

Safety Light Curtains

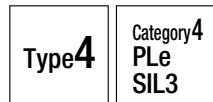
SE4D



Robust Safety Light Curtains
with Advanced and
Easy-to-Use Functionality



• See website for details on approvals and standards.



Easy Installation

The hexagonal socket head screws, used for adjusting the beam axis, can be easily tightened from the front of the light curtain. Also, the beam axis adjustment section is directly and securely fixed by M5 screws to prevent misalignment of the beam.

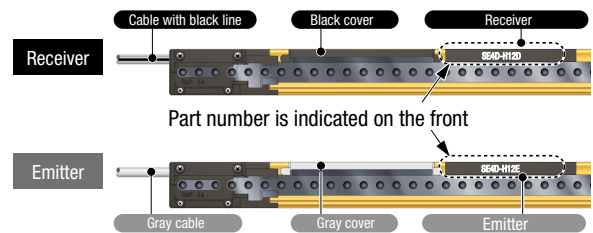
Beam axis can be adjusted from the front



Direct mounting reduces misalignment

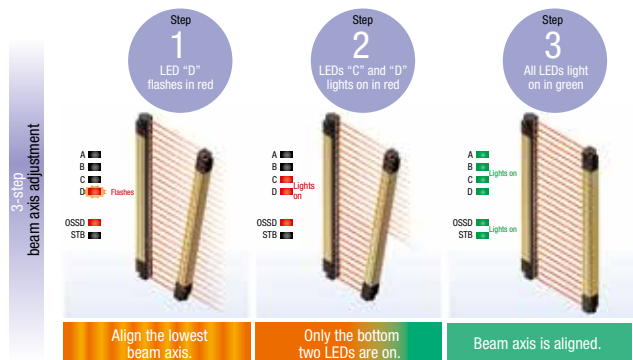
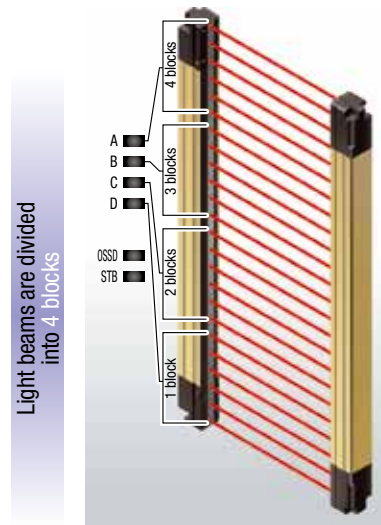
Only few screws are required

Easily distinguish the receiver from the emitter.



Beam axis adjustment is easy with visible incident light

Connects up to 4 units with RS-485. Monitors wide areas.



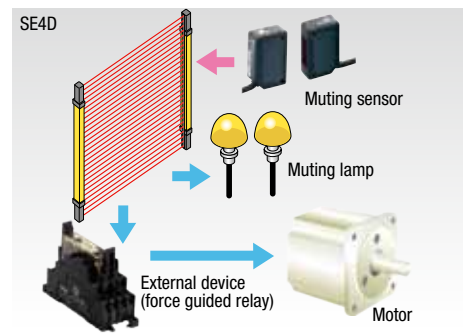
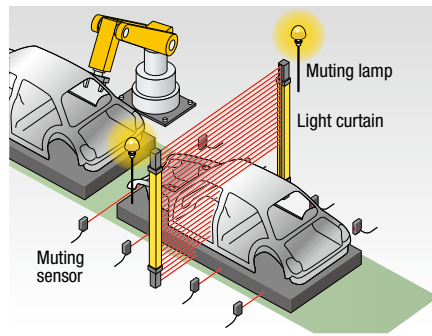
- APEM
- Switches & Pilot Lights
- Control Boxes
- Emergency Stop Switches
- Enabling Switches
- Safety Products
- Explosion Proof
- Terminal Blocks
- Relays & Sockets
- Circuit Protectors
- Power Supplies
- LED Illumination
- Controllers
- Operator Interfaces
- Sensors
- AUTO-ID
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- Non-contact Interlock Switches
- Safety Laser Scanners
- Safety Light Curtains
- Safety Modules

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Muting Function

Built-in muting function increases safety and productivity

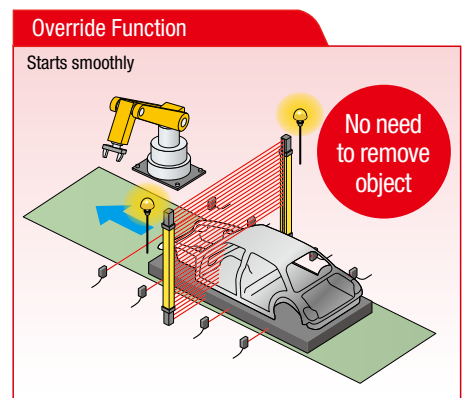
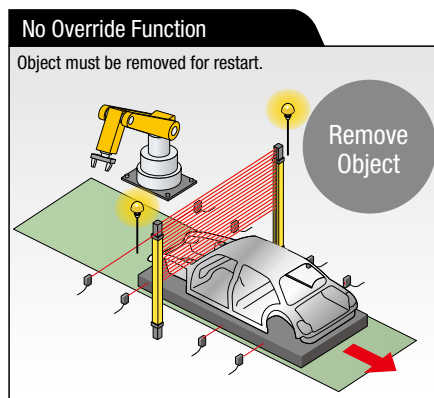
The light curtain is equipped with a muting function that causes a line to stop only when a person passes through the light curtain, but does not stop the line when an object passes through. The muting sensor and muting lamp can be directly connected to the light curtain. A special controller for muting is not required.



Override Function

Override function enables safe restart of factory lines

With the override function, when the light curtain is interrupted by an object or when a line stops before muting conditions are established (when only one muting sensor is interrupted), the object interrupting the light does not have to be removed. Therefore, the line can be restarted smoothly and safely.

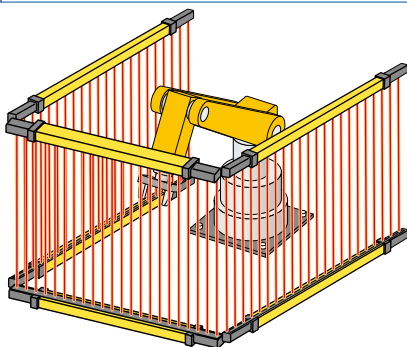


Response Time
14ms
Max.

Fast response time of 14 ms for all models

Regardless of the number of beams or the number of light curtains connected in series, the response speed is 14 ms maximum. Therefore, safety distances can be easily calculated.

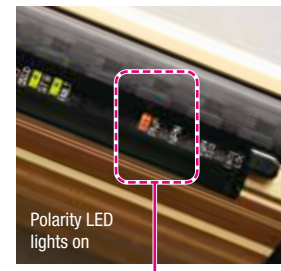
Series Connection



Series Connection
Up to **3** units
192 beams

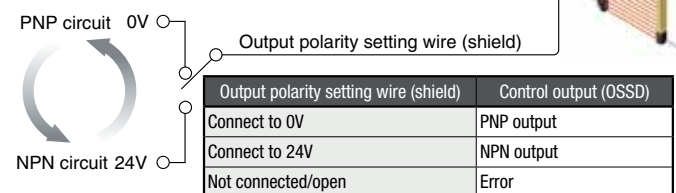
Supports both PNP and NPN outputs

Both PNP transistor output and NPN transistor output are available in one light curtain. Ideal for installation in overseas equipment requiring PNP, replacement with NPN sensors, positively grounded factories, and overseas transfer of equipment. A single light curtain supports control circuits worldwide.



PNP/NPN polarity LED

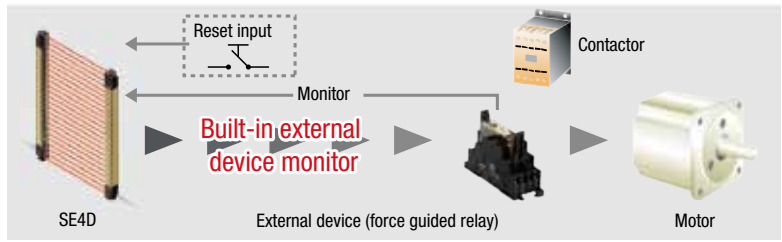
PNP/NPN can be switched easily by changing the wiring
PNP output is selected when the output polarity setting wire (shield) is connected to 0V, switches to NPN when connected to 24V.



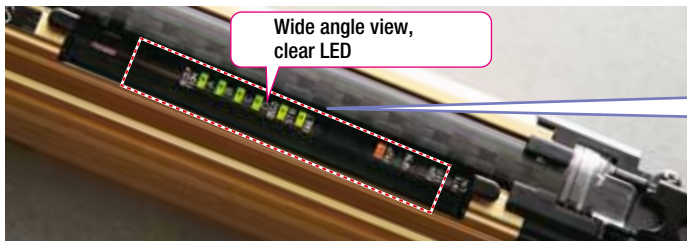
Safety circuits can be constructed without a safety relay module

- Safety Relay Module Not Required
- Save Space
- Reduce Cost

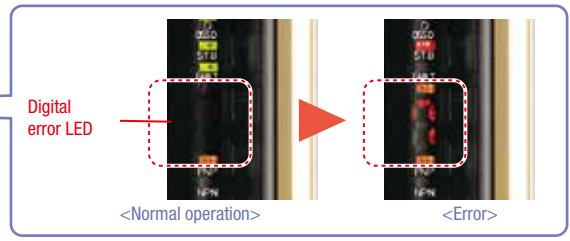
Because the light curtain has a built-in EDM (external device monitoring), a safety circuit can be easily constructed without a safety relay module. The control panel can be downsized and cost reduced.



Find the cause of an error at a glance



Wide angle view, clear LED



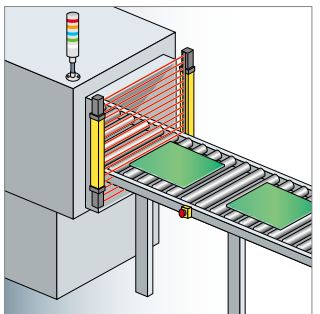
Digital error LED

- APEM
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- Safety Light Curtains
- Safety Modules

Easy construction and installation of safety circuits using blanking functions

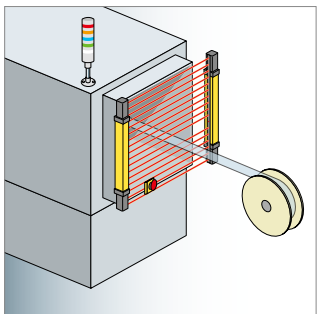
Fixed blanking function

Fixed blanking function prevents the control output (OSSD1/2) from turning off when a specific beam is interrupted. Used in applications where a specific beam is always interrupted. When the object is moved outside of the sensing area, the control output (OSSD1/2) turns off.



Floating blanking function

Floating blanking function prevents the control output (OSSD1/2) from turning off when the number of beams interrupted is less than the set number. The number that can be set is 1 to 3 beams. This function enables sensing even when the position of the obstacles changes in the sensing area.



Note: The size of the minimum sensing object changes when the floating blanking function is used.



A controller (SE9Z-HC) is required for setting the blanking function.

SE4D Safety Light Curtains

SE4D Safety Light Curtains

Main Unit

Package Quantity: 1 Set (Emitter/Receiver) (Note 1)

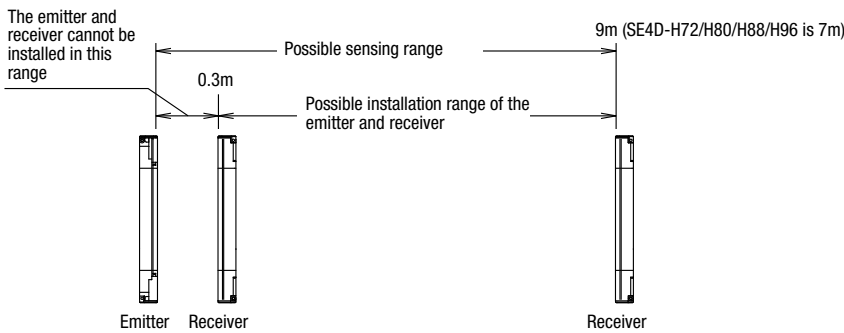
Shape	Minimum Sensing Object	Sensing Distance (Note 2) (Effective Distance)	No. of Beams	Sensing Length (mm)	Part No. (Note 3)
<p>The diagram shows a cross-section of the light curtain with multiple horizontal beams. Labels include 'Beam No.' pointing to a specific beam, 'Sensing Length' indicating the vertical distance between the top and bottom beams, and 'Beam pitch 20mm' showing the distance between adjacent beams. Small arrows indicate a 5mm offset from the top and bottom edges.</p>	<p>ø25mm</p>	<p>0.3 to 9m</p>	12	230	SE4D-H12
			16	310	SE4D-H16
			20	390	SE4D-H20
			24	470	SE4D-H24
			28	550	SE4D-H28
			32	630	SE4D-H32
			36	710	SE4D-H36
			40	790	SE4D-H40
			48	950	SE4D-H48
		<p>0.3 to 7m</p>	56	1,110	SE4D-H56
			64	1,270	SE4D-H64
			72	1,430	SE4D-H72
			80	1,590	SE4D-H80
			88	1,750	SE4D-H88
			96	1,910	SE4D-H96

Note 1: Mounting brackets and bottom cap cables are not included with the light curtain. Purchase an mounting bracket and bottom cap cable separately. (See E-133)

Note 2: The sensing distance is the possible setting distance between the emitter and the receiver.

