SA1E-X
Miniature Photoelectric Switches
(Transparent Object Sensing)

Detects transparent objects, features a long sensing range up to 2m!

Sensing range: 2m max.
Long sensing range of up to 2m accommodates a wide range of objects from small pallets carrying glass or plastic bottles to large pallets.

IP67 construction provides resistance against water and dust
IP67 housing allows reliable use in wet locations.

Not affected by irregular surfaces and angle of the target object
Coaxial optical structure and narrow beam ensure stable detection; unaffected by constriction, inclination or shaking of a bottle.

Reliably counts objects close to each other
High-speed response and small beam ensure reliable counting of target objects moving at high speed.

Twice the response speed
High response speed of 500 μs, twice that of IDEC’s existing model, achieves stable detection when objects pass by quickly.
SA1E-X Miniature Photoelectric Switches

Application Examples

- Detects ends of transparent film
- Detects transparent case packaging
- Detects wafer displacement

SA1E Miniature Photoelectric Switches (Built-in Amplifier)

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<th>Sensing Method</th>
<th>Sensing Range</th>
<th>Connection</th>
<th>Cable Length (m)</th>
<th>Operation Mode</th>
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<td>Cable</td>
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<td>SA1E-N</td>
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<td>Red LED</td>
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<td>Cable</td>
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<td>Red LED</td>
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<td>With Sensing Range</td>
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<td>Convergent Reflective</td>
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<td>With Sensitivity</td>
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For details, see catalog Cat. No. EP1155.
### Types

<table>
<thead>
<tr>
<th>Sensing Method</th>
<th>Sensing Range</th>
<th>Connection</th>
<th>Cable Length (m)</th>
<th>Operation Mode</th>
<th>Type No.</th>
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<tr>
<td>Coaxial Polarized Retro-reflective</td>
<td>2.0 m (when using IAC-R9)</td>
<td>1</td>
<td>Light ON</td>
<td>NPN Output</td>
<td>SA1E-XN1</td>
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<tr>
<td>Red LED</td>
<td>1.0 m [100 mm] (when using IAC-R10)</td>
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<td>Light ON</td>
<td>PNP Output</td>
<td>SA1E-XN1-2M</td>
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<td>With Sensitivity Adjustment</td>
<td>1.0 m [100 mm] (when using IAC-R11)</td>
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<td>Dark ON</td>
<td>PNP Output</td>
<td>SA1E-XN1-5M</td>
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<td>Connector</td>
<td>–</td>
<td>2.0 m (when using IAC-R9)</td>
<td>1</td>
<td>Light ON</td>
<td>NPN Output</td>
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<td>–</td>
<td>1.0 m [100 mm] (when using IAC-R10)</td>
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<td>Light ON</td>
<td>NPN Output</td>
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<td>–</td>
<td>1.0 m [100 mm] (when using IAC-R11)</td>
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<td>Dark ON</td>
<td>PNP Output</td>
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<td></td>
<td>–</td>
<td>–</td>
<td>Dark ON</td>
<td>PNP Output</td>
<td>SA1E-XN2C</td>
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</tbody>
</table>

### Specifications

- **Part Number**: SA1E-XC
- **Voltage**: 12 to 24V DC (Operating range: 10 to 30V DC; reverse-polarity protected)
- **Power Consumption**: 20 mA maximum
- **Sensing Range**: 2m (when using IAC-R9)
- **Detectable Object**: Opaque, transparent and mirror-like objects
- **Response Time**: 500 μs maximum
- **Sensitivity Adjustment**: Adjustable using a potentiometer (approx. 240°)
- **Light Source Element**: Red LED
- **Operation Mode**: Light ON/Dark ON
- **Control Output**: NPN/PNP open collector (30V DC, 100 mA maximum; short-circuit protection)
- **Voltage drop**: 2V maximum
- **LED Indicators**: Operation LED: Yellow
- **Interference Prevention**: Two units can be mounted closely
- **Degree of Protection**: IP67 (IEC60529)
- **Extraneous Light Immunity (at receiver)**: Sunlight: 10,000 lux maximum, Incandescent lamp: 5,000 lux maximum
- **Operating Temperature**: –25 to +55°C (no freezing)
- **Operating Humidity**: 35 to 85% RH (no condensation)
- **Storage Temperature**: –40 to +70°C (no freezing)
- **Insulation Resistance**: Between live part and mounting bracket: 20 MΩ minimum (500 VDC Megger)
- **Dielectric Strength**: Between live part and mounting bracket: 1,000V AC, 50/60 Hz, 1 minute
- **Vibration Resistance**: Damage limits: 10 to 55 Hz, Amplitude 0.75 mm, 20 cycles in each of 3 axes
- **Shock Resistance**: Damage limits: 500 m/s², 10 shocks in each of 3 axes
- **Material**: Housing: PBT, Lens: PMMA, Indicator cover: PC
- **Connections**: Main Unit Mounting Brackets: Vertical Mounting, Horizontal Mounting, Cover type, Back Mounting
- **Cable**: Cable ø3.5 mm, 3-core, 0.2 mm², vinyl cableynyl rubber (Note)

