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

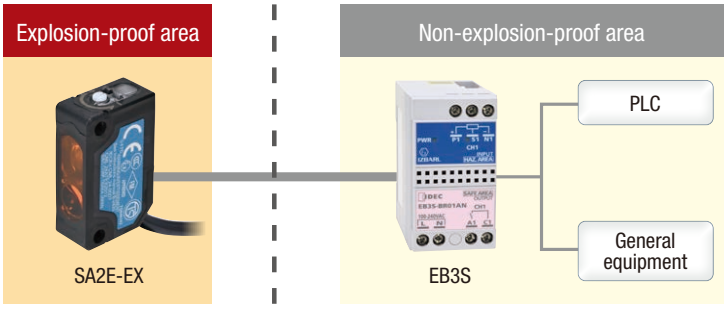
Accessories

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.

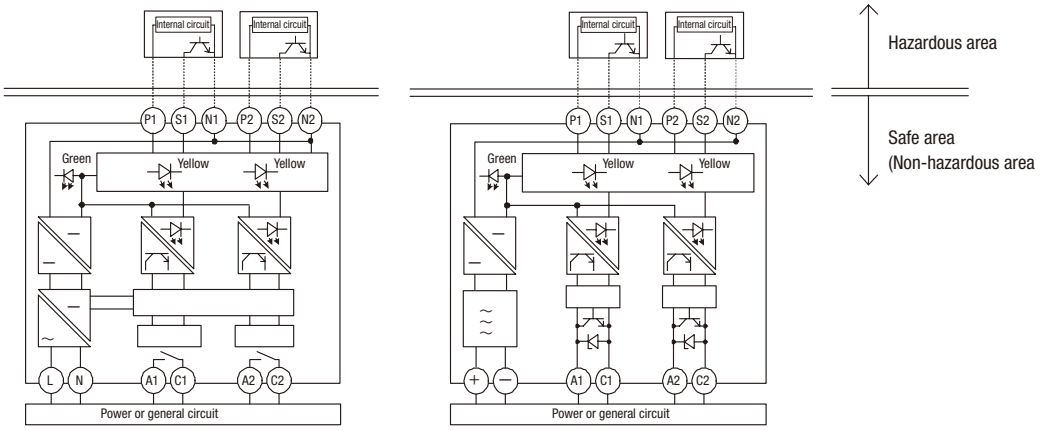
Certification organization	Explosion protection performance	Certification number
FM	AIS Class I,II,III Division 1, Groups A, B, C, D, E, F, G	FM22US0085X
	AIS Zone0,1 [AEx ia Ga] IIC, IIB, IIA	
DEKRA (IECEx)	[Ex ia Ga] IIC, IIB: Gas vapor [Ex ia Da] IIC, IIB: Dust	IECEx DEK 21.0070
DEKRA (ATEX)	II(1)G [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)