Note 3: The light curtain with "E" in the part no. indicated on the nameplate is the emitter. The light curtain with "D" in the part no. indicated on the nameplate is the receiver.

Part number example: Emitter for SE4D-H12: SE4D-H12E Receiver for SE4D-H12: SE4D-H12D



Accessories (optional)

Cable (1 each for emitter and receiver)


Name and Shape	Part No.	Remarks
<p>8-pin Bottom Cap Cable</p>	Cable length: 3m Weight: 370g approx. (2 pcs)	<ul style="list-style-type: none"> Standard cable Cable diameter: ø6mm Cable color: For emitter - Gray For receiver - Gray with black line Minimum bending diameter: R6 mm
	Cable length: 7m Weight: 820g approx. (2 pcs)	
	Cable length: 10m Weight: 1,160g approx. (2 pcs)	
	Cable length: 15m Weight: 1,710g approx. (2 pcs)	
<p>12-pin Bottom Cap Cable</p>	Cable length: 3m Weight: 420g approx. (2 pcs)	<ul style="list-style-type: none"> Used for muting function Cable diameter: ø6mm Cable color: For emitter - Gray For receiver - Gray with black line Minimum bending diameter: R6 mm
	Cable length: 7m Weight: 930g approx. (2 pcs)	
<p>Cable for Series Connection</p>	Cable length: 0.5m Weight: 95g approx. (2 pcs)	<ul style="list-style-type: none"> Used for connecting the light curtains in series. Cable color: Gray (for emitter and receiver) Minimum bending diameter: R6 mm

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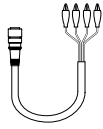
SE4D

SE4D Safety Light Curtains

Controller

Name and Shape	Part No.
 <p>Controller</p> <p>Adapter cable (2 pcs) included</p>	<p>SE9Z-HC</p>

- The controller is used for setting optional functions. See **E-135** for details.

Name and Shape	Part No.
 <p>Cable for Connecting the Controller</p>	<p>SE9Z-WNC1</p>

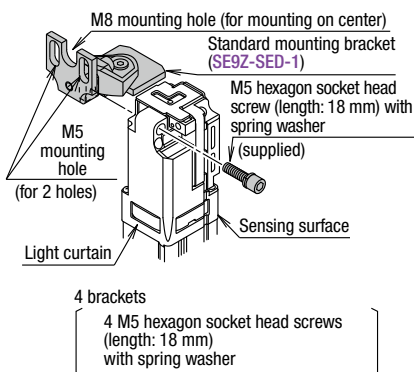
- The cable is used for connecting the controller and the light curtain. Order the cable when purchasing the controller.

Mounting Bracket

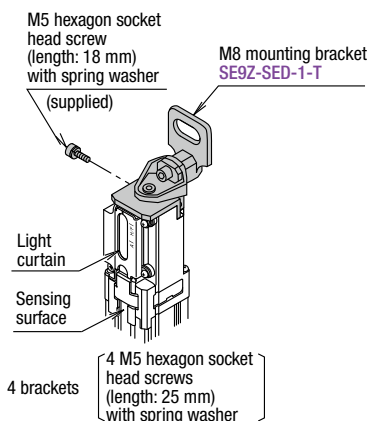
Package Quantity: 4

Name	Part No.	Remarks
Standard Mounting Bracket	SE9Z-SED-1	<ul style="list-style-type: none"> • Mounting bracket for easy adjustment of the beam axis. • For 2 pcs of hexagon socket head screw (M5) or 1 pc of hexagon socket head screw (M8). • The light curtain can be rotated 360 degrees. • Material: Zinc diecast
M8 Mounting Bracket	SE9Z-SED-1-T	<ul style="list-style-type: none"> • Mounting bracket for easy adjustment of the beam axis. • The light curtain can be rotated 360 degrees. • Material: Zinc diecast
Dead Space Mounting Bracket	SE9Z-SED-3	<ul style="list-style-type: none"> • Mounting bracket to remove dead space. • Material: Zinc diecast

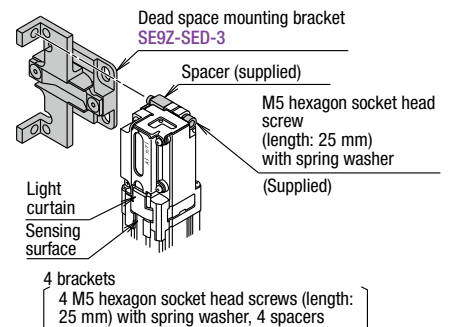
Standard Mounting Bracket (SE9Z-SED-1)



M8 Mounting Bracket (SE9Z-SED-1-T)



Dead Spaceless Mounting Bracket (SE9Z-SED-3)



Specifications

Common Specifications

Part No.	SE4D-H□	
Applicable standards	IEC/EN 61496-1 (TÜV), IEC 61496-2 (TÜV), IEC 61508-1 to 4 (TÜV), ISO 13849-1 (TÜV), EN 50178 (TÜV), EN 55011, EN 61000-6-2, UL 508 (UL), UL 61496-1/2 (UL), UL 1998 (UL), CSA C22.2 No.14 (c-UL), CSA C22.2 No.0.8 (c-UL)	
Minimum Sensing Object	ø25 mm (opaque)	
Effective Aperture Angle	When detection distance is more than 3m: within ±2.5° maximum (IEC 61496-2, UL 61496-2)	
Rated Voltage	24V DC ±20% Ripple P-P10% maximum	
Control output (OSSD1/2)	PNP open-collector transistor / NPN open-collector transistor (switching type) <PNP output> Maximum source current: 200mA Applied voltage: Same as supply voltage (between control output and +V) Residual voltage: 2.5V max. (source current 200mA, when using 15m length cable) Leakage current: 0.1mA max. (includes power off state) Maximum load capacity: 0.22µF (no load to max. output current) Load wiring resistance: 3Ω max.	
	<NPN output> Maximum sink current: 200mA Applied voltage: Same as supply voltage (between control output and 0V) Residual voltage: 2.5V max. (sink current 200 mA, when using 15m length cable) Leakage current: 0.1mA max. (includes power off state) Maximum load capacity: 0.22µF (no load to max. output current) Load wiring resistance: 3Ω max.	
	Operation mode (Output operation)	ON when all beams are received, OFF when one or more beams are interrupted (Note 1, 2) (Also turns OFF at sensor or synchronization error)
	Protection circuit (Short-circuit)	Built-in
Response Time	OFF response: 14ms max., ON response: 80 to 90ms	
Auxiliary output (Non-safety output)	PNP open-collector transistor / NPN open-collector transistor (switching type) <For PNP output> Maximum source current: 60mA Applied voltage: Same as supply voltage (between auxiliary output and +V) Residual voltage: 2.5V min. (source current 60mA, when using 15m length cable)	
	<For NPN output> Maximum sink current: 60mA Applied voltage: Same as supply voltage (between auxiliary output and 0V) Residual voltage: 2.5V min. (sink current 60mA, when using 15m length cable)	
	Operation mode (Output operation)	When OSSDs are ON: OFF, when OSSDs are OFF: ON (factory set) [Operation modes can be changed by using the SE9Z-HC controller (optional).]
	Protection circuit (Short-circuit)	Built-in
Response Time	OFF response: 34ms max., ON response: 110ms max.	
Interference Prevention Function	Built-in	
Emission Halt Function	Built-in	
Interlock Function	Built-in	
External Device Monitoring Function	Built-in	
Override Function	Built-in	
Muting Function	Built-in	
Optional Functions (Note 4)	Fixed blanking function, Floating blanking function, Auxiliary output switching function, Interlock setting adjust function, External relay monitoring setting adjust function, Muting setting adjust function, Protect function, Emitted light intensity control function	
Degree of Protection	IP65, IP67 (IEC 60529)	
Operating Conditions	Operating temperature: -10 to +55°C (no freezing) Relative humidity: 30 to 85%RH (no condensation) Storage temperature: -25 to +70°C (no freezing) Storage humidity: 30 to 95%RH (no condensation) Pollution Degree: 3	
Operating Illuminance	Incandescent lamp: 3,500 lux max. at light-receiving surface	
Dielectric Strength	1,000V AC, 1 minute between power terminals connected together and enclosure	
Insulation Resistance	20MΩ minimum (500V DC megger) between power terminals connected together and enclosure	
Vibration Resistance	Damage limits: 10 to 55Hz, amplitude: 0.75mm 2 hours each in 3 axes	
Shock Resistance	Damage limits: 300m/s ² (30G approx.) 3 times each in 3 axes	
Light Source	Infrared LED (emission wavelength = 870nm)	
Connection	Connector	
Material	Enclosure: Aluminum, Upper / lower case: SPCC, Sensing surface: PC / Polyester resin, Cap: PBT	
Accessories	SE9Z-SED-2 (intermediate supporting bracket) (Note 3), SE9Z-TR25 (test rod): 1	

Note 1: Does not turn OFF during muting even when the light beam is interrupted.

Note 2: When the blanking function is enabled, the operation mode will change.

	Floating blanking function			
	No setting	Setting		
		1 beam	2 beam	3 beam
SE4D-H□ (minimum sensing object)	ø25mm	ø45mm	ø65mm	ø85mm

Note 3: The number of intermediate supporting bracket supplied differs with each model.

1 set: SE4D-H40/H48/H56, 2 sets: SE4D-H64/H72/H80, 3 sets: SE4D-H88/H96

Note 4: When using the optional function, the controller is required. For specification on the controller, see E-135.



SE4D Safety Light Curtains

Individual Specifications

Part No.	SE4D-H12	SE4D-H16	SE4D-H20	SE4D-H24	SE4D-H28	SE4D-H32
No. of Beams	12	16	20	24	28	32
Sensing Range	0.3 to 9m					
Beam Width	20mm					
Protective Height	230mm	310mm	390mm	470mm	550mm	630mm
Current Consumption	Emitter: 70mA max., Receiver: 95mA max.			Emitter: 80mA max., Receiver: 115mA max.		
PFHd	1.8×10^{-9}	2.0×10^{-9}	2.2×10^{-9}	2.4×10^{-9}	2.6×10^{-9}	2.8×10^{-9}
MTTFd	100 years minimum					
Weight (approx.) (total of emitter and receiver)	510g	660g	810g	960g	1,110g	1,260g

Part No.	SE4D-H36	SE4D-H40	SE4D-H48	SE4D-H56	SE4D-H64	SE4D-H72
No. of Beams	36	40	48	56	64	72
Sensing Range	0.3 to 9m					0.3 to 7m
Beam Width	20mm					
Protective Height	710mm	790mm	950mm	1,110mm	1,270mm	1,430mm
Current Consumption	Emitter: 80mA max. Receiver: 115mA max.		Emitter: 90mA max. Receiver: 140mA max.		Emitter: 100mA max. Receiver: 160mA max.	
PFHd	3.0×10^{-9}	3.2×10^{-9}	3.6×10^{-9}	4.0×10^{-9}	4.4×10^{-9}	4.8×10^{-9}
MTTFd	100 years minimum					
Weight (approx.) (total of emitter and receiver)	1,420g	1,570g	1,870g	2,170g	2,470g	2,770g

Part No.	SE4D-H80	SE4D-H88	SE4D-H96
No. of Beams	80	88	96
Sensing Range	0.3 to 7m		
Beam Width	20mm		
Protective Height	1,590mm	1,750mm	1,910mm
Current Consumption	Emitter: 110mA max. Receiver: 180mA max.		Emitter: 120mA max. Receiver: 200mA max.
PFHd	5.2×10^{-9}	5.6×10^{-9}	6.0×10^{-9}
MTTFd	100 years minimum		
Weight (approx.) (total of emitter and receiver)	3,070g	3,370g	3,670g

Note: PFHd (Probability of dangerous failure per hour), MTTFd (Mean time to dangerous failure)

Controller

Part No.	SE9Z-HC
Supply Voltage	24V DC $\pm 10\%$ Ripple P-P10 % or less (common to light curtain power supply)
Current Consumption	65mA max.
Communication Method	RS-485 two-way communications (exclusive procedure)
Digital LED	4-digit red LED display $\times 2$ (selected beams and settings are displayed)
Functional LED	Green LED $\times 9$ (lights on when set)
Functions	Fixed blanking function (factory setting: disabled) / Floating blanking function (factory setting: disabled) / Auxiliary output switching function (factory setting: negative logic of OSSD) / Emitted light intensity control function (factory setting: disabled) / Muting setting adjust function (factory setting: all beam channels enabled, A = B (Note 1), Muting lamp diagnosis function enabled, Muting sensor output operation N.O/N.O) / Interlock setting adjust function (factory setting: start / restart) / External device monitoring setting adjust function (factory setting: enabled, 300 ms) / Override setting adjust function, Setting detail monitoring function / Protect function (factory setting: disabled) (factory password setting: 0000) / Initialization function / Copy function
Operating Conditions	Operating Temperature: -10 to $+55^\circ\text{C}$ (no freezing) Operating Humidity: 30 to 85% RH (no condensation) Storage Temperature: -25 to $+70^\circ\text{C}$ (no freezing) Storage Humidity: 30 to 85% RH (no condensation)
Dielectric Strength	1,000V AC, 1 minute between power terminals connected together and enclosure
Insulation Resistance	20M Ω min. (500V DC megger) between power terminals connected together and enclosure
Cable	8-core shielded cable, 0.5 m 1.640 ft long, with a connector at the end (2 cables)
Weight (approx.)	200g
Accessories	Adapter cable: 2

• The operating humidity is $+20^\circ$ for measurement conditions that are not specified.

