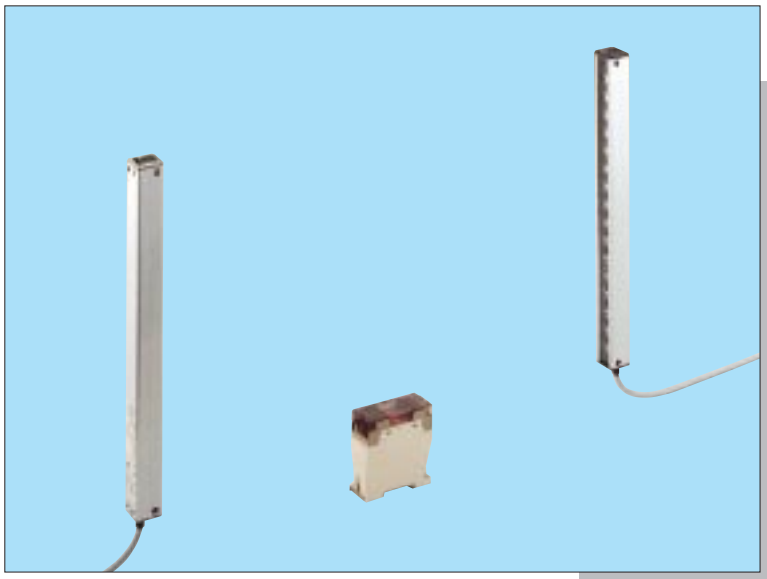
SF1-S SERIES
20mm Beam Pitch

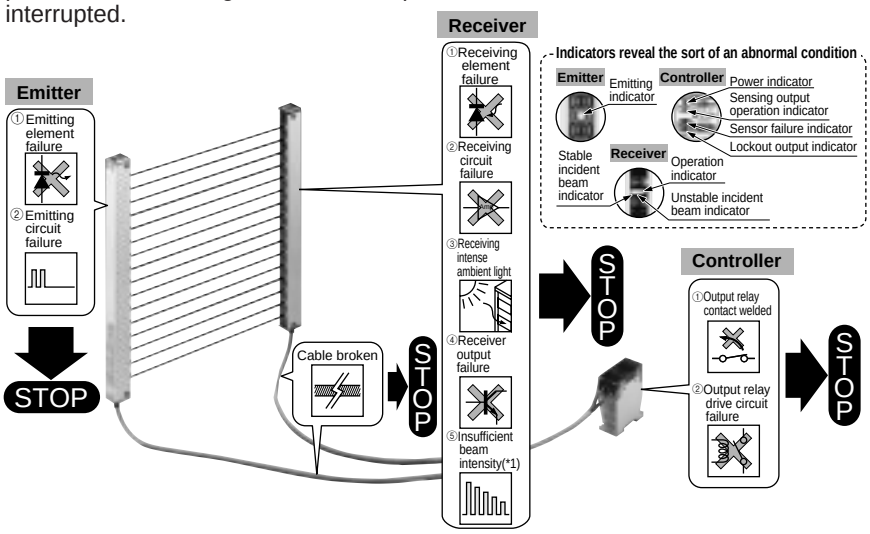
NEW



Fail-safe Design

Supreme Fail-safe Design

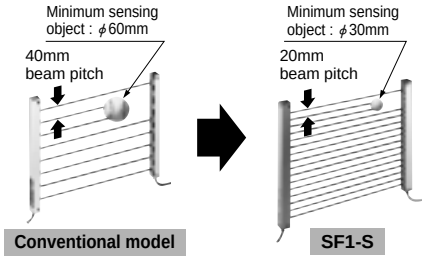
The **SF1-S** system always check there is no internal circuit failure, no cable breakage, nor incident ambient light. If any error insists, the system turns the output relay OFF to force a machine to stop. Whatever malfunction occurs, the perfect fail-safe design forces the output into the same state as when the beam is interrupted.



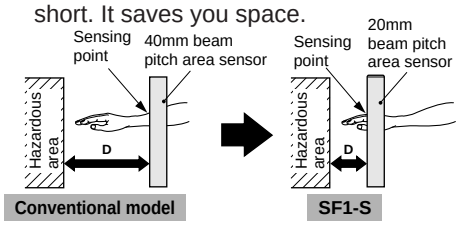
(*1) : The sensor perfects the output operation normally even under the insufficient beam receiving.

20mm Beam Pitch

• Much smaller objects can be detected.



• The separation distance becomes short. It saves you space.



The sefety distance **D** can be shorten because of the narrow beam pitch.

Automatic Sensitivity Compensation

SF1-S series constantly maintains the optimum sensitivity according to your setting distance and the sensing condition. The sensitivity is automatically gained if the incident beam intensity decreases by dirt, dust, mist or oil on the sensing face. It also makes the sensor insusceptible to any ambient beam such as the other sensor's beam, or the glare of welding.

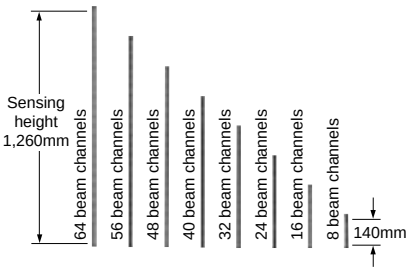
Long Sensing Range : 7m

Its sensing range is 7m long at 20mm beam pitch.