### Accessories (Optional)

- **Reflectors (used only for transparent-object sensing)**
  - Standard IAC-R9
  - Small IAC-R10
  - Ultra-small IAC-R11
- **Reflective Mounting Bracket**: For IAC-R9 IAC-L3
- **Sensor Mounting Brackets**: Vertical Mounting, Horizontal Mounting, Cover type, Back Mounting
- **Sensitivity Control Screwdriver**: SA9Z-AD01
- **Connector Cable (for connector type sensors)**
  - Straight, 2m: SA9Z-CM8K-4S2
  - Straight, 5m: SA9Z-CM8K-4S5
  - Right angle, 2m: SA9Z-CM8K-4L2
  - Right angle, 5m: SA9Z-CM8K-4L5
- **Air Blower Mounting Block**: SA9Z-A02
- **Slits**: Vertical Slit: 0.5 mm × 18 mm, 1.0 mm × 18 mm, 2.0 mm × 18 mm (Note: Horizontal or round slits cannot be used.)

### Output Circuit/Wiring

- **NPN Output Type**
  
- **PNP Output Type**

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Dimensions

- **Cable Type**

- **Connector Type**

Accessory Dimensions

- **Mounting Bracket (SA9Z-K01)**

- **Mounting Bracket (SA9Z-K02)**

- **With Mounting Bracket**

- **With Mounting Bracket**

Material: Stainless Steel

All dimensions in mm.

*The connector length is 18 mm when a right-angle connector cable (SA9Z-CM8K-4L) is attached.
**SA1E-X Miniature Photoelectric Switches**

- **Mounting Bracket (SA9Z-K03)**

- **With Mounting Bracket**

  - All dimensions in mm.

  Material: Stainless Steel

- **Mounting Bracket (SA9Z-K04)**

- **With Mounting Bracket**

- **Reflector (IAC-R9)**

  - Reflecting surface 47x47.6

- **(IAC-R10)**

  - Reflecting surface 38.5x16

- **(IAC-R11)**

  - Reflecting surface 18x18.2

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- **Reflector Mounting Bracket**
  IAC-L3 (for IAC-R9)
  - All dimensions in mm.

- **Slit (Vertical Slit)**
  SA9Z-S06, -S07, -S08
  - All dimensions in mm.
  
<table>
<thead>
<tr>
<th>Type No.</th>
<th>Slit Width: A</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA9Z-S06</td>
<td>0.5 mm</td>
</tr>
<tr>
<td>SA9Z-S07</td>
<td>1.0 mm</td>
</tr>
<tr>
<td>SA9Z-S08</td>
<td>2.0 mm</td>
</tr>
</tbody>
</table>

  Material: Stainless Steel

- **Connector Cable**
  Straight Type
  SA9Z-CM8K-4S
  - All dimensions in mm.

  - Materials: Stainless Steel
  - Dimension: 5.8x2-ø3.2

- **Air Blower Mounting Block**
  SA9Z-CM8K-A02
  - All dimensions in mm.
  - Materials: Stainless Steel
  - Dimension: 5.8x2-ø3.2

  - Note: Dielectric strength when installed on the SA1E-X
    Between live part and mounting bracket: 1,000V AC
    (except between live part and clamp ring)

- **Air Blower Mounting Block**
  With Mounting Bracket
  SA9Z-CM8K-A02
  - All dimensions in mm.