Note 1: To enable the muting function, the input order of A or B can be specified.

At factory setting, the muting function is enabled whether muting A or B is input first.

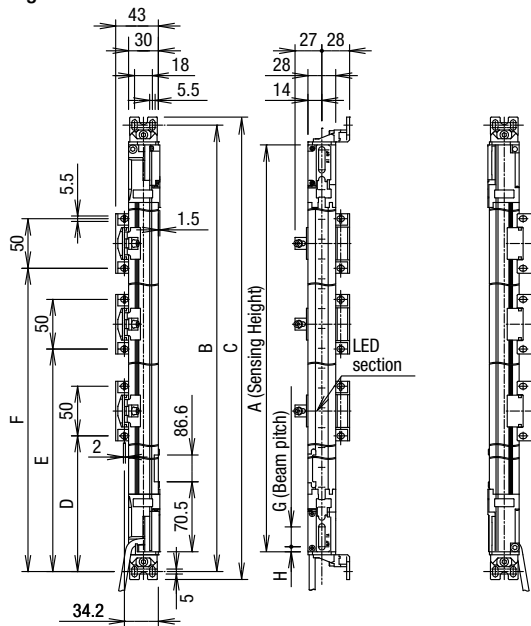
For more information, visit <http://asia.idec.com>

Dimensions

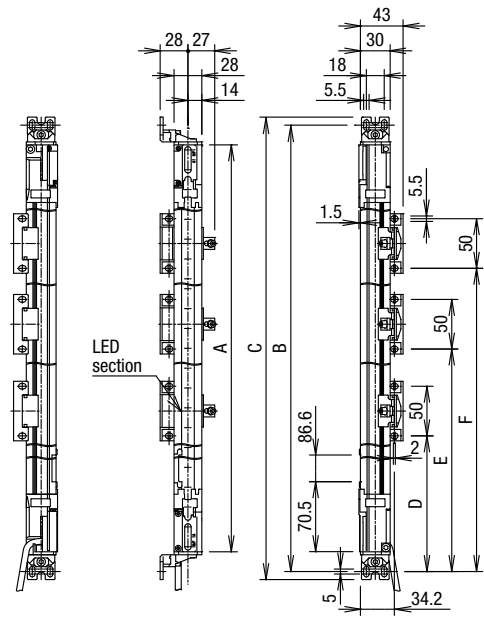
Light Curtains with Standard Mounting Bracket (SE9Z-SED-1) and Intermediate Supporting Bracket (Note 1)

Side Mounting

Emitter

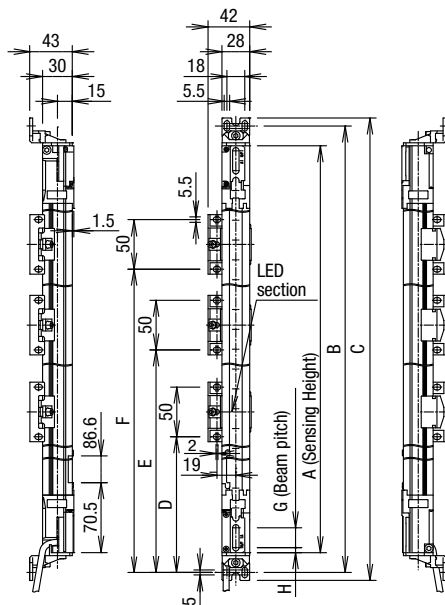


Receiver

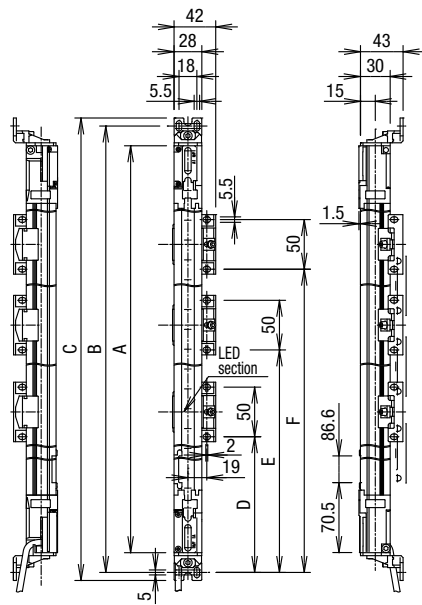


Rear Mounting

Emitter



Receiver



Part No.	A	B	C	D	E	F
SE4D-H12	230	270	286	—	—	—
SE4D-H16	310	350	366	—	—	—
SE4D-H20	390	430	446	—	—	—
SE4D-H24	470	510	526	—	—	—
SE4D-H28	550	590	606	—	—	—
SE4D-H32	630	670	686	—	—	—
SE4D-H36	710	750	766	—	—	—
SE4D-H40	790	830	846	390	—	—
SE4D-H48	950	990	1,006	470	—	—
SE4D-H56	1,110	1,150	1,166	550	—	—
SE4D-H64	1,270	1,310	1,326	418	842	—
SE4D-H72	1,430	1,470	1,486	472	948	—
SE4D-H80	1,590	1,630	1,646	525	1,055	—
SE4D-H88	1,750	1,790	1,806	433	870	1,308
SE4D-H96	1,910	1,950	1,966	473	950	1,428

Part No.	G	H
SE4D-H□	20	5

Note 1: The intermediate supporting bracket (SE9Z-SED-2) is supplied (for SE4D-H40 to H96). The number of brackets supplied varies according to the model. (See E-134)

• See E-138 for bracket dimensions.

All dimensions in mm.

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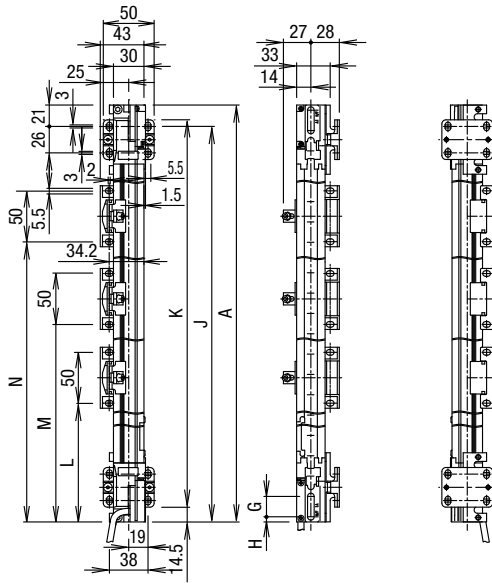
Download catalogs and CAD from <http://asia.idec.com/downloads>

SE4D Safety Light Curtains

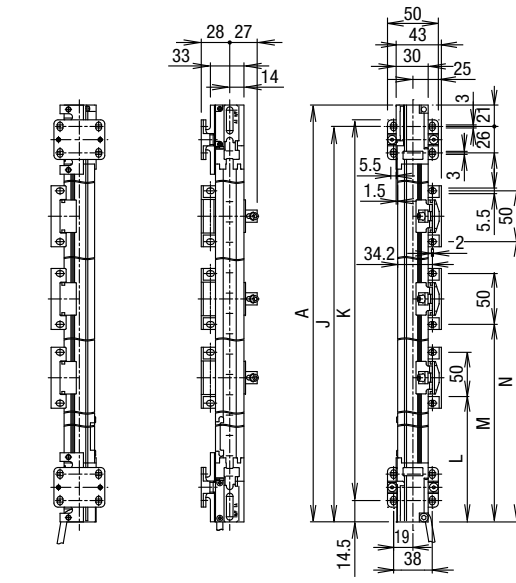
Light Curtains with Dead Space Mounting Bracket (SE9Z-SED-3) and Intermediate Supporting Bracket (Note 1)

Side Mounting

Emitter

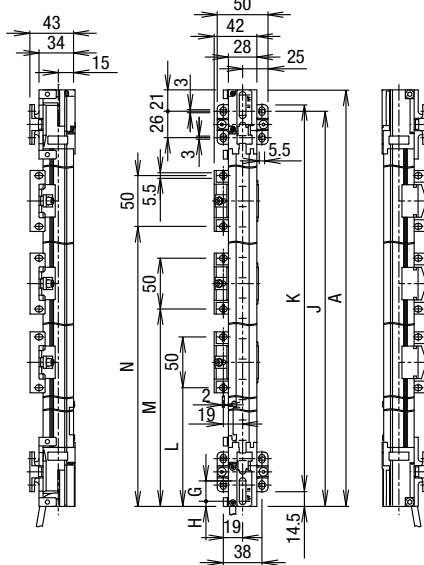


Receiver

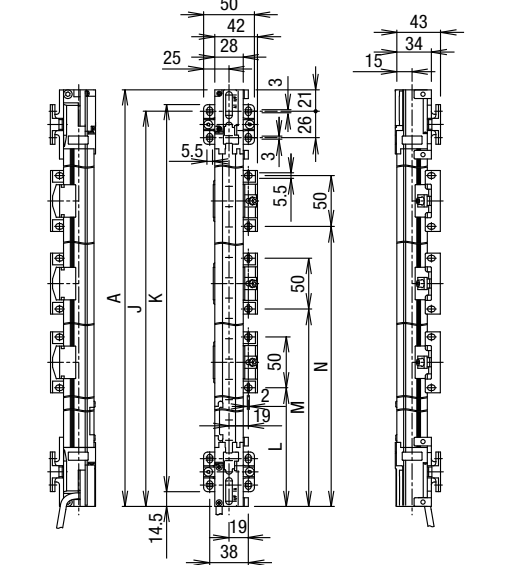


Rear Mounting

Emitter



Receiver



Part No.	A	J	K	L	M	N
SE4D-H12	230	209	201	—	—	—
SE4D-H16	310	289	281	—	—	—
SE4D-H20	390	369	361	—	—	—
SE4D-H24	470	449	441	—	—	—
SE4D-H28	550	529	521	—	—	—
SE4D-H32	630	609	601	—	—	—
SE4D-H36	710	689	681	—	—	—
SE4D-H40	790	769	761	370	—	—
SE4D-H48	950	929	921	450	—	—
SE4D-H56	1,110	1,089	1,081	530	—	—
SE4D-H64	1,270	1,249	1,241	398	822	—
SE4D-H72	1,430	1,409	1,401	452	928	—
SE4D-H80	1,590	1,569	1,561	505	1,035	—
SE4D-H88	1,750	1,729	1,721	413	850	1,288
SE4D-H96	1,910	1,889	1,881	453	930	1,408

Part No.	G	H
SE4D-H□	20	5

Note 1: The intermediate supporting bracket (SE9Z-SED-2) is supplied (for SE4D-H40 to H96).
The number of brackets supplied varies according to the model. (See E-134)

• See E-138 for bracket dimensions.