Wide Variation

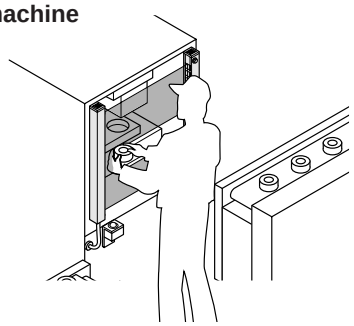
There are eight types of sensors in height from 140mm (8 beam channels) to 1,260mm (64 beam channels). The spatter-protection model is also available in each height that protects the sensing face against welding spatters by the hood.

The longest in the series contains 64 beam channels at 1,260mm high.

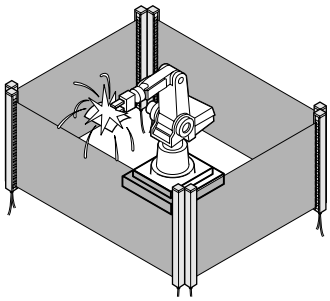


APPLICATIONS

Safe guard on miniature injection machine

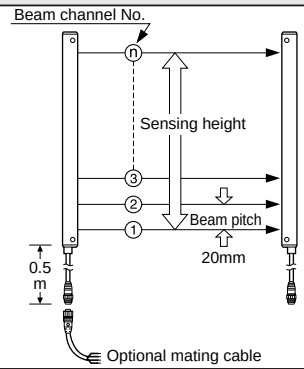
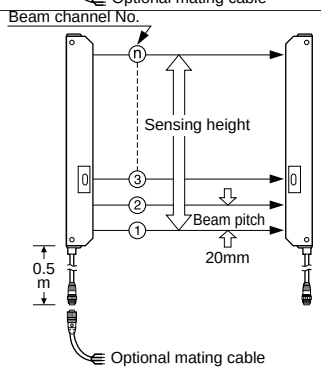


Guard around welding robot

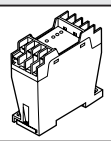


ORDER GUIDE

Sensors

Type	Appearance	Sensing range	Model No.	Number of beam channels	Sensing height (mm)
Area sensor		7m	**SF1-S8**	8	140
			SF1-S16	16	300
			SF1-S24	24	460
			SF1-S32	32	620
			SF1-S40	40	780
			SF1-S48	48	940
			SF1-S56	56	1,100
			SF1-S64	64	1,260
With spatter protection hood			**SF1-S8-H**	8	140
			SF1-S16-H	16	300
			SF1-S24-H	24	460
			SF1-S32-H	32	620
			SF1-S40-H	40	780
			SF1-S48-H	48	940
			SF1-S56-H	56	1,100
			SF1-S64-H	64	1,260

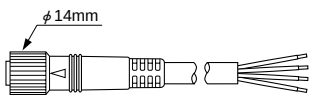
Controller

Appearance	Model No.
	**SF1-SC**

No mating cable is attached to the sensor and the controller. Please order it separately.

Use the sensor and the controller together.

Mating cables

Appearance	Model No.	Description	
	**SF1-CC3A**	Length : 3m Weight : Approx. 600g	Cabtyre cable with four 0.5mm² conductors Outer diameter : ϕ7mm With the connector on one end Two cables a set
	SF1-CC7A	Length : 7m Weight : Approx. 950g	

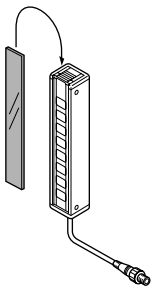
SF1-S

ORDER GUIDE

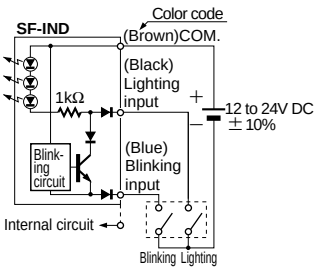
Front covers (Accessory for sensor)

Applicable beam channels	8 beam channels	16 beam channels	24 beam channels	32 beam channels	40 beam channels	48 beam channels	56 beam channels	64 beam channels
Model No.	**FC-SF1-8**	**FC-SF1-16**	**FC-SF1-24**	**FC-SF1-32**	**FC-SF1-40**	**FC-SF1-48**	**FC-SF1-56**	**FC-SF1-64**

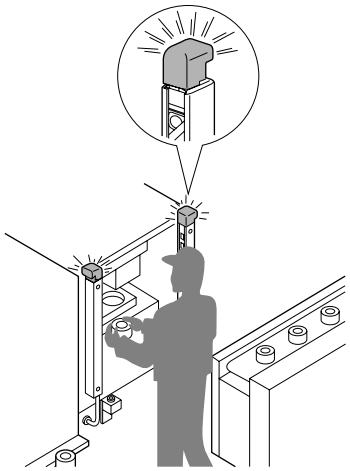
(*1) : The product assigned with the above model No. consists of one single unit only, not a pair of units.



