

### SA1A and SA1B: High-Speed, Slim Style Photoelectric Sensors

#### Key features of the SA1A and SA1B include:



- Ideal for installations with broad or narrow clearances
- Available with through-beam between the projector and receiver, which features a sensing range of 6'-6-3/4" (2m)
- Sensing by diffuse-rected light available, with a sensitivity adjustment for eliminating the interference of background light
- Through-beam and diffuse-rected light sensors are featured in all configurations
- Configurations include NPN or PNP transistor output, with light on or dark on (senses the presence or absence of an object)
- Adverse results and circuit damage are avoided through protection from reverse polarity
- High-speed, 1ms response time
- Automatic reset with power-up
- Protection rated IP66



<b>General Specifications</b>	<b>Power Voltage</b>	12V to 24V DC
	<b>Operating Voltage</b>	10V to 30V DC, (ripple 10% maximum)
	<b>Current Draw</b>	25mA (maximum)
	<b>Dielectric Strength</b>	Between live and dead parts: 1,000V AC, 50/60Hz, 1 minute
	<b>Insulation Resistance</b>	Between live and dead parts: 20MΩ (minimum), with 500V DC megger
	<b>Operating Humidity</b>	35 to 85% RH (avoid condensation)
	<b>Operating Temperature</b>	-15 to +55C (avoid freezing)
	<b>Storage Temperature</b>	-25 to +65C
	<b>Vibration Resistance</b>	Damage limits: 10 to 55Hz, amplitude 1.5mm p-p, 2 hours in each of 3 axes
	<b>Shock Resistance</b>	Damage limits: 500m/s <sup>2</sup> (approximately 50G), 10 shocks in each of 3 axes
	<b>Extraneous Light Immunity</b>	Sunlight: 10,000 lux (maximum), Incandescent light: 3,000 lux (maximum) — denoted as incident or unwanted light received by a sensor, unrelated to the presence or absence of the intended object
	<b>Material</b>	Housing and lens: polycarbonate
	<b>Degree of Protection</b>	IP66 — IEC Pub 529, sensors rated IP66 are dust-tight, water-resistant, and perform best when not subjected to heavy particle or water blasts
	<b>Cable</b>	Cable type: 0.2mm <sup>2</sup> ; Vinyl cable #26 AWG x 6'-6-3/4" (2m) long Transmitter: 2-core, Receiver: 4-core
<b>Cable Extension</b>	328' (100m) maximum using #22 AWG (0.3mm <sup>2</sup> ) cable or better	
<b>Weight</b>	Projector: 40g; Receiver: 45g	

<b>Function Specifications</b>	<b>Narrow/Flat Type</b>	<b>SA1A/B-TN1, -TN2</b>	<b>SA1A/B-DN1, -DN2</b>	<b>SA1A/B-TP1, -TP2</b>	<b>SA1A/B-DP1, -DP2</b>
	<b>Detection</b>	Through-beam	Diffuse-rected light	Through-beam	Diffuse-rected light
	<b>Sensitivity</b>	-----	Adjustable	-----	Adjustable
	<b>Hysteresis</b>	-----	20% (maximum)	-----	20% (maximum)
	<b>Output</b>	NPN transistor open collector 30V DC, 100mA (maximum)		PNP transistor open collector 30V DC, 100mA (maximum)	
	<b>Light Source</b>	Infrared LED (modulation mode)			
	<b>LED</b>	On: When output is on			
	<b>Response</b>	1ms (maximum)			

### Part Numbers: SA1A and SA1B Sensors

Part Number	Type	Output	On	Sensing Range	Detects	Style
SA1A-TN1	Through-Beam	NPN	Light On: No Object Detected	6' – 6-3/4" (2m)	Opaque Objects Ø 0.20" (5mm) Minimum	 <b>Broad Style</b>
SA1A-TN2			Dark On: Object Detected			
SA1A-TP1		PNP	Light On: No Object Detected			
SA1A-TP2			Dark On: Object Detected			
SA1A-DN1	Reflected Light	NPN	Light On: Object Detected	1.97" (50mm)	Opaque or Transparent Objects	
SA1A-DN2			Dark On: No Object Detected			
SA1A-DP1		PNP	Light On: Object Detected			
SA1A-DP2			Dark On: No Object Detected			
SA1B-TN1	Through-Beam	NPN	Light On: No Object Detected	6' – 6-3/4" (2m)	Opaque Objects Ø 0.20" (5mm) Minimum	 <b>Narrow Style</b>
SA1B-TN2			Dark On: Object Detected			
SA1B-TP1		PNP	Light On: No Object Detected			
SA1B-TP2			Dark On: Object Detected			
SA1B-DN1	Reflected Light	NPN	Light On: Object Detected	1.97" (50mm)	Opaque or Transparent Objects	
SA1B-DN2			Dark On: No Object Detected			
SA1B-DP1		PNP	Light On: Object Detected			
SA1B-DP2			Dark On: No Object Detected			



All sensors include mounting brackets/screws. Through-beam sensors come with a crimping tool, and diffuse-reflected sensors include a screwdriver.