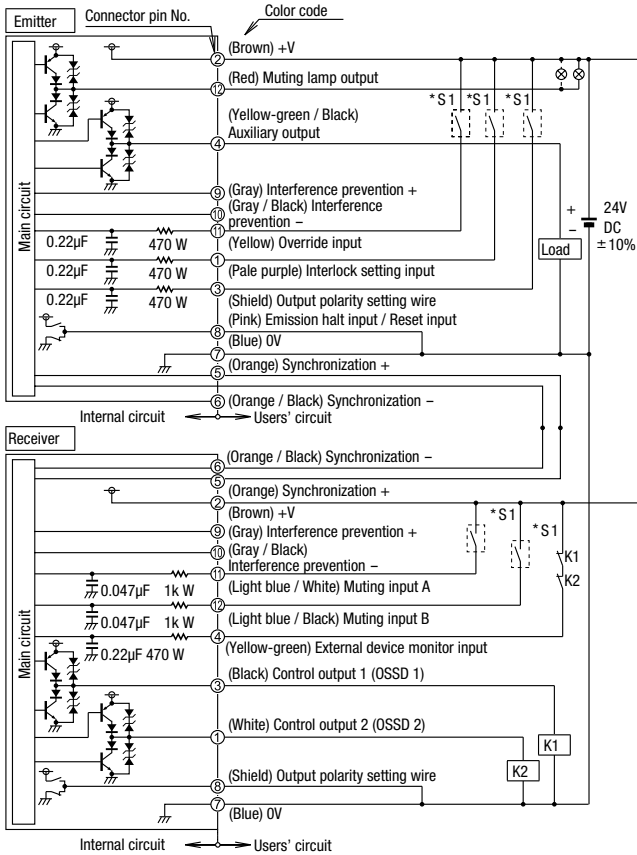
All dimensions in mm.

SE4D Safety Light Curtains

Wiring Example

I/O Circuit Diagram and Output Waveform

PNP Output



*S1

Switch S1

- Emission halt input / Reset input
For manual reset
Vs to Vs - 2.5V (sink current 5mA max.): Light Emit Stop (Note 1)
Open: light emit
For automatic reset
Vs to Vs - 2.5V (sink current 5mA max.): Light emit (Note 1)
Open: Light emit stop
- Interlock setting input, Override input, Muting input A / B, External device monitor input
Vs to Vs - 2.5V (sink current 5mA max.): Enabled (Note 1) Open: Disabled

Note 1: Vs is the applied supply voltage.

- The above circuit diagram is for 12-core cable. For 8-core cable, red, yellow, gray, gray/black, light blue/white, and light blue/black lead wires are not provided.
- The above circuit is for PNP output. When using NPN output, see the instruction manual.

[Reference]

K1, K2: External device (force guided relay or magnet contactor)

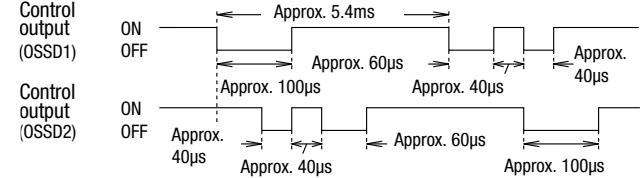
Output waveform [when control output (OSSD1/2) is on]

Because the receiver performs self-diagnosis of the output circuit when the device is in light receiving status (ON), the output transistor periodically becomes OFF. (See time chart on the right) When the OFF signal is normal, the receiver judges the output circuit as normal. When the OFF signal is not normal, the receiver judges the output circuit or wiring as an error and the control output (OSSD1/2) maintains an OFF status.



The OFF signal of the device may cause malfunction of the machine. Take into consideration the input response time of the machine connected to the device.

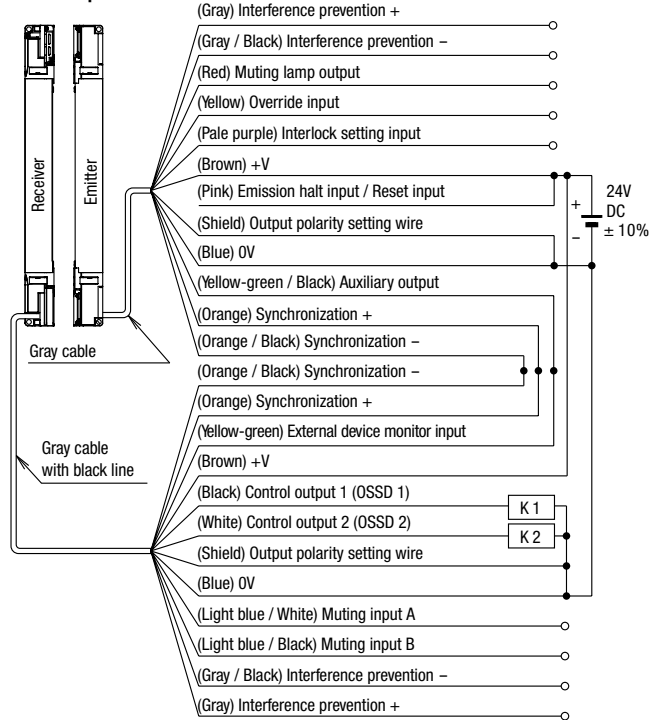
Time Chart



Basic Wiring

The emitter and receiver are set facing each other. The output signal (OSSD1/2) turns OFF when the light is interrupted and turns ON when it receives the light. The auxiliary output is used to disable the external device monitoring function. The auxiliary output should be set to "negative logic of the control output" (factory setting). The auxiliary output cannot be connected to external devices.

PNP Output




Interlock function	Disabled (auto-reset)
External device monitoring function	Disabled
Auxiliary output	N/A

- The above circuit diagram is for 12-core cable. For 8-core cable, red, yellow, gray, gray/black, light blue/white, and light blue/black lead wires are not provided.
- The above circuit diagram is for PNP output. When using NPN output, see the instruction manual.

Series Connection (category 4 compliant)

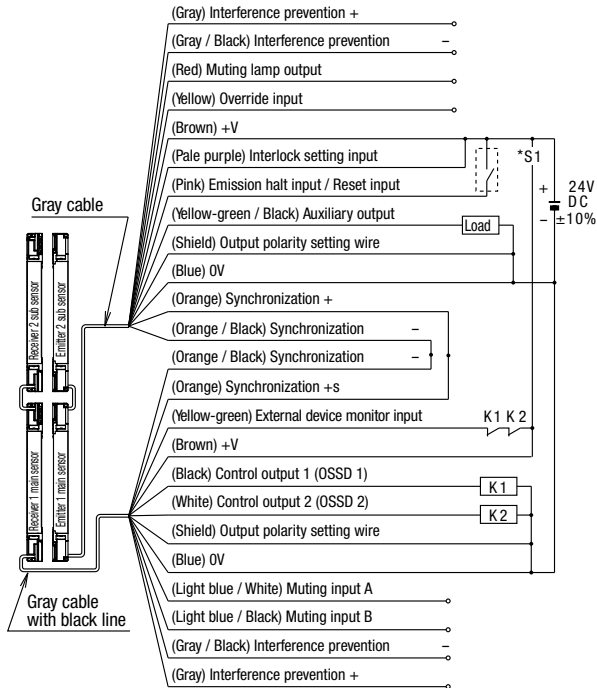
[Connect up to 3 sets (emitter/receiver)
(up to 192 beams max.)]

Several emitters and receivers are set opposite to each other. A dangerous area can be reached from two or more directions. The control output (OSSD1/2) turns OFF when the beam of any of the light curtains are interrupted.



When connecting in series, connect the emitter and emitter, receiver and receiver with an exclusive cable (SE9Z-CSL05) as shown in the diagram below. Incorrect wiring may create a non-sensing area which may cause death or serious injury.

PNP Output



Interlock function	Enabled (manual reset)
External device monitoring function	Enabled
Auxiliary output	Available

The device output is set by connecting to the output polarity setting wire (shield). Improper wiring may cause lockout.

*** Symbols**

Switch S1
Vs to Vs – 2.5V (sink current 5 mA max.): Light emit stop (Note 1),
Open: Light emit
K1, K2: External device (forced guided relay or magnetic contactor)


Note 1: Vs is the applied supply voltage.

- The above circuit diagram is for 12-core cable. For 8-core cable, red, yellow, gray, gray/black, light blue/white, and light blue/black lead wires are not available.
- To reset, see the instruction manual.
- The above circuit is for PNP output. When using NPN output, see the instruction manual.

Parallel Connection (category 4 compliant)

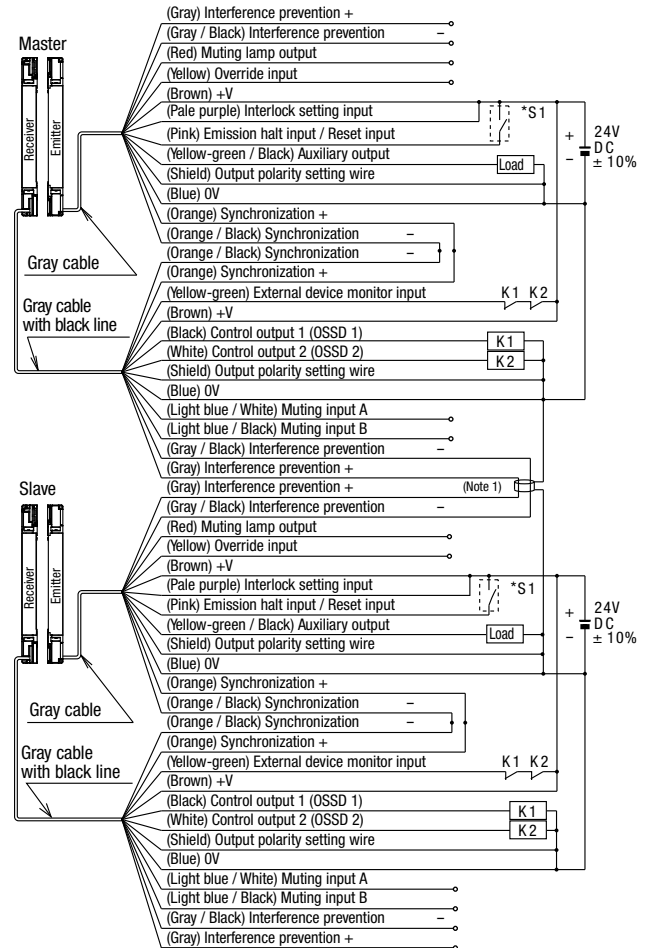
Several emitters and receivers are set opposite to each other. There are two dangerous areas and each area can be reached from only one direction. By connecting the interference prevention line, up to 3 sets of light curtains can be connected in parallel.

Only the control output (OSSD1/2) of the light curtain which the light is interrupted turns OFF.



When connecting in parallel, connect the receiver of one light curtain to the emitter of another light curtain using the interference prevention line. Incorrect wiring may create a non-sensing area which may cause death or serious injury.

PNP Output



Interlock function	Enabled (manual reset)
External device monitoring function	Enabled
Auxiliary output	Available

The device output is set by connecting to the output polarity setting wire (shield). Improper wiring may cause lockout.

*** Symbols**

Switch S1
Vs to Vs – 2.5V (sink current 5 mA max.): Light emit stop (Note 2) Open: Light emit
K1, K2: External device (forced guided relay or magnetic contactor)

Note 1: To extend the interference prevention wire, use a 0.2 mm² shielded twisted pair cable (not supplied).

Note 2: Vs is the applied supply voltage.

- To reset, see the instruction manual.
- The above circuit is for PNP output. When using NPN output, see the instruction manual.

APEM

Switches & Pilot Lights

Control Boxes

Emergency Stop Switches

Enabling Switches

Safety Products

Explosion Proof

Terminal Blocks

Relays & Sockets

Circuit Protectors

Power Supplies

LED Illumination

Controllers

Operator Interfaces

Sensors

AUTO-ID

Interlock Switches

Non-contact Interlock Switches

Safety Laser Scanners

Safety Light Curtains


Safety Modules

SE4D

SE4D Safety Light Curtains

Series and Parallel Mixed Connection (control category 4 wiring example)

Several emitters and receivers are set opposite to each other in parallel and in series combinations. This connection is used where there are more than 2 dangerous areas and the dangerous areas can be reached from two or more directions. Up to 3 sets of the light curtains can be connected in series and in parallel depending on the combination. However the total number of beams should be up to 192 beams maximum. In a series connection, the control output (OSSD1/2) will become OFF when the light of any of the light curtains is interrupted.



- When connecting in series, connect the emitter and emitter, receiver and receiver with an exclusive cable (SE9Z-CSL05) as shown in the diagram below. Incorrect wiring may create a non-sensing area which may cause death or serious injury.
- When connecting in parallel, connect the receiver of one light curtain to the emitter of another light curtain using the interference prevention line. Incorrect wiring may create a non-sensing area which may cause death or serious injury.

Interlock function	Enabled (manual reset)
External device monitoring function	Enabled
Auxiliary output	Available

The device output is set by connecting to the output polarity setting wire (shield). Improper wiring may cause lockout.