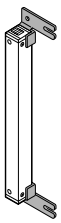
OPTION

Designation	Model No.	Description
Large indicator	**SF-IND**	With the large indicators put on the sensor, the operation is remarkably observeable. **Specifications** • Supply voltage : 12 to 24V DC ± 10% Ripple P-P 10% or less • Current consumption : 30mA or less • Indicator : Three orange LEDs Either light up, blink, or light off is selected by the input wire • Ambient temperature : − 10 to + 55°C • Cable : Oil resistant cable 2m long with three 0.2mm² conductors • Cable extension : Maximum extension is 100m overall with an equivalent cable with conductors 0.2mm² or more • Material : Polycarbonate (Cover), POM (Mounting base) **I/O circuit diagram**  • Input rate Applied voltage : 24V DC or less (between COM. and input) ON voltage : 9.6V or more (between COM. and input) OFF voltage : 5V or less (between COM. and input) Input impedance : Approx. 1kΩ
Sensor mounting bracket	**MS-SF1-P**	It consists of one pair of two brackets for the emitter and the receiver each. Two **SF-IND**s are needed on both the emitter and the receiver.

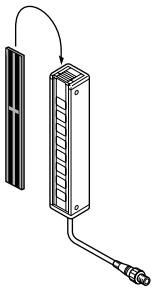
Large indicator



Sensor mounting bracket



Slit mask



Designation \ Applicable beam channels		8 beam channels	16 beam channels	24 beam channels	32 beam channels	40 beam channels	48 beam channels	56 beam channels	64 beam channels
Slit mask	Model No.	**OS-SF1-8**	**OS-SF1-16**	**OS-SF1-24**	**OS-SF1-32**	**OS-SF1-40**	**OS-SF1-48**	**OS-SF1-56**	**OS-SF1-64**

(*1) : The product assigned with the above model No. consists of one single unit only, not a pair of units.

The slit mask restrains the amount of the beam emitted or received.
Replace the original front cover with the slit mask. Remove the front cover, and put the slit mask on the sensor.
The slit mask is used to reduce the beam intensity so that the sensing range becomes shorter than the range without it.
For more details, contact us.

SPECIFICATIONS

Sensors

Item		Number of beam channels	8	16	24	32	40	48	56	64
		Model No.	**SF1-S8**	**SF1-S16**	**SF1-S24**	**SF1-S32**	**SF1-S40**	**SF1-S48**	**SF1-S56**	**SF1-S64**
		With spatter protection hood	**SF1-S8-H**	**SF1-S16-H**	**SF1-S24-H**	**SF1-S32-H**	**SF1-S40-H**	**SF1-S48-H**	**SF1-S56-H**	**SF1-S64-H**
Applicable controller			**SF1-SC**							
Sensing height			140mm	300mm	460mm	620mm	780mm	940mm	1,100mm	1,260mm
Sensing range			7m							
Beam pitch			20mm							
Sensing object			Opaque objects of ϕ30mm or more							
Indicator	Emitter		Emitting indicator : Green LED (lights up under the normal emission, blinks under the emitting circuit failure)							
Indicator	Receiver		Operation indicator : Red LED (lights up when one or more beams are interrupted, and blinks when any ambient light is received) Stable incident beam indicator : Green LED (lights up when all beams are received stably) Unstable incident beam indicator : Yellow LED (lights up when one or more beams are received unstably) ※The three-color indicators blink one another when the receiving circuit fails. The operation indicator and the unstable incident beam indicator blink alternately when the emitting circuit fails or the synchronization wire breaks.							
Crosstalk prevention function			Incorporated							
Automatic sensitivity compensation function			Incorporated							
Environmental resistance	Pollution degree		3 (Industrial environment)							
Environmental resistance	Protection		IP65 (IEC)							
Environmental resistance	Ambient temperature		−10 to +55°C (No dew condensation nor icing allowed), Storage : −10 to +60°C							
Environmental resistance	Ambient humidity		35 to 85%RH, Storage : 35 to 85%RH							
Environmental resistance	Ambient illuminance (Extraneous light immunity)		Sun light : 20,000ℓx at the light-receiving face, Incandescent light : 3,500ℓx at the light-receiving face							
Environmental resistance	EMC		Emission • Immunity : prEN50100-1							
Environmental resistance	Voltage withstandability		1,500V AC for one min. between all terminals connected and enclosure							
Environmental resistance	Insulation resistivity		20MΩ or more at 500V DC Megger between all terminals connected and enclosure							
Environmental resistance	Vibration-proof		10 to 55Hz frequency, 1.5mm amplitude, and X,Y, and Z directions each for two hours (unenergized)							
Environmental resistance	Shock-proof		100m/s^2 acceleration (approx. 10G), and X, Y, and Z directions each for three times (unenergized)							
Emitting element			Infrared LED (modulated)							
Material			Protective enclosure : Aluminum, Module case : ABS, Front cover : Acrylic, Lens : Acrylic							
Cable			Cabtyre cable 0.5m long with four 0.5mm^2 conductors with the round connector on the end ※Use the optional mating cable together							
Cable extension			Maximum extension is 20m overall with an equivalent cable with conductors 0.5mm^2 or more (the emitter and the receiver each)							
Weight			Approx. 500g	Approx. 840g	Approx.1,170g	Approx.1,500g	Approx.1,830g	Approx.2,170g	Approx.2,500g	Approx.2,830g
Weight	With spatter protection hood		Approx. 630g	Approx.1,080g	Approx.1,530g	Approx.1,990g	Approx.2,440g	Approx.2,900g	Approx.3,350g	Approx.3,800g
Accessory			**MS-SF1-1** (Mounting bracket) : 1 set							