  - Materials: Stainless Steel
  - Dimension: 5.8x2-ø3.2

  - Note: Dielectric strength when installed on the SA1E-X
    Between live part and mounting bracket: 1,000V AC
    (except between live part and clamp ring)

  - Accessories
    - 2 mounting screws (M3 × 20 mm sems screws)
    - 1 air supply port plug screw (M5 × 6 screw)
    - 1 air supply port plug gasket (1 mm thick)
  - Use the air supply port plug screw and gasket in either direction.
  - Tightening torque: 0.5 N•m maximum
  - Air tube fitting and mounting bracket are not supplied.
    (recommended mounting bracket: SA9Z-K01)
SA1E-X Miniature Photoelectric Switches

Characteristics

- **Excess Gain**

  ![Excess Gain Graph]

- **Lateral Displacement**

  ![Lateral Displacement Graph]

- **Angle**

  ![Angle Graph]

- **Light Beam Diameter**

  ![Light Beam Diameter Graph]

**Instructions**

**LED Indicator and Output Operation**

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<thead>
<tr>
<th>Light Reception Status</th>
<th>Operation LED (Yellow)/Output Operation</th>
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</thead>
<tbody>
<tr>
<td>Receiving light (No object detected)</td>
<td>Illuminated (Output ON)</td>
</tr>
<tr>
<td>Light interrupted (Object detected)</td>
<td>Not illuminated (Output OFF)</td>
</tr>
</tbody>
</table>

**Optical Axis Alignment (Light ON)**

Install the reflector perpendicularly to the optical axis. Move the SA1E-X photoelectric switch up, down, right and left to find the range where the operation LED turns on. Fasten the SA1E-X in the middle of the range. The SA1E-X can also be installed by finding the position where the reflection of projected red light is most intense, while observing the reflection on the reflector from behind the switch.

**Sensitivity Adjustment (Light ON)**

Sensitivity is set to the maximum at the factory before shipment. Referring to the table on the right, adjust the sensitivity. The table explains the status of the operation LED when the operation mode is set to light ON. After adjusting the sensitivity, make sure that the operation LED and control output turn on at stable incident and turn off at stable interruption. When adjusting the sensitivity, use a screwdriver matching the slot in the knob to turn the sensitivity control, with a maximum torque of 0.05 N•m. An optional sensitivity control screwdriver (SA9Z-AD01) is also available. If the distance from the reflector is too short to adjust the sensitivity, use of a vertical slit (SA9Z-S06, -S07, -S08) is recommended. (See page 6.)

- **Step**
- **Photoelectric Switch Status**
- **Sensitivity Control**
- **Adjusting Procedure**

  ① Receiving light (No object detected) Max. Min. Turn the control counterclockwise to the minimum. Then turn clockwise until the operation LED turns on (turns off with dark ON type) (point A).

  ② Light interrupted (Object detected) Max. Min. At interruption status, turn the control clockwise 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 Once points A and B have been determined, set the control midway between points A and B (point C). Temporarily turn the control counterclockwise until the operation LED turns off and set the control back to point C. When points A and B are close to each other, set the control at point A.

  ![Operation LED (Yellow)]

  ![Sensitivity Control]

  * Stable LED is not provided on the SA1E-X.
SA1E-X Miniature Photoelectric Switches

Power Supply and Wiring

- Do not use the SA1E-X photoelectric switch during 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 switch within the rated voltage range. Make sure that the ripple factor is within the allowable limit. Do not apply AC voltage, otherwise the switch may blow out or burn.
- When using a switching power supply, make sure to ground the frame ground (FG) terminal, otherwise high-frequency noise may affect the photoelectric switch.
- Turn the power off before inserting or removing the connector on the photoelectric switch. Make sure that excessive mechanical force is not applied to the connector.
- Tighten the connector cable ring to a maximum tightening torque of 0.5 N·m.
- To ensure sufficient protection, use the connector that is applicable for the connector type. 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 that has core wires of a minimum of 0.3 mm², then the cable can be extended up to 100m.

Notes on Installation

- Do not install the SA1E-X photoelectric switches in an area where the switches are subject to the following conditions, otherwise malfunction and damage may occur.
  1) Inductive devices or heat sources
  2) Extreme vibration or shock
  3) Large amounts of dust
  4) Toxic gases
  5) Water, oil, chemicals
  6) Outdoors
- Do not expose the receiver of the sensor to sunlight or fluorescent lamps.
- The interference prevention function allows installation of two units adjacent to each other.
- The degree of protection of the sensor is IP67, but do not use the sensor with drops of water remaining on the lens.
- Note that the optical components use polycarbonate and acrylic resin, which dissolves in ammonia, caustic soda, benzene, etc. Remove any soiling on the optical components with a dry, soft cloth.
- Excessive tightening of the mounting screws or hammering of the SA1E-X when installing may deteriorate the performance of the housing. Make sure that the tightening torque for mounting screws (M3 screws) is 0.5 N·m or less.

- Note that excessive tightening of screws when installing a reflector may damage the screw holes in the reflector.
- Make sure that the tightening torque for mounting screws (M3 screws) is 0.5 N·m or less.
- If the SA1E-X is used in a place subject to 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.

Specifications and other descriptions in this catalog are subject to change without notice.