* Symbols

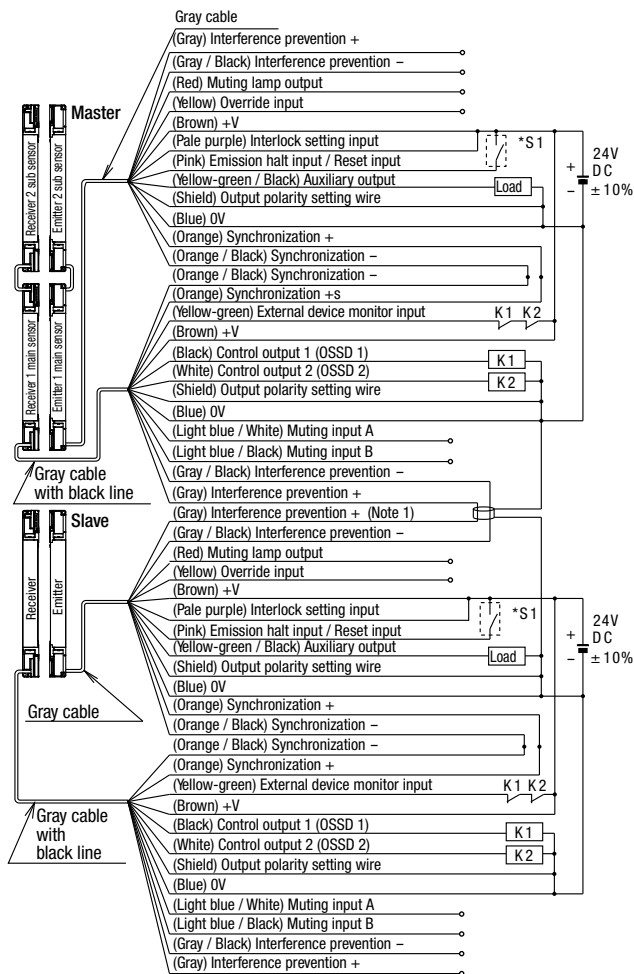
Switch S1
Vs to Vs – 2.5V (sink current 5 mA max.): Light emit stop (Note 2) Open: Light emit
K1, K2: External device (forced guided relay or magnetic contactor)

Note 1: To extend the interference prevention wire, use a 0.2 mm² shielded twisted pair cable (not supplied).

Note 2: Vs is the applied supply voltage.

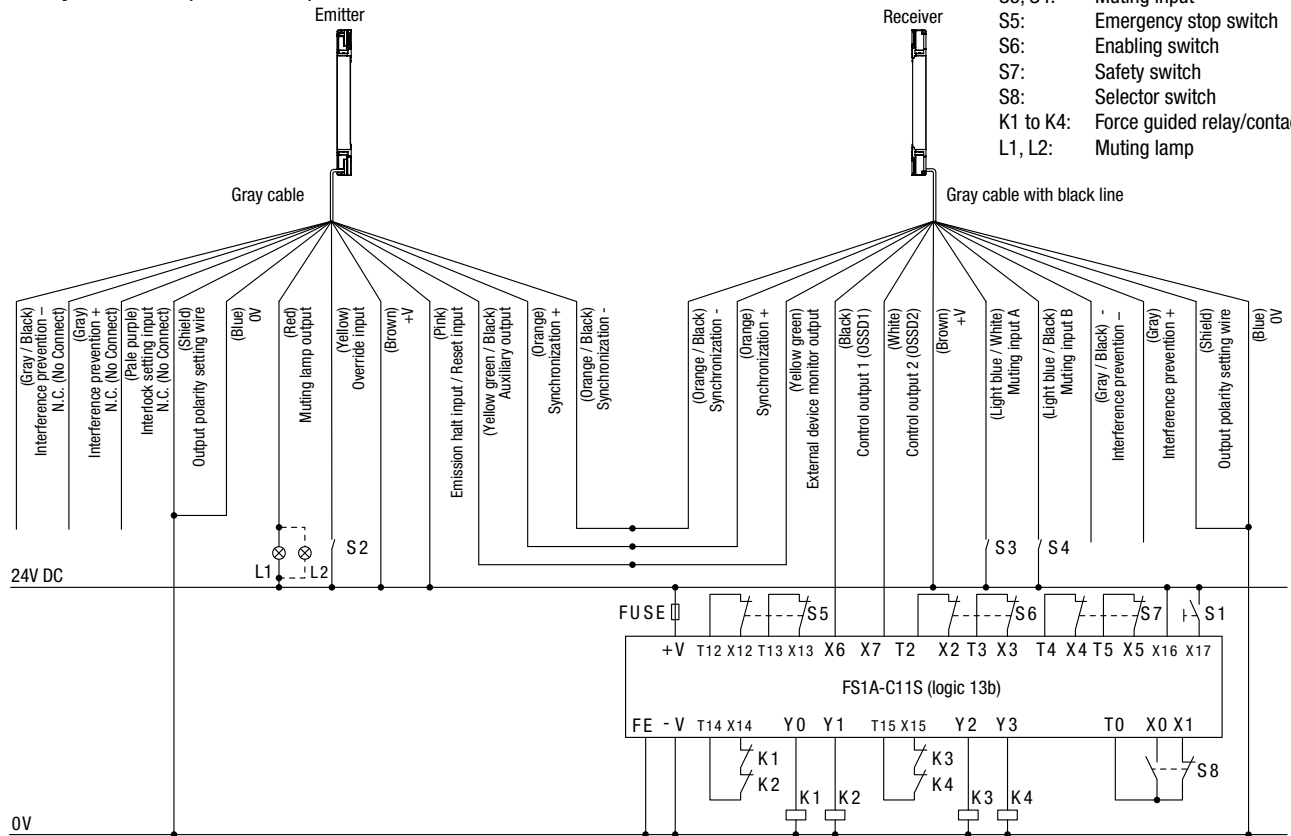
- To reset, see the instruction manual.
- The above circuit is for PNP output. When using NPN output, see the instruction manual.

PNP Output



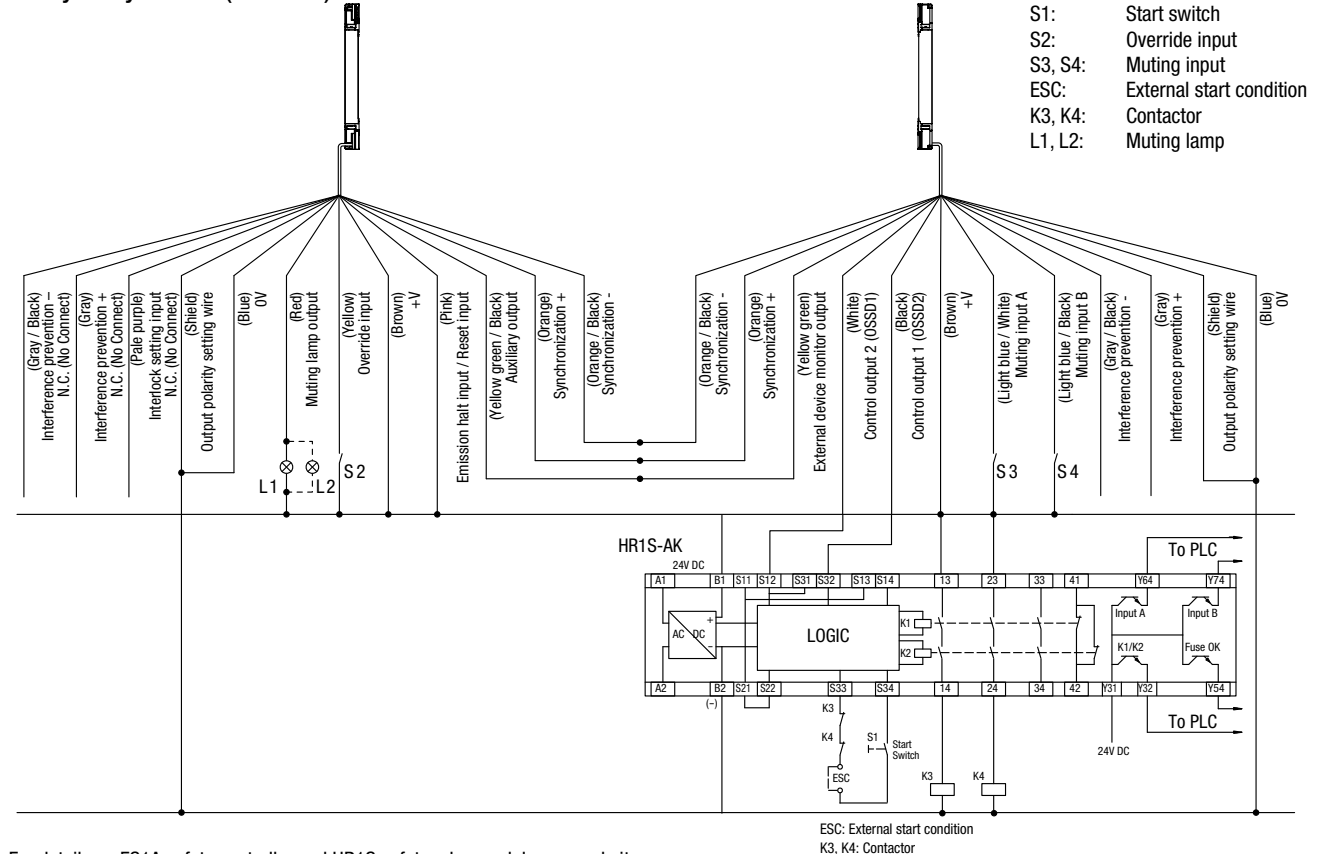
Wiring Example

Safety Controller (FS1A-C11S)



Wiring Example

Safety Relay Module (HR1S-AK)



For details on FS1A safety controller and HR1S safety relay module, see website.

- APEM
- Switches & Pilot Lights
- Control Boxes
- Emergency Stop Switches
- Enabling Switches
- Safety Products
- Explosion Proof
- Terminal Blocks
- Relays & Sockets
- Circuit Protectors
- Power Supplies
- LED Illumination
- Controllers
- Operator Interfaces
- Sensors
- AUTO-ID

- Interlock Switches
- Non-contact Interlock Switches
- Safety Laser Scanners
- Safety Light Curtains
- Safety Modules

SE4D

SE4D Safety Light Curtains

Interlock Function

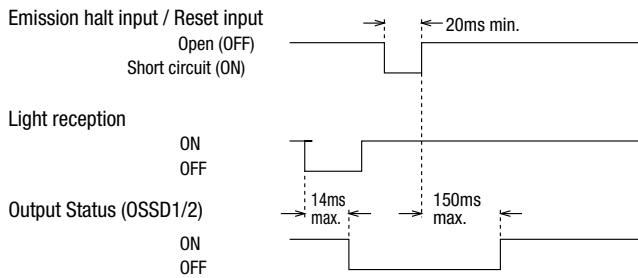
Manual reset and automatic reset can be selected by wiring the interlock setting input. Interlock is enabled when manual reset is selected.

Interlock setting input wire (pale purple)	Interlock function
For PNP output: connect to +V For NPN output: connect to 0V	Manual reset
Open	Automatic reset

When using the interlock function, make sure that the operator is not in the danger zone. Otherwise, death or injury may result.

Manual reset: The control output (OSSD1/2) does not automatically turn ON when the light curtain receives the light. The control output (OSSD1/2) turns ON when reset while receiving the light. [To reset: Open Emission halt input / Reset input → Short-circuit 0V or +V → Open]

Time Chart



Install the reset button where the entire danger zone is visible and can be operated outside of the danger zone.

Automatic reset: The control output (OSSD1/2) automatically turns ON when the light curtain receives the light.

When using the light curtain in automatic reset mode, prevent automatic restart of the system after safety output is stopped using a safety relay module (from EN 60204-1).

<Reference>

Interlocking conditions can be changed by using the SE9Z-HC controller (optional)

Emission Halt Function

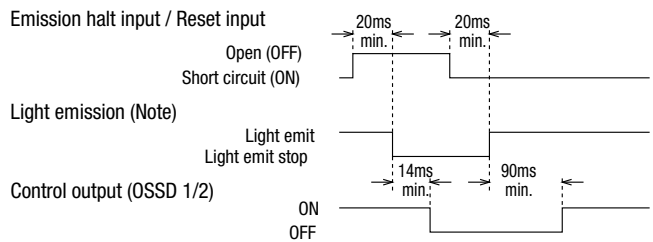
This function stops the emitter from emitting light. Emission / Emission halt can be selected in an emission halt input status.

Interlock function	Emission halt input/ Reset input (pink)	Emission halt input	Control output (OSSD1/2) status
Manual reset	Open	Disabled	ON
	PNP output: connect to +V NPN output: connect to 0V	Enabled	OFF
Automatic Reset	Open	Enabled	OFF
	PNP output: connect to +V NPN output: connect to 0V	Disabled	ON

Control output (OSSD1/2) is OFF when the light is not emitted. By using this function, malfunction due to noise and abnormal operation of control output (OSSD1/2) or auxiliary output can be determined from the equipment side.