SF1-S

SPECIFICATIONS

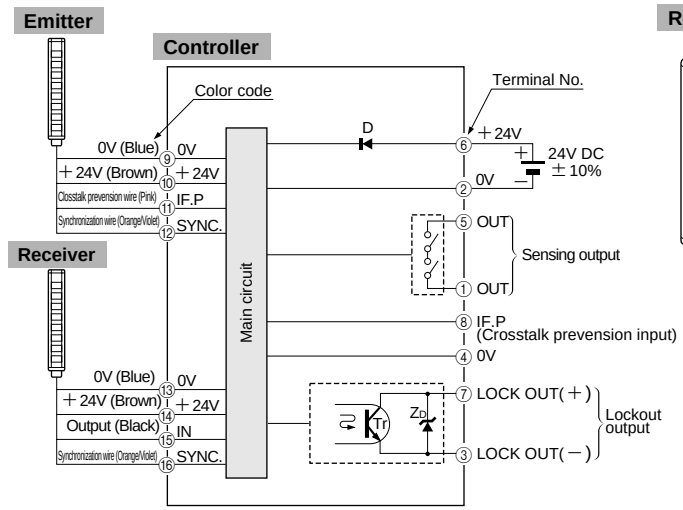
Controller

Item \ Model No.		SF1-SC
Applicable sensors		**SF1-S□**, **SF1-S□-H**
Supply voltage		24V DC ± 10% Ripple P-P 10% or less, Warm-up time : 500ms or less
Current consumption		300mA or less (including the sensor)
Sensing output		Relay contact 1a (Two relays in series) • Switching capacity : 250V 3A AC (resistive load) 30V 3A DC (resistive load) • Electrical life : 100,000 operations or more (rated load) • Mechanical life : 50,000,000 operations or more
	Utilization category	DC-12 or DC-13
	Output operation	ON (closed) when all beams are received / OFF (open) when one or more beams are interrupted In case that any failure happens or the system goes into the lockout condition, the output relay is turned off (*1)
	Response time	20ms or less (including sensor's response time)
Lockout output		NPN open-collector transistor (photo-coupler isolation) • Maximum sink current :100mA • Applied voltage : 30V DC or less • Residual voltage : 1.0V or less (at 100mA sink current) 0.8V or less (at 16mA sink current)
	Output operation	ON (closed) in the normal condition/OFF (open) in the lockout condition or the warm-up condition for approx. one sec. after power-up (*1)
	Response time	50ms or less (including sensor's response time)
Indicator		Power indicator : Green LED (lights up while the power is supplied) Sensing output operation indicator : Yellow LED [lights up when the sensing output is not activated (open condition)] Sensor failure indicator : Red LED (lights up when the proper signal from the sensor can not be received or the supply current to the sensor flows excessively) Lockout output indicator : Red LED (lights up in the lockout condition or in the warm-up condition for approx. one sec. after power-up)
Environmental resistance	Pollution degree	3 (Industrial environment)
	Ambient temperature	− 10 to + 55°C (No dew condensation nor icing allowed), Storage : − 10 to + 70°C
	Ambient humidity	35 to 85% RH, Storage : 35 to 85% RH
	EMC	Emission • Immunity : pr50100-1
	Voltage withstandability	1,500V AC for one min. between power and output terminals
	Insulation resistivity	20MΩ or more at 500V DC Megger between power and output terminals
	Vibration-proof	10 to 55Hz frequency, 0.75mm amplitude, and X, Y, and Z directions each for two hours (unenergized)
	Shock-proof	100m/s^2 acceleration (approx. 10G), and X, Y, and Z directions each for three times (unenergized)
Material		Enclosure : ABS, Terminal block : PBT (containing glass fiber), Protective cover : Polycarbonate
Weight		Approx. 150g
Accessory		**NPS-CV** (Protective cover) : 1 pc.

(*1) : The lockout stands for the function that forces the sensing output into OFF when any internal circuit fails. The **SF1-SC** includes the completely doubled safety circuitry that introduce the lockout condition when they yield inconsistency.
If the connected power source with the **SF1-S** takes time 500ms or more to stabilize voltage, the sensor may recognize it as a failure that leads the lockout condition.

