessively high voltage or a reverse voltage is applied to the output terminals, the clamping circuit or output transistor may be damaged.
When driving an inductive load, be sure to connect a diode across the load to absorb reverse emf.

Example of an overvoltage absorption circuit



5. Wiring for intrinsic safety

(1) The voltage applied on the general circuit connected to the non-intrinsically safe circuit terminals of the product must be 250V AC, 50/60Hz, or 250V DC at the maximum under any conditions, including the voltage of the input power and the internal circuit.

(2) When wiring, take into consideration the prevention of electromagnetic and electrostatic charges on intrinsically safe circuits. Also, prevent intrinsically safe circuits from contacting with other circuits. The intrinsically safe circuits must be separated from non-intrinsically safe circuits.

(3) Enclose intrinsically safe circuits in a metallic tube or duct, or separate the intrinsically safe circuits referring to the table below.
Reference: Cables with a magnetic shield, such as a metallic sheath, prevent electromagnetic induction and electrostatic induction, however, a non-magnetic shield cannot prevent electromagnetic induction.

Finely twisted pair cables prevent electromagnetic induction.
Twisted pair cables with shields prevent electrostatic induction.

(4) When identifying intrinsically safe circuits by color, use light blue terminal blocks and cables.

Minimum parallel distance between the intrinsically safe circuit and other circuits (mm)

Voltage and current of other circuits	Over 100A	100A maximum	50A maximum	10A maximum
Over 440V	2000	2000	2000	2000
440V maximum	2000	600	600	600
220V maximum	2000	600	600	500
110V maximum	2000	600	500	300
60V maximum	2000	500	300	150

(5) Make sure that the power of the relay barrier and contact part are turned off before inspection or replacement.

(6) Connect one set of sensors per barrier channel.

(7) When wiring the intrinsically safe circuit, determine the distance to satisfy the wiring parameters shown below.

(a) Wiring inductance: Lc≤0.453mH-Li

(b) Wiring capacitance: Cc≤5.8μF-Ci

(c) Allowable wiring distance is the smallest value of those calculated from the following three equations:

①Lc/L ②Cc/C ③0.5V/(20mA×2R)

L [mH/km]:Inductance of cable per km

C [nF/km]:Capacitance of cable per km

R [Ω/km]: Resistance of cable per km

Example: Li=10μH, Ci=5.4μF, R=40Ω/km,

When connecting to SA2E-EX,

L=1mH/km(1uH/m) and C=0.2μF/km(200pF/m),

the possible sensor wiring distances from equations are

Lc/L=(Lo-Li)/L=0.453mH-10uH/1mH=0.443km

Cc/C=(Co-Ci)/C=5.8uF-5.4uF/0.2uF=2km

0.5V/(20mA×2R)=0.5/(0.02A×2×40)=0.3125km

Therefore, the wiring distance is less than 312m.

(8) Compatible wire size
0.5 to 2.1mm^2 (AWG20 to 14)

Read the instruction manual carefully before performing installation, wiring, maintenance, and inspection work, and before operating this product. Be sure to use the product correctly.