To return to normal operation, connect the Emission halt input / Reset input to 0V or +V. (manual reset: open)

Time Chart



Note: Operation in automatic reset mode. In manual reset mode, the light emits when open, stops when short-circuited.

Do not use the emission halt function for the purpose of stopping the operation of the machine on which the SE4D is installed. Otherwise, death or injury may result.

Interference Prevention Function

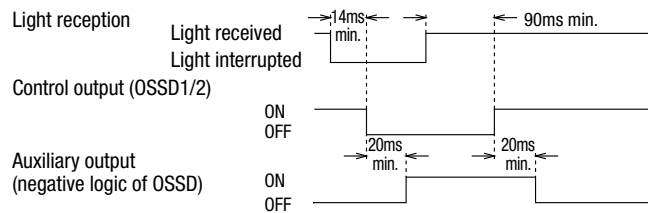
To prevent the interference of light between devices, an interference prevention system can be constructed. In the interference prevention system, up to 3 sets of the light curtain can be connected in a series and parallel combination. The maximum number of light beams is 192 when connected in a series and parallel combination. For details, see the instruction manual.

Auxiliary Output (Non-Safety Output)

An auxiliary output is available for non-safety use. The auxiliary output is equipped on the receiver.

Auxiliary output setting	Emission halt input	Normal Operation		Lock out
		Control output (OSSD1/2) status		
		Light received	Light interrupted	
Negative logic of OSSD (factory setting)	ON	OFF	ON	ON

Time Chart



Do not use the auxiliary output for the purpose of stopping the operation of the machine on which the SE4D is installed. Otherwise, death or injury may result.

<Reference>

The output operation settings of the auxiliary output can be changed by using the SE9Z-HC controller (optional).

External Device Monitoring Function

This function checks that the external device (force guided relay or magnet contactor) connected to the control output (OSSD1/2) operates normally according to the control output (OSSD1/2). If the NO contact of the external device is monitored and abnormal operation such as contact welding is detected, the light curtain goes to a lockout state and turns off the control output (OSSD1/2).

Enabling the external device monitoring

Connect the external device (force guided relay or magnet contactor) connected to control output 1 (OSSD1) wire (black) and control output 2 (OSSD2) to the external device monitoring input wire (yellow green).

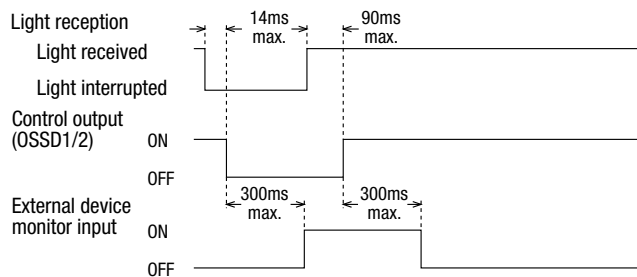
Disabling the external device monitoring

Connect the external device monitoring wire (yellow green) to the auxiliary output wire (yellow green / black). The setting of the auxiliary output should be "negative logic of control output (OSSD1/2)" (at factory setting). Use the SE9Z-HC controller (optional) to set the auxiliary output.

<Reference>

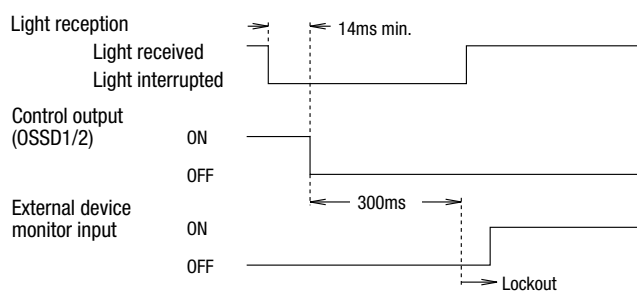
External devices cannot be connected to the auxiliary output when the external device monitoring function is disabled.

Time chart (normal)

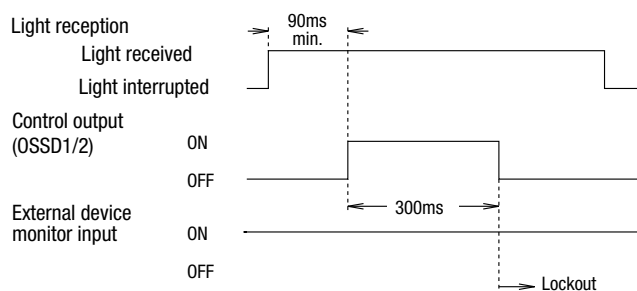


The set time for the device monitoring is 300 ms maximum. Lockout occurs when it exceeds 300 ms. Using the SE9Z-HC controller (optional), setting from 100 to 600 ms (in 10 ms units) is possible.

Time chart (error 1)



Time chart (error 2)



Muting Function



- Incorrect use of muting control may cause accidents. Be sure to understand how to configure muting control. Muting control should comply with the following international standards.

ISO 13849-1 (EN ISO 954-1 / JIS B 9705-1):

"Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design, Article 5.9 Muting"

IEC 61496-1 (ANSI/UL 61496 / JIS B 9704-1):

"Safety of machinery - Electro sensitive protective equipment - Part 1: General requirements and tests" Annex A, A.7 Muting

IEC 60204-1 (JIS B 9960-1):

"Safety of machinery - Electrical equipment of machines - Part 1: General requirements, 9.2.4 Overriding safeguards"

EN 415-4:

"Safety of packaging machines - Part 4: Palletizers and depalletizers, Annex A, A.2.2 Muting"

ANSI B11.19-1990:

"for Machine Tools-Safeguarding When Referenced by the Other B11 Machine Tool Safety Standards-Performance Criteria for the Design, Construction, Care, and Operation" 4.2.3 Presence-Sensing Devices: Electro-Optical and Radio Frequency (R.F.)

ANSI/RIA R15.06-1999:

"for Industrial Robots and Robot Systems - Safety Requirements, 10.4.5 Muting"

- The muting function should be used when the machine cycle is not in a dangerous mode. Maintain safety during muting by other methods.
- In an application where muting activates when the object passes through, align the muting sensor so that muting conditions are not satisfied when a person enters without the object passing through.
- Make sure that the muting lamp is visible from the operator during set up or adjustment.
- Make sure to check operation before using the muting lamp. Also check the muting lamp conditions (for dirt or brightness).

Muting temporarily disables the safety functions of the light curtain. When the control output (OSSD1/2) is ON, the muting function is used for passing the object through the sensing area without stopping the machine. All of the following conditions must be satisfied:

- Control output (OSSD1/2) is ON.
- An incandescent lamp (3 to 10W) is connected to the muting lamp output. (Note 1)
- Muting input A, B changes from OFF (open) to ON. In this case, the time difference from when the muting input A, B turns ON is 0.03 to 3 sec (Note 2)

Photoelectric sensors and proximity sensors with semiconductor output and position switches with NO (normally open) contacts can be used as muting sensors.

Note 1: Muting lamp diagnosis function can be set using a SE9Z-HC controller (optional). When the muting lamp diagnosis function is disabled, the muting function is maintained even if the lamp is worn out or disconnected.

Note 2: Using a SE9Z-HC controller (optional) and by connecting a NO (normally open) type muting sensor to muting input A and connecting NC (normally closed) type muting sensor to muting input B, the time can be set to 0 to 3 sec.

Output Operation of Muting Sensor

	When ON	When OFF
NO (normally open) type		
ON when no light is received (photoelectric sensor)	Output 0V or +V	Open
ON when approached (proximity sensor)		
ON when contacted (position switch)		

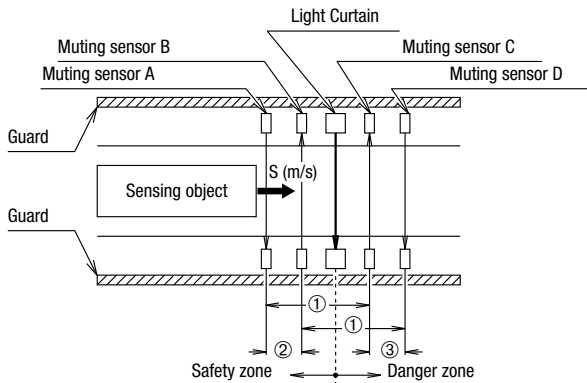


SE4D Safety Light Curtains



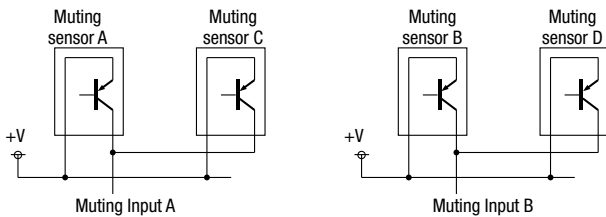
Use muting sensors that satisfy the conditions mentioned in the table (Output Operation of Muting Sensor) on the previous page. Using muting sensors that are not described in the table may activate the muting function unexpectedly and could result in death or serious accidents.

Installation Example of Muting Sensors

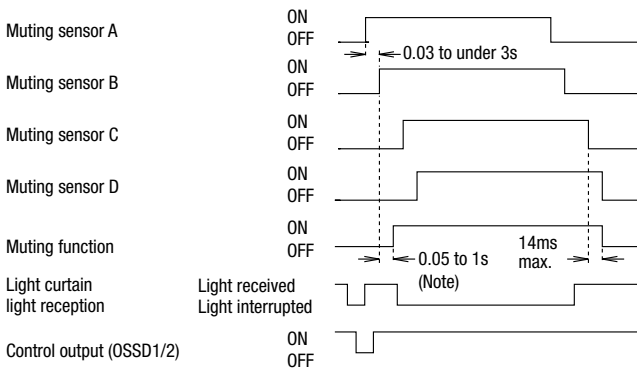


- ① Shorten the distance between the muting sensor A-C and B-D than the length of the sensing object.
- ② The time taken for the sensing object to pass through shall be from 0.03 to under 3 sec.
 $\text{Distance between muting sensor A-B (m)} < S \text{ (m/sec)} \times 3 \text{ (sec)}$
 S : Velocity of the sensing object (m/sec)
- ③ The time taken for the sensing object to pass through muting sensor C-D shall be under 3 sec.
 $\text{The distance between muting sensor C-D (m)} < S \text{ (m/sec)} \times 3 \text{ (sec)}$
 S : Velocity of the sensing object (m/sec)

PNP Output



Time Chart



Note: When the muting lamp diagnosis function is enabled, if the muting lamp does not turn on even after 1 second has passed, the muting function will be disabled. When the muting lamp diagnosis function is disabled, the muting sensor will activate 0.05 seconds after the input conditions for the muting sensor A (C) and B (D) are satisfied.

<Reference>

By using the SE9Z-HC controller (optional), the muting function of each beam can be disabled and the input order of muting input A and B can be changed. It is recommended that two muting lamps are connected in parallel. However, make sure that it does not exceed 10W.

Override Function

The override function forcibly disables the safety function of the light curtain. The override function can be used when the control output (OSSD1/2) is OFF during muting or when the muting sensor is ON at start-up of the line operation.

The override function is enabled when all of the following conditions are satisfied.

- Incandescent lamp (3 to 10W) incandescent lamp is connected to the muting lamp output (Note 1).
- Signals are input in both or either of muting A or B.
- Override input is short-circuited to 0V or +V, emission stop input/reset input is opened. (3 seconds continuously)

The override function will be disabled when any of the three conditions are disabled or when the time exceeds 60 seconds (Note 2).

Note 1: Muting lamp diagnosis function can be set using a SE9Z-HC controller (optional). When the muting lamp diagnosis function is disabled, the muting function is maintained even if the lamp is worn out or disconnected.

Note 2: Using the SE9Z-HC controller (optional), setting from 60 to 600 ms (in 10 sec units) is possible.

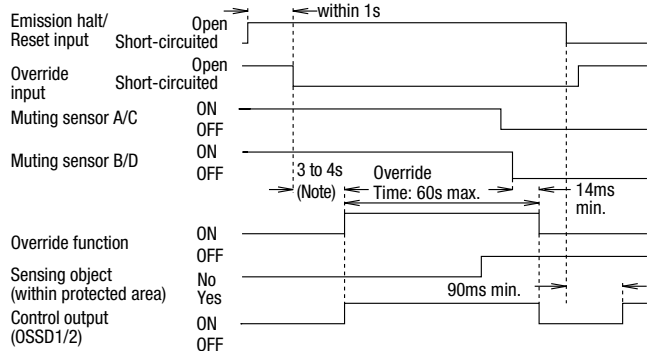
Note 3: The override function operates only during automatic reset (interlock disabled) mode.

Note 4: When using the override function, be sure to understand the cautions for muting functions on E-144.



Make sure that the system to start to the override function is operated manually. Also, install the system where the entire danger area is visible and can be operated outside of the danger area. When using the override function, make sure that an operator does not exist in the danger zone. Otherwise, death or injury may result.