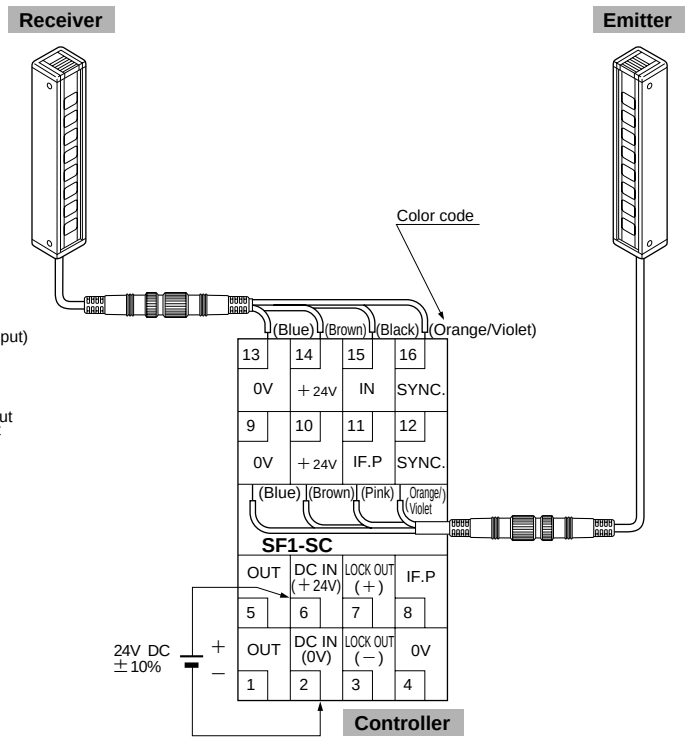
I/O CIRCUIT AND WIRING DIAGRAMS

I/O circuit diagram



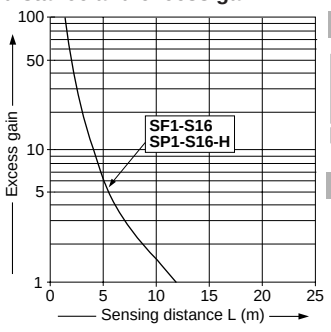
Symbol . . . D : Reverse polarity protection diode
Zᴅ: Surge absorption zener diode
Tr : NPN output transistor (photo-coupler)

Pin position

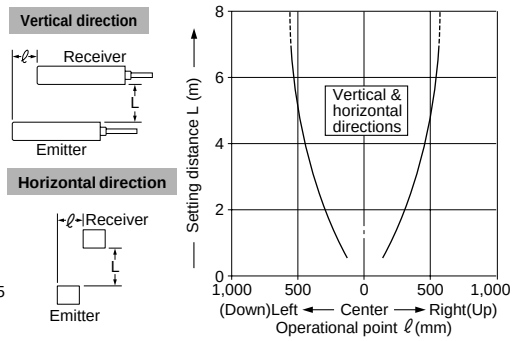


SENSING FIELDS (TYPICAL)

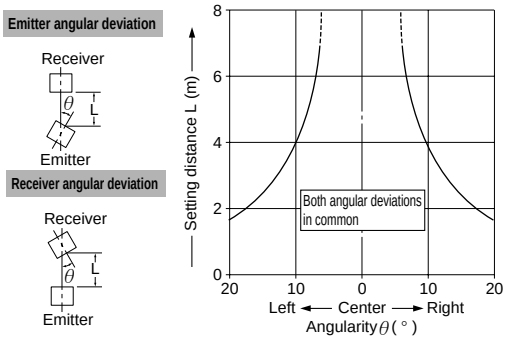
Correlation between setting distance and excess gain



Parallel deviation (All models)



Angular deviation (All models)



PRECAUTIONS FOR PROPER USE

Refer to P.682～for general cautions

Mounting

- Use the sensor with the front cover and the enclosure always. Otherwise, IP protection can not be maintained or a contact failure may occur between modular units.
- The tightening torque should be 2N·m {20.3kgf·cm} or less.
  To mount the **SF1-SC** controller with screws, apply M4 screws at the tightening torque of 0.78N·m {8kgf·cm} or less.

Wiring

- Use a power source that can rise voltage up to the rated level 500ms or less.
- Do not bypass the sensing output directly or indirectly by any means.

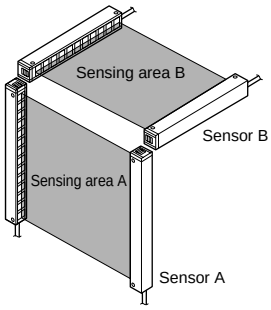
SF1-S

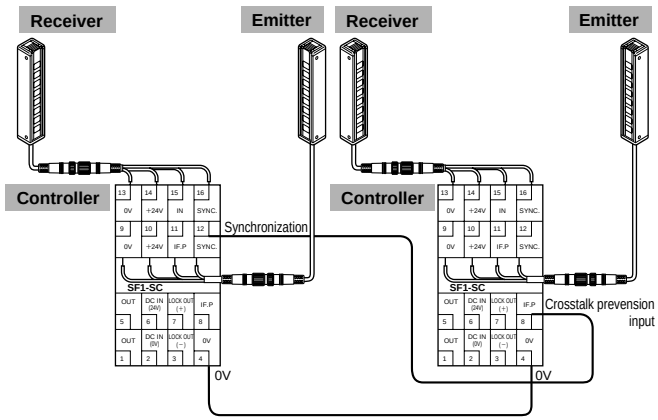
PRECAUTIONS FOR PROPER USE

Refer to P.682～for general cautions

Crosstalk prevention function

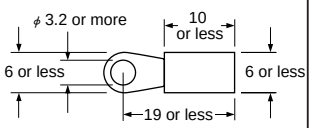
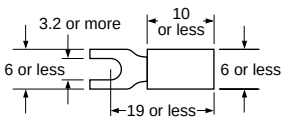
• Complete the below wiring to install two sets of sensor adjacently as the illustration on the right. Connect the synchronization input (terminal No. 12) of one controller to the crosstalk prevention input (terminal No.8). of the other controller. Both 0V terminals must be in common.