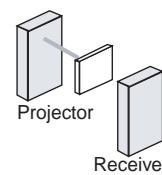
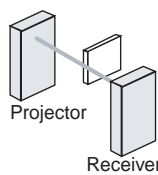
### Operation Principle

Through-beam sensors transmit an infrared LED from the projector to the receiver. Since the receiver detects a well-defined beam (or the lack of it), this sensor is ideal for precise leading-edge detection. The NPN or PNP transistor output turns on:

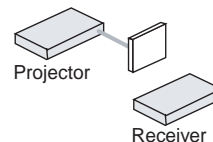
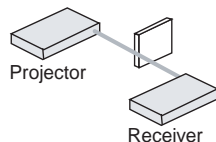
- In the presence of an object → dark on
- In the absence of an object → light on

#### Through-Beam Sensors

**SA1A**  
(Broad):  
Ideal for  
spaces with  
wide clearance.



**SA1B**  
(Narrow):  
Ideal for  
spaces with  
low clearance.

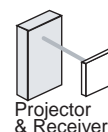
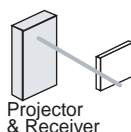


Diffuse-reflected light sensors feature a built-in projector and receiver. The sensor receives the scattered light reflected from an object, making it possible to detect transparent objects. Since a separate receiver or reflective backplate is not required, wiring is reduced and installation is simplified. The NPN or PNP transistor output turns on:

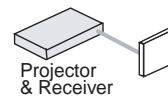
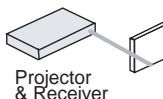
- In the presence of an object → light on
- In the absence of an object → dark on

#### Diffuse-Reflected Light Sensors

**SA1A**  
(Broad):  
Ideal for  
spaces with  
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**SA1B**  
(Narrow):  
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### Operation

See page H-112 for general sensor instructions. Below are considerations specific to SA1A/B miniature photoelectrics.


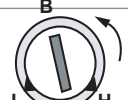
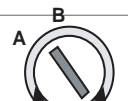
#### Modifying Beam Width: Through-Beam

Slit options, ordered separately, modify the beam size of through-beam sensors. Use when interference results from mounting sensors in close proximity.

Part Number and Slit Width	Used on One Side	Used on Both Sides
<b>SA9Z-S01</b> 0.02" (0.5mm)	19.69" (0.5m)	11.81" (0.3m)
<b>SA9Z-S02</b> 0.04" (1mm)	39.37" (1m)	23.62" (0.6m)
<b>SA9Z-S03</b> 0.08" (2mm)	59.06" (1.5m)	35.43" (0.9m)

#### Sensitivity Adjustment

The diffuse-rected light sensors feature a sensitivity adjustment dial. When background light which interferes with sensing results cannot be eliminated, or when the sensor light beam is reflected from nearby objects unintentionally, adjust the sensitivity as follows.

	Place the object to be detected in the sensing range with sensor light beam on. Start with the dial in the L position, and turn it clockwise until the operation indicator goes on (A).*
	Remove the object. Start with the dial in the H position, and turn it counterclockwise until the operation indicator goes off (B).**
	Finally, set the dial at the midpoint between (A) and (B) to adjust sensitivity so that unwanted incident light is ignored.

- \* For a sensor which detects the absence of light (dark on), the indicator turns off at point (A).
- \*\* For a sensor which detects the absence of light (dark on), the indicator turns on at point (B).

#### Installation

The output is off for approximately 50ms upon power up. This delay is normal; it prevents a transient state.

Cable extension is allowed up to 328' (100m) using a cable with core wires of 22AWG (0.3mm<sup>2</sup>) or larger. The synchronous line (ORANGE/PURPLE) cannot be extended.