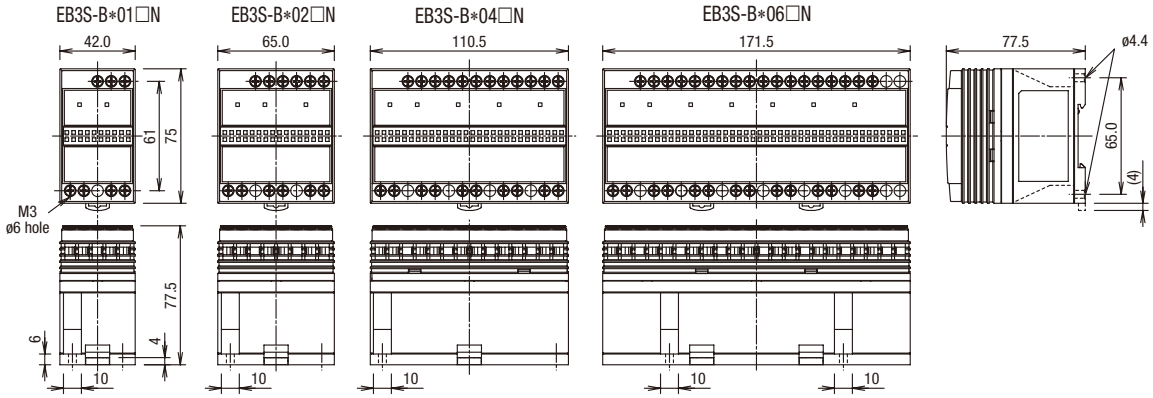


〈Example: AC power relay output type〉 〈Example: DC power transistor output type〉

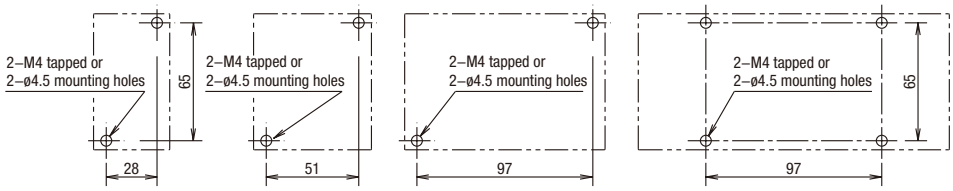
*Power LED lights up in green at normal status. If the power LED lights up in red, replace the product.

Dimensions

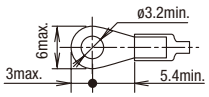
All dimensions in mm.



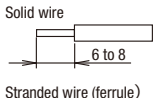
Mounting hole dimensions (for screw mounting)



Applicable crimping terminal

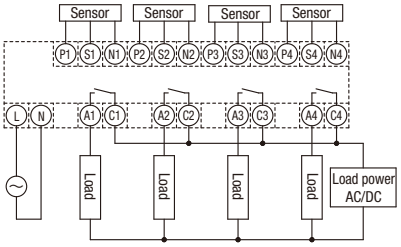


Wire end stripping

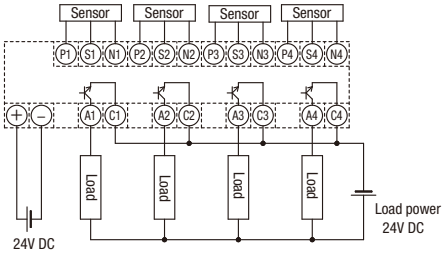


External wiring examples

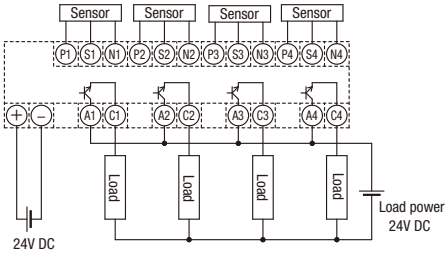
Relay output
(Example: EB3S-BR04AN)



Transistor sink output
(Example: EB3S-BT04DN)

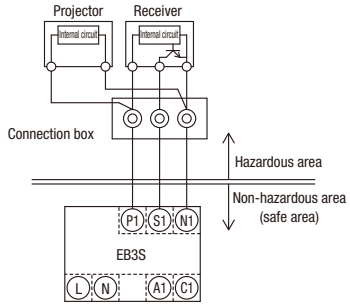


Transistor source output
(Example: EB3S-BT04DN)

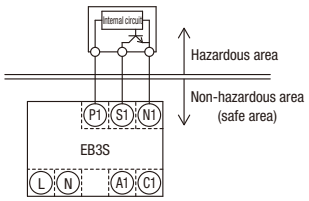


Sensor wiring

When using through-beam sensor



Diffuse reflective sensor
When a polarized reflector sensor is used

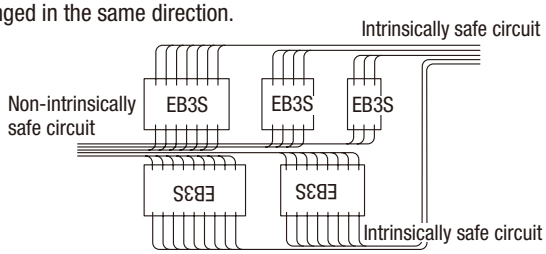


Note: See instructions for wiring.
For wiring photoelectric sensors,
follow according to the specifications of the sensor.

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

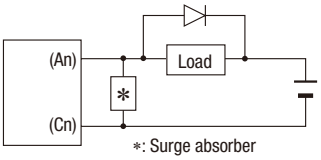
4. Output specifications

(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.