Dimensions of the applicable crimp contacts

Unit : mm

Round type	Y-shaped type
	
(When crushed)	(When crushed)

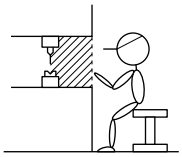
(*1) : Use a crimp contact with insulating tubes.
Recommended crimp contact : Normal size 1.25 - 3.0

Others

- The transient time duration is 1 sec. after power-up.
- Do not expose the receiver directly to the sun, a beacon, another sensor's emitter, or a fluorescent lamp of rapid starting or high-frequency modulating. Their lights may affect the detectability.
- The lockout output can be used for the monitoring purpose only. Do not use it to control the machine operation directly instead of the sensing output (relay contacts). If the lockout output does not retreat into ON by power-up, the **SF1-SC** might be out of order such as by the output relay contact welded, or the internal circuit failure. Replace the controller with the new **SF1-SC**.
- The set of the sensor is incorporated with the automatic sensitivity compensation function. While the beam alignment is carried out, the indication and the output may delay to respond to movement of either or both sensors.

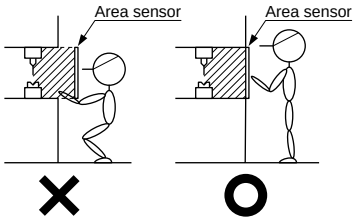
From selection to installation of sensor

①Determine the hazardous area, in height and length.

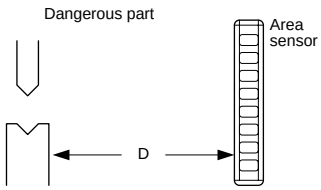


②Determine the protection area with the sensor.

• Access to the hazardous area should only be attained by breaking the sensor's beams.



• Obtain the safety distance (D). The following equation yields the safety distance (D).



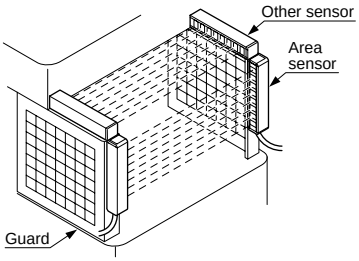
$D \geqq 78.2 + (RT \times 1.8)$

RT : Stopping overall response time of the system (ms)
(Response time of the controller including the sensor + Stopping response time of machinery)

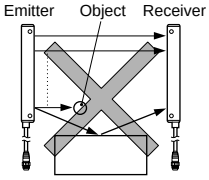
1.8 : Hand speed constant (mm/ms)

③Determine the sensing height of the sensor as well as the number of beam channels.

④Access to the hazardous area of machinery from any direction not protected by the safe guard must be prevented by fixed or interlocking guards, or equally effective measures such as a fixed screen, an access door with a captive fastener or the other safe guard sensor.



⑤Install the sensor where they can not be affected by the beam reflected on a frame of machinery or a workpiece.

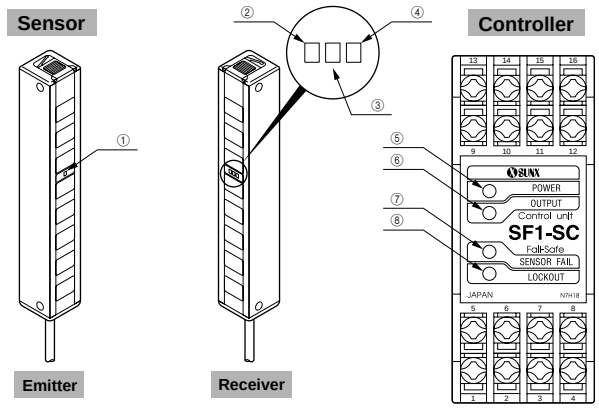


If the reflected beam is received, the beam interruption may not be perfected.

PRECAUTIONS FOR PROPER USE

Refer to P.682～for general use

Designation and function



		Designation	Description	
Sensor	①	Emitting indicator (Green LED)	Lights up under the normal emission, blinks under the emitting circuit failure.	
	②	Stable incident beam indicator (Green LED)	Lights up when all beams are received stably.	②, ③ and ④ blink one another when the receiving circuit fails. ③ and ④ blink alternately when the synchronization wire is broken.
	③	Unstable incident beam indicator (Yellow LED)	Lights up when one or more beams are received unstably.	
	④	Operation indicator (Red LED)	Lights up when one or more beams are interrupted and blinks when any ambient light is received.	
Controller	⑤	Power indicator (Green LED)	Lights up while the power is supplied.	
	⑥	Sensing output operation indicator (Yellow LED)	Lights up when the sensing output is not activated (open condition).	
	⑦	Sensor failure indicator (Red LED)	Lights up when the proper signal from the sensor can not be received, or the supply current to the sensor flows excessively.	
	⑧	Lockout output indicator (Red LED)	Lights up in the lockout condition or in the warm-up condition for approx. one sec. after power-up.	