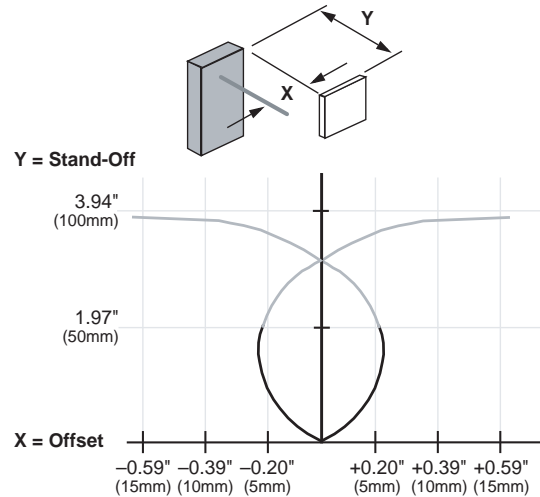
**Through-beam sensors:** Install the projector and receiver so that the optical windows are in parallel planes. Make sure that the center of projection for the projector and receiver are aligned.

Connect the synchronous lines (ORANGE/PURPLE) of the projector and receiver by twisting them together. Fold them back, and twist again. Insert the twisted strand into the crimping terminal (included), and use the crimping tool.

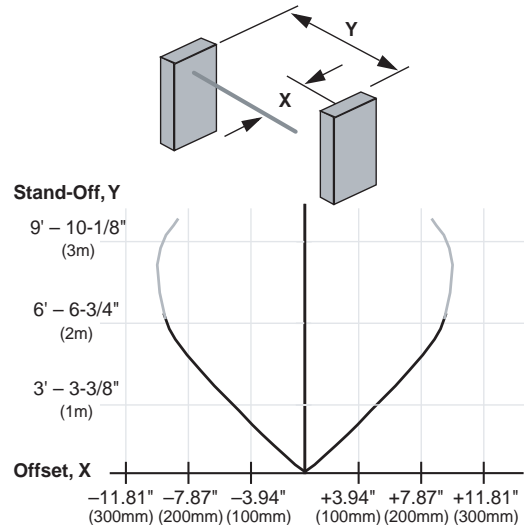
**Diffuse-rected light sensors:** Install so that the object being detected is in the center of projection.

#### Sensing Characteristics

**Diffuse-rected light sensors :** Stand-off is measured between the face of the sensor and the object surface. Offset is the perpendicular distance between the center of projection for the sensor and the nearest object edge.

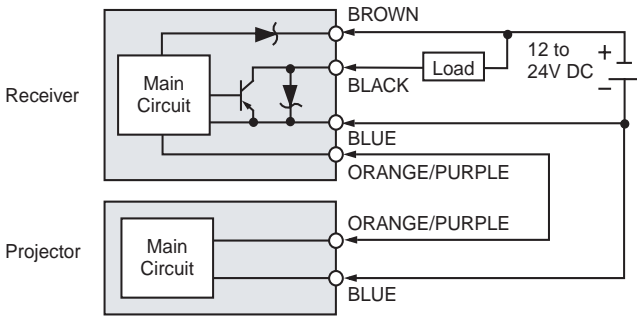


**Through-beam sensors:** Stand-off is measured between the face of the transmitter and the face of the receiver. Offset refers to the perpendicular distance between the centerlines of the projector and receiver.