Time Chart



Note: When the muting lamp diagnosis function is activated, if the muting lamp does not turn on even after 1 second has passed, the muting function will be disabled. When the muting lamp diagnosis function is disabled, the muting sensor will activate 3 seconds after the input conditions for the muting sensor A (C) and B (D) are satisfied.

Functions using the SE9Z-HC Controller (optional)

Functions for the light curtain can be set using the SE9Z-HC controller (optional). The functions that can be set are described below. For details, see the controller instruction manual.



In some functions, the contents related to safety distance such as the size of the minimum sensing object may vary. When setting each function, re-calculate the safety distance and install the light curtain with enough safety distance. If the safety distance is not enough, the machine may not stop operating before the machine reaches the danger area and may cause death or serious injury.

Fixed Blanking Function

This function inhibits the control output (OSSD1/2) from turning OFF when a specific beam is interrupted.

The fixed blanking function is disabled at factory setting.

Floating Blanking Function

This function inhibits the control output (OSSD1/2) from turning OFF when the number of beams interrupted is less than the set number. The number of beams that can be set is 1 to 3 beams.

The floating blanking function is disabled at factory setting. Fixed blanking function and floating blanking function can be set simultaneously.

Emitted Light Intensity Control Function

The amount of light emitted can be controlled by using normal mode or short mode. Normal mode is set at factory setting.

Auxiliary Output Switching Function (Non- Safety Output)

The auxiliary output can be used for the following outputs:

- 0: Negative logic of control output (OSSD1/2) (factory setting)
- 1: Positive logic of control output (OSSD1/2)
- 2: Light emitted: output ON, light not emitted: output OFF
- 3: Light emitted: output OFF, light not emitted: output ON
- 4: Light received is unstable: OFF (Note 1)
- 5: Light received is unstable: ON (Note 1)
- 6: Muting activated: ON
- 7: Muting activated: OFF
- 8: Light emitted: ON, light blocked: OFF (Note 2)
- 9: Light emitted: OFF, light blocked: ON (Note 2)

Note 1: The auxiliary output cannot be used when fixed blanking, floating blanking, or muting function is activated.

Note 2: The light emitted status and light interrupted status in the sensing area is output regardless of fixed blanking, floating blanking, or muting functions.

Example: When fixed blanking is used and an obstacle exists in the set area, the control output (OSSD1/2) will turn ON if the area outside of the set area is able to receive light. However, it will turn OFF if the auxiliary output switching function is set to No. 8, because the sensor itself is detecting the object.

Interlock Setting Adjust Function

One out of the three following settings can be selected.

Start/Restart Interlock

The light curtain goes into the interlock condition after the power is turned on or when a beam is interrupted.

Start Interlock

The light curtain goes into the interlock condition only when the power is turned on. Once reset, the light curtain will not go into the interlock condition.

Restart Interlock

The light curtain does not go into the interlock condition when the power is turned on. The light curtain will go into the interlock condition only when the control output (OSSD1/2) turns ON and the light is interrupted after the power is turned on and the light curtain receives the light.

External Device Monitoring Setting Adjust Function

The settings for the external device monitoring function can be changed.

1. Allowable range for the response speed: 100 to 600 ms (unit: 10 ms) The factory setting is 300 ms.
2. The external device monitoring function can be enabled or disabled. The external device monitoring function is enabled at factory setting.

Muting Setting Changing Function

The settings for the muting function can be changed.

1. The input order of muting input A and B enable the muting function. At factory setting, the muting function is set so that it will be enabled whether muting input A or B is input first.
2. The muting function can be enabled or disabled for each beam. (Note 1) The muting function for all beams are enabled at factory setting.
3. The muting lamp diagnosis function can be enabled or disabled. (Note 2) The muting lamp diagnosis function is enabled at factory setting.
4. The output operation of the muting sensor connected to the muting input of the light curtain can be set. (Note 3) (Note 4)

NONO (normally open/normally open)

Factory setting

NONC (normally open/normally closed)

For muting A, connect a NO (normally open) sensor or switch. For muting B, connect a NO (normally closed) sensor or switch.

For the muting function to become enabled, the time difference of the muting input A to turn OFF (open) to ON and the muting input B to turn ON to OFF (open) should be 0 to 3 sec.

Output Operation of the Muting Sensor (at NONC)

	Muting Input	When ON	When OFF
NO (normally-open) type ON when no light is received (photoelectric sensor) ON when approached (proximity sensor) ON when contacted (position switch)	A	Output OV or +V	Open
NO (normally-open) sensor ON when light is received (photoelectric sensor) ON when not approached (proximity sensor) ON when not contacted (position switch)	B		

Note 1: If a beam with a disabled muting function is interrupted during muting, the control function (OSSD1/2) will turn OFF and the muting function will stop.

Note 2: Can be set using the SE9Z-HC controller (optional). When the muting lamp diagnosis function is disabled, the muting function is maintained even if the lamp is worn out or disconnected.

Note 3: Can be set using the SE9Z-HC controller (optional).

Note 4: When the output operation of the muting sensor connected to the muting input of the light curtain differs with the SE9Z-HC controller (optional), the muting function will be disabled.

Override Setting Adjust Function

The setting of the maximum continuous effective time can be changed between 60 to 600 sec (unit: 10 sec) .

Note: The setting can be changed using the SE9Z-HC controller (optional)

Protection Function

A password can be set to change the setting of the light curtain. This protection function is disabled at factory default setting.

APEM

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Non-contact Interlock Switches

Safety Laser Scanners

Safety Light Curtains

Safety Modules

SE4D

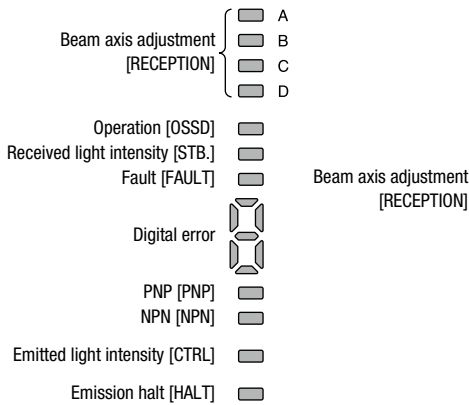


SE4D Safety Light Curtains

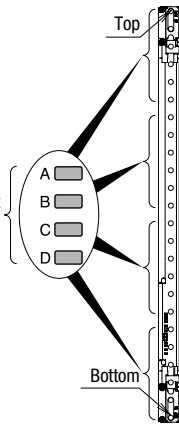
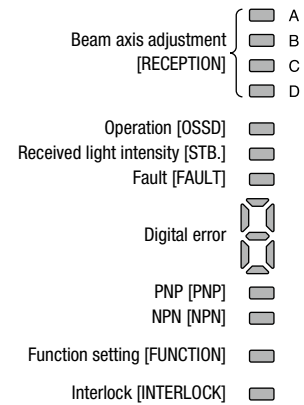
Name and Description of Parts

LED Display

Emitter



Receiver



Name	Function
Beam axis adjustment (Red/Green) [RECEPTION]	A When section A receives all lights: red lights on When top end receives light: red flashes When control output (OSSD1/2) is ON: green lights on
	B When section B receives all lights: red lights on When control output (OSSD1/2) is ON: green lights on
	C When section C receives all lights: red lights on When control output (OSSD1/2) is ON: green lights on
	D When section D receives all lights: red lights on When bottom end receives light: red flashes When control output (OSSD1/2) is ON: green lights on
Operation (Note 1) (Red/Green) [OSSD]	During operation: lights on [operates with control output (OSSD1/2)] When control output (OSSD1/2) is OFF: red lights on When control output (OSSD1/2) is ON: green lights on
Received light intensity (Green/Orange) [STB.]	When sufficient light is received (received light intensity 130% min.) (Note 2): green lights on When stable light is received (received light intensity 115 to 130%) (Note 2): lights off When unstable light is received (received light intensity 100 to 115%) (Note 2): orange lights on When light is interrupted: lights off (Note 3)
Fault (Yellow) [FAULT]	When fault occurs: lights on or flashes
Digital error (red)	Displays the error at lockout When the sensor is connected in parallel, the bottom part of the digital error LED on the slave side lights on in red
PNP (Orange) [PNP]	When PNP output is set: lights on
NPN (Orange) [NPN]	When NPN output is set: lights on
Emitted light intensity (Orange) [CTRL]	During short mode: lights on During normal mode: lights off
Light emission halt (Orange) [HALT]	When light is not emitted: lights on When light is emitted: lights off

Name	Function
Beam axis adjustment (Red/Green) [RECEPTION]	A When section A receives all lights: red lights on When top end receives light: red flashes When control output (OSSD1/2) is ON: green lights on
	B When section B receives all lights: red lights on When control output (OSSD1/2) is ON: green lights on
	C When section C receives all lights: red lights on When control output (OSSD1/2) is ON: green lights on
	D When section D receives all lights: red lights on When bottom end receives light: red flashes When control output (OSSD1/2) is ON: green lights on
OSSD (Red/Green) [OSSD]	When control output (OSSD1/2) is OFF: red lights on When control output (OSSD1/2) is ON: green lights on
Received light intensity (Green/Orange) [STB.]	When sufficient light is received (received light intensity 130% min.) (Note 2): green lights on When stable light is received (received light intensity 115 to 130%) (Note 2): lights off When unstable light is received (received light intensity 100 to 115%) (Note 2): orange lights on When light is blocked: lights off (Note 3)
Fault (Yellow) [FAULT]	When fault occurs: lights on or flashes
Digital error (Red)	Displays the error at lockout When the sensor is connected in parallel, the bottom part of the digital error indicator on the slave side lights on in red
PNP (Orange) [PNP]	When setting PNP output: lights on
NPN (Orange) [NPN]	When setting NPN output: lights on
Function setting (Orange) [FUNCTION]	When blanking function is used: lights on (Note 4) When controller is connected: light flashes
Interlock (Yellow) [INTERLOCK]	During interlock: lights on Other conditions: lights off

Note 1: Because the color of the LED changes with the status of the control output (OSSD1/2), the LED is marked as "OSSD" on the light curtain.

Note 2: The threshold value of the control output (OSSD1/2) that changes from OFF to ON is set as 100% received light intensity.

Note 3: "When light is interrupted" refers to a condition where an object blocking the light exists in the sensing area.

Note 4: The blanking function is set using a SE9Z-HC controller (optional). The controller can be purchased separately. (See E-133 and E-135.)

• The name description in [] is marked on the light curtain.

Digital Error LED

Digital error LED	Example
	Combination error of emitter and receiver (no. of beam axis). Output polarity setting wire (shield) wiring error.
	Output polarity wire (shield) wiring error.

Digital error LED	Example
	Synchronization wire wiring error. <Emitter lights on> Receiver error <Receiver lights on> Emitter error

• For details, see the instruction manual.

Protection Area

Sensing Area

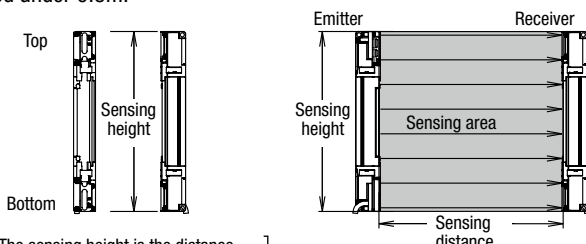


- Make sure that the machine is designed so that the operator must pass the sensing area when reaching the dangerous area of the machine. Also make sure that a part of the operator's body remains in the sensing area. Failure to do so may result in death or serious injury. Make sure that reflective or recursive reflection does not affect the machine.
- If an emitter (receiver) is connected facing several receivers (emitters), a non-sensing area may be created or cause mutual interference which may lead to death or serious injury.

The sensing area is the area enclosed by the sensing height and the sensing distance.

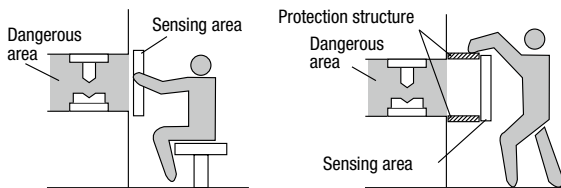
The sensing height is determined by the number of beams on the light curtain. The sensing distance is 0.3 to 9m with 12 to 64 beams and 0.3 to 7m with 72 to 96 beams.

Note that the light curtain may malfunction due to optical influences if used under 0.3m.

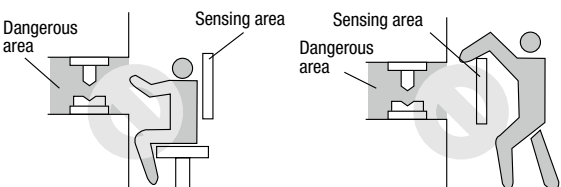


The sensing height is the distance from the top end to the bottom end of the light curtain.