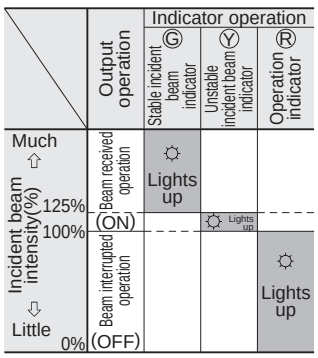
Operation matrix

• To acknowledge operating conditions of the outputs, and indicators on sensor and the controller

☼ : ON ◑ : Blink ● : OFF △ : Uncertain state according to situation

Item \ Unit			Emitter	Receiver (*3) Indicator			Controller Indicator				Controller Output	
			Emitting indicator (Green LED)	Stable incident beam indicator (Green LED)	Unstable incident beam indicator (Yellow LED)	Operation indicator (Red LED)	Power indicator (Green LED)	Sensing output operation indicator (Yellow LED)	Sensor failure indicator (Red LED)	Lockout output indicator (Red LED)	Sensing output (*1)	Lockout output
Normal Operation		Stable beam received (All beams)	☼	☼	●	●	☼	●	●	●		ON
		Beam interrupted (One or more beams are interrupted)		●		☼		☼				
Abnormal condition	Sensor	Emitting element failure	☼	●	●	☼	☼	☼	●	●	Restrain	ON
		Emitting circuit failure	◑		◑ Alternate	◑			☼			
		Receiving element failure	☼	●	●	☼	☼	☼	●	●	Restrain	ON
		Receiving circuit failure		◑ Sequential	◑	◑			☼			
		Output circuit failure/Output wire broken		△	△	△					(*2)	
		Power wire broken: Receiver	☼	●	●	●	☼	☼	☼	●		ON
		Power wire broken: Emitter	●	●	◑ Alternate	◑						
		Synchronization wire broken	☼									
		Ambient light check: Faint ambient light	☼	△	△	◑	☼	△	●	●	△	ON
		Ambient light check: Intense ambient light		●	●			☼				
		Insufficient beam intensity (Unstable beam received)		●	☼	●		●				
	Controller	Ouytput relay contact welded Output relay driving circuit failure	☼	△	△	△	☼	☼	●	☼	Restrain	OFF
		AC power wire broken	●	●	●	●	●	●		●		

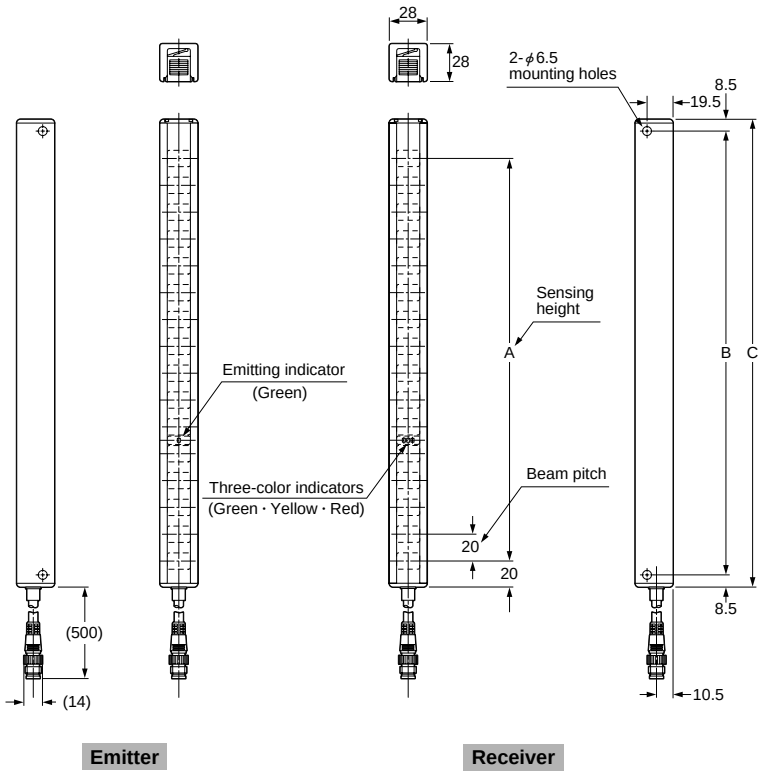
(*1) : "Restrain" is specified that the relay is held in Open since a circuit failure.
(*2) : When the output circuit fails, the sensor enters into "Restrain" condition.
(*3) : The indicators on the receiver reveal the incident beam intensity level as follows.