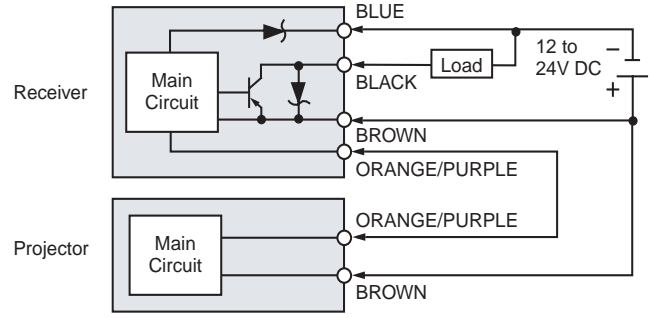


### Schematics

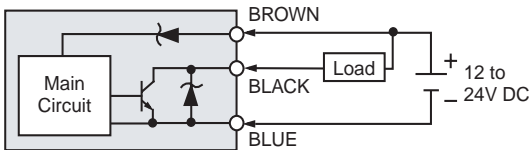
#### Through-Beam Sensors: NPN



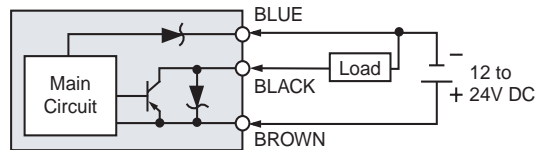
#### Through-Beam Sensors: PNP



#### Diffuse-Reflected Light Sensors: NPN



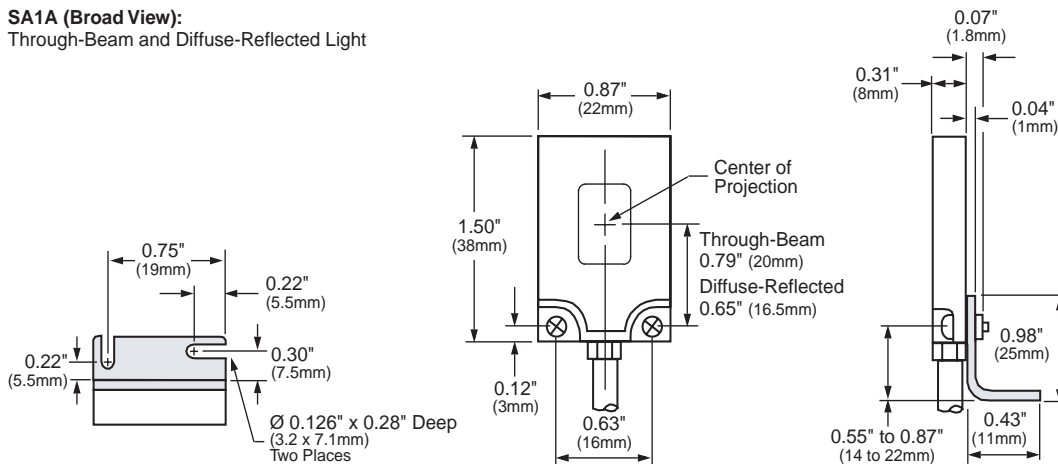
#### Diffuse-Reflected Light Sensors: PNP



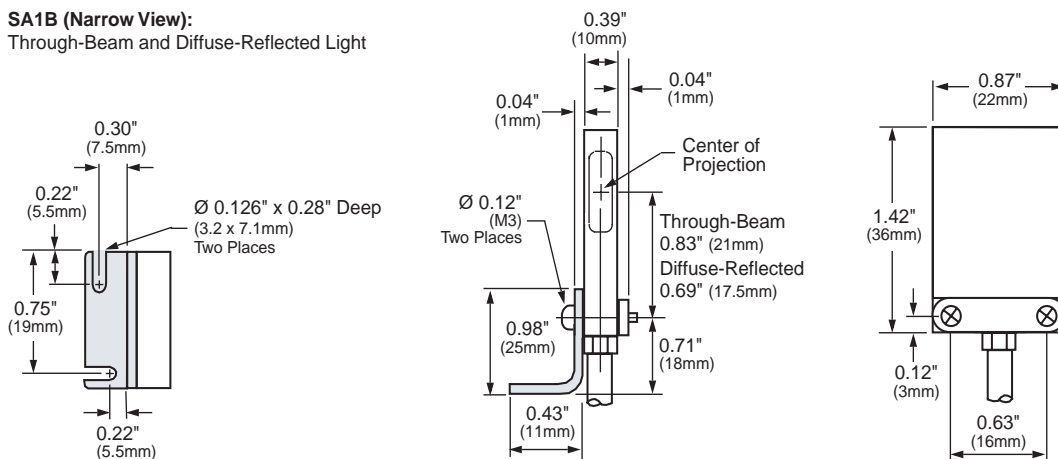
1. "ORANGE/PURPLE" wires are orange with purple stripe.

### Dimensions

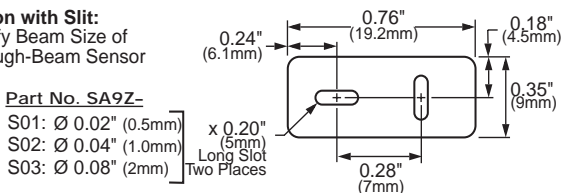
#### SA1A (Broad View): Through-Beam and Diffuse-Reflected Light



#### SA1B (Narrow View): Through-Beam and Diffuse-Reflected Light



#### Option with Slit: Modify Beam Size of Through-Beam Sensor



Part No. SA9Z-  
S01:  $\varnothing$  0.02" (0.5mm)  
S02:  $\varnothing$  0.04" (1.0mm)  
S03:  $\varnothing$  0.08" (2mm)



2. For through-beam sensors, dimensions for the projector and receiver are the same. On all sensors, the cord is  $\varnothing$  0.16" x 6' - 6-3/4" long ( $\varnothing$  4mm x 2m).