<Correct Installation>



<Incorrect Installation>

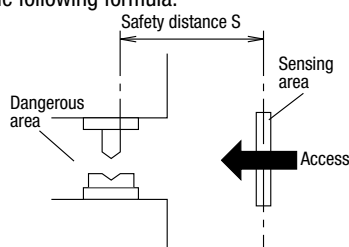


Sensing Distance



When installing the light curtain, make sure that the distance between the dangerous area of the machine and the sensing area of the light curtain is greater than the calculated safety distance. If sufficient space is not provided, the machine will not stop immediately before reaching the dangerous area of the machine, and may cause death or serious injury.

The safety distance is the minimum distance between the light curtain and dangerous area required for the machine to stop immediately before the human body or object reaches the dangerous area. The safety distance for the vertical access of the human body into the sensing area can be calculated by the following formula.



Before designing the system, refer to the standards of the region where the light curtain will be installed. The formula below is effective only for vertical access to the sensing area. If access is not vertical, be sure to refer to appropriate standards (according to region or machine).



The maximum response time of the machine is the time for the machine to stop from the time the light curtain receives the stop signal. Calculate the time on the actual machine that will be used.



The size of the minimum sensing object differs whether the floating blanking function is used or not. Calculate the safety distance with the correct minimum sensing object and correct formula.

The maximum sensing object when the floating blanking function is used

	Floating blanking function			
	Disabled	Setting (Note)		
		1 beam	2 beams	3 beams
SE4D-H□	ø25mm	ø45mm	ø65mm	ø85mm

Note: For details on the floating blanking function, see "Functions using SE9Z-HC Controller" on E-146.

[For use in Europe (EU) (EN 999)]

(also applicable to ISO 13855) (Vertical access to the light curtain)

<When minimum sensing object is ø40mm minimum>

Formula① $S = K \times T + C$

S: Safety distance (mm)

Minimum required distance between the sensing area surface and the dangerous area of the machine

K: Approach velocity of the human body or object (mm/sec)

Usually calculated at 2,000 (mm/sec)

T: Response speed for the entire system (sec)

$T = T_m + T_{SE4D}$

T_m : Maximum stopping time of the machine (sec)

T_{SE4D} : Response speed of the light curtain (sec)

C: Additional distance calculated from the size of the minimum sensing object of the light curtain (mm)

However, C cannot be under 0.

$C = 8 \times (d - 14)$

d: Diameter of the minimum sensing object (mm)

[Reference]

- To calculate the safety distance S, the following 5 methods are possible. First, substitute $K=2,000$ (mm/sec) in the formula above. Sort the result of the calculation in 3 groups: 1) $S < 100$, 2) $100 \leq S \leq 500$, 3) $S > 500$. If $S > 500$, re-calculate by substituting $K=1,600$ (mm/sec) in the above formula. Sort the result of this calculation in 2 groups: 4) $S \leq 500$, 5) $S > 500$. For details, see the instruction manual.

- When using the light curtain in "PSDI mode", calculate the appropriate safety distance. For details, see the standards/regulation of each country or region.

<When minimum sensing object is greater than ø40mm>

Formula① $S = K \times T + C$

S: Safety distance (mm)

Minimum required distance between the sensing area surface and the dangerous area of the machine

K: Approach velocity of the human body or object (mm/sec)

Usually calculated at 1,600 (mm/sec)

T: Response speed for the entire system (sec)

$T = T_m + T_{SE4D}$

T_m : Maximum stopping time of the machine (sec)

T_{SE4D} : Response speed of the light curtain (sec)

C: Additional distance calculated from the size of the minimum sensing object of the light curtain (mm)

$C=850$ (mm)



SE4D Safety Light Curtains

[For use in the United States (according to ANSI B11.19)]

Formula^② $D_s = K \times (T_s + T_c + T_{SE4D} + T_{bm}) + D_{pf}$

- D_s:** Safety distance (mm)
Minimum required distance between the sensing area surface and the dangerous area of the machine.
- K:** Approach velocity (recommended value by OSHA is 63 (inch/sec) [≈1,600 (mm/sec)])
Approach velocity K is not defined in ANSI B11.19. When determining the value of K, take into consideration every possible factor including the physical ability of the operator.
- T_s:** Stopping time calculated from the operation time of the control elements such as air valves (sec.)
- T_c:** Maximum response time of the control circuit required for functioning of the brake (sec.)
- T_{SE4D}:** Response time of the light curtain (sec.)
- T_{bm}:** Additional stopping time allowed for the brake monitor (sec.)
 $T_{bm} = T_a - (T_s + T_c)$
T_a: Brake monitor setting time (sec.)
If the machine is not equipped with the brake monitor, the recommended additional stopping time is 20% or more of (T_s+T_c).
- D_{pf}:** Additional distance calculated from the minimum sensing object of the light curtain (mm).
SE4D-H□ $D_{pf} = 61.2 \text{ mm}$
 $D_{pf} = 3.4 \times (d - 0.276)$ (inch)
 $\approx 3.4 \times (d - 7)$ (mm)
[d: Diameter of the minimum sensing object 0.985 (inch) ≈ 25 (mm) SE4D-H□]

[Reference]

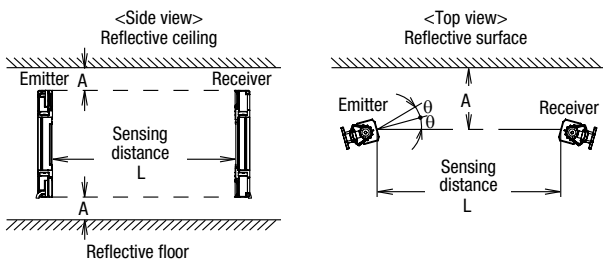
The minimum sensing object will become larger when the floating blanking function is used.
According to ANSI B11.19, $D_{pf} = 900 \text{ mm}$ (3ft) when $d > 64 \text{ mm}$ (2.5 inches). The above numbers are calculated as 1 (inch) = 25.4 (mm). The description in (mm) and (inch) may cause a slight variance. See the standards for details.

Influence of Reflective Surfaces



When a reflective surface exists near the light curtain, install the light curtain so that the reflective light from the reflective surface cannot be received by the receiver, or take countermeasures such as by painting, masking, rough surface treatment or changing the material of the reflective surface. Otherwise, the sensing function of the light curtain may not work and cause death or serious injury.

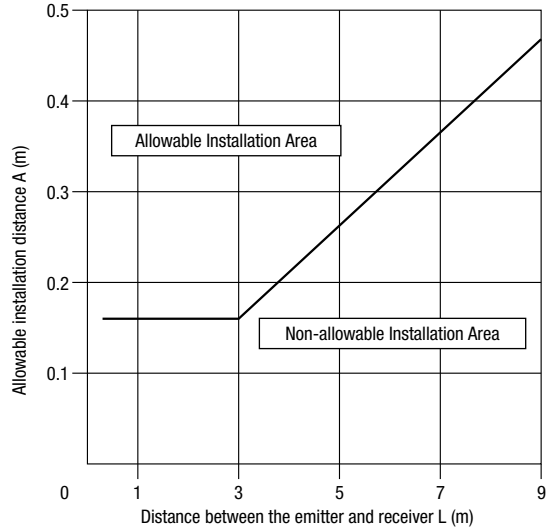
Install the light curtain so that the metal wall, floor, ceiling, and sensing object or reflective surfaces such as cover, panel, glass (surfaces with high reflectivity) has a distance of more than distance A (m) mentioned below.



Distance between emitter and receiver (Sensing distance L)	Allowable installation distance A
0.3 to 3m	0.16m
3 to 9m (Note)	$L/2 \times \tan 2\theta = L/2 \times 0.105$ (m) ($\theta = 3^\circ$)

Note: The sensing distance L is the distance for 12 to 64 beams.
The distance for 72 to 96 beams is 3 to 7m.
• The effective aperture angle of the light curtain is $\pm 2.5^\circ$ (at $L > 3 \text{ m}$) according to IEC 61496-2, ANSI/UL 61496-2. However, install the light curtain so that the aperture angle is $\pm 3^\circ$ taking into consideration the misalignment of the beam at mounting.

Allowable Installation Distance between the Light Curtain and Reflective Surface



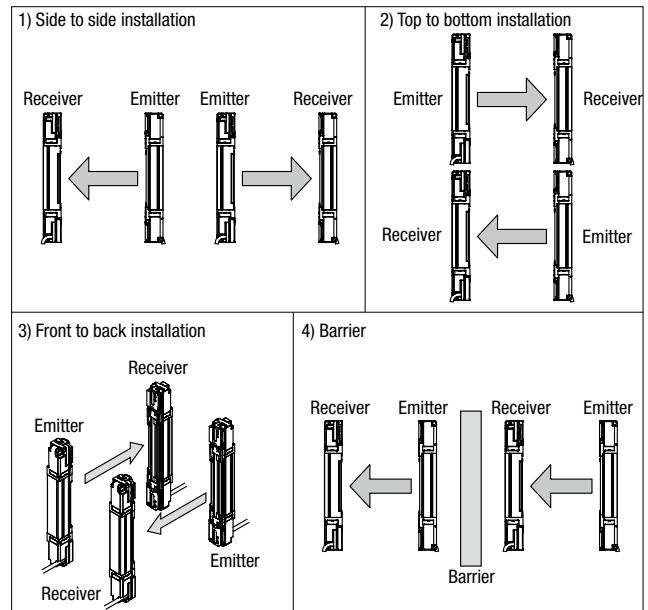
Installation

Installation method for when the emitter and receiver of multiple light curtains are not connected in series or parallel but installed facing each other. This method is used when there is a problem with wiring or when evaluating the system related to the addition of an equipment. See the instruction manual for details. Perform an operation test using a test rod.



- Install the light curtain by referring to and understanding the examples below. Inappropriate installation may cause death or serious injury.
- When using multiple light curtains, install so that mutual interference does not occur. Otherwise, death or injury may occur.

Installation Example of the Light Curtain



[Reference]

The above are just some examples of installation. Contact IDEC for more information.

APEM

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Stop SwitchesEnabling
Switches

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Controllers

Operator
Interfaces

Sensors

AUTO-ID

Interlock
SwitchesNon-contact
Interlock SwitchesSafety Laser
ScannersSafety Light
Curtains

Safety Modules

SE4D

Safety Precautions

- Use the SE4D in the range of the specification. Do not disassemble, otherwise the function and performance cannot be guaranteed.
- The SE4D is a product designed for industrial use.
- Do not use outdoors.
- The SE4D is not designed for use in the following environment.
 - 1) A condition or environment not mentioned in the instruction manual.
 - 2) For use in nuclear power control, railroad facilities, aircraft facilities, automobiles, combustion facilities, medical systems, or space development.
- If the SE4D is used to strengthen human protection from dangers that may occur in the vicinity of the machine installed with the SE4D, there are restrictions by national or regional safety related authorities (such as Occupational Safety and Health Administration: OSHA, European Standardization Committee)
For details, contact the appropriate organization.
- When installing the SE4D on a machine, follow the safety regulations according to the appropriate installation, operation, and maintenance instructions.
- Take appropriate countermeasures to prevent damages to the light curtain.
- Before operating, check that the functions and performance of the SE4D is in a normal condition according to design specifications.
- When disposing the SE4D, dispose as industrial waste.

Environment Precautions

- Do not use mobile phones or radios near the SE4D.
- When a reflective surface exists near the SE4D, install so that the reflective light from the reflective surface cannot be received by the receiver, or take countermeasures such as by painting, masking, rough surface treatment or changing the material of the reflective surface. Otherwise, the sensing abilities of the light curtain may not work and cause death or serious injury.
- Do not install the SE4D in the following environments:
 - 1) Areas exposed to direct extraneous light such as high frequency (inverter) light, rapid start fluorescent light, stroboscopic light and sunlight.
 - 2) Areas with high humidity where condensation is likely to occur.
 - 3) Areas exposed to corrosive or explosive gases.
 - 4) Areas exposed to severe vibration or shock.
 - 5) Areas exposed to water.
 - 6) Areas exposed to too much moisture or dust.

Installation

- Be sure to keep the correctly calculated safety distance between the light curtain and dangerous area.
- Make sure that the machine is designed so that the operator must pass the sensing area when reaching the dangerous area of the machine.
- Make sure that the machine is designed so that a part of the operator's body remains in the sensing area.
- Install so that the SE4D is not affected by wall reflection.
- When using multiple light curtains, install so that mutual interference does not occur. For details, see "2-3-4 Device Placement" and "3-4 Interference Prevention Function" in the instruction manual.
- Make sure that reflective or recursive reflection does not affect the machine.
- Use only the combination of emitter and receiver delivered in the same packaging with the same serial no. and install in the correct direction.