SF1-S

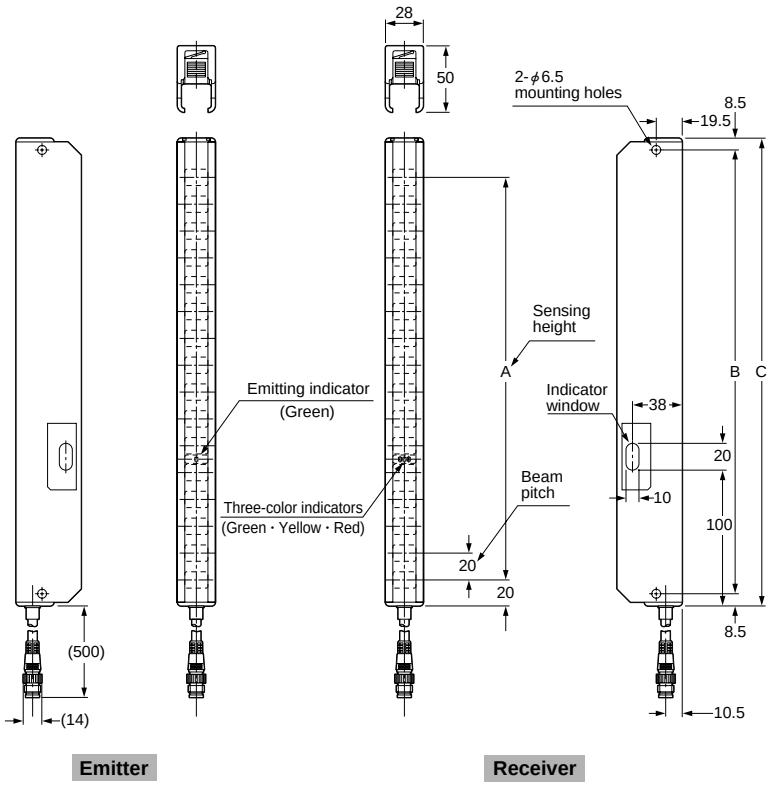
DIMENSIONS (Unit : mm)

SF1-S□ Sensor



Model No.	A	B	C
SF1-S8	140	172	189
SF1-S16	300	332	349
SF1-S24	460	492	509
SF1-S32	620	652	669
SF1-S40	780	812	829
SF1-S48	940	972	989
SF1-S56	1,100	1,132	1,149
SF1-S64	1,260	1,292	1,309

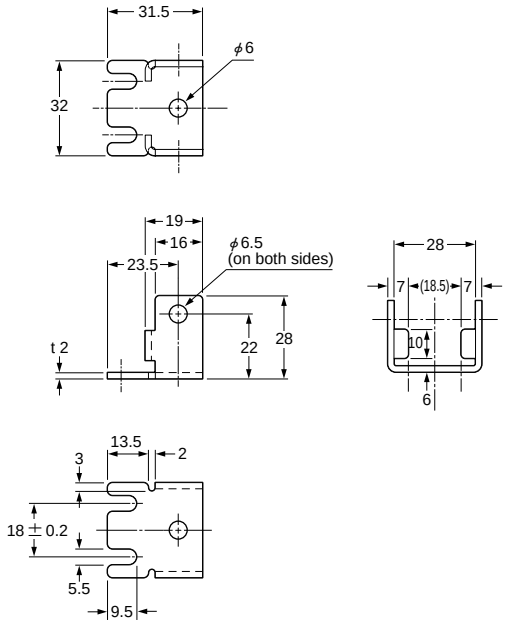
SF1-S□-H Sensor



Model No.	A	B	C
SF1-S8-H	140	172	189
SF1-S16-H	300	332	349
SF1-S24-H	460	492	509
SF1-S32-H	620	652	669
SF1-S40-H	780	812	829
SF1-S48-H	940	972	989
SF1-S56-H	1,100	1,132	1,149
SF1-S64-H	1,260	1,292	1,309

DIMENSIONS (Unit : mm)

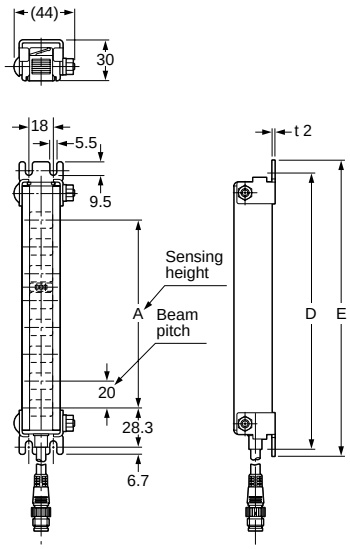
MS-SF1-1 Sensor mounting bracket (Accessory)



Material : SPCC (Uni-chrome plated)
One package consists of four sets of brackets.
(Four M6 × 40mm truss head screws, four nuts and four spring washers are attached.)

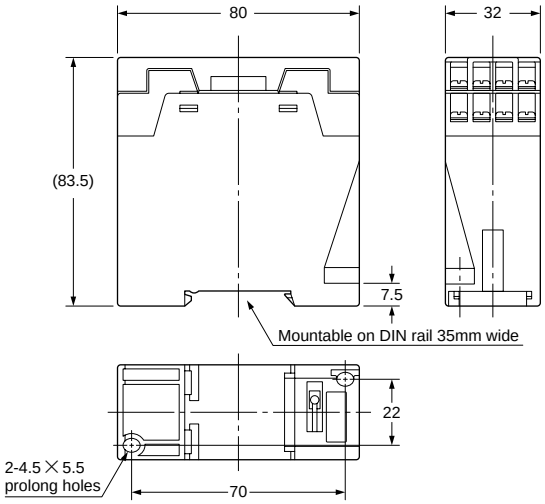
Assembled dimensions

Mounting drawing with **SF1-S□**.
The spatter protection hood type (**SF1-S□-H**) is assembled in the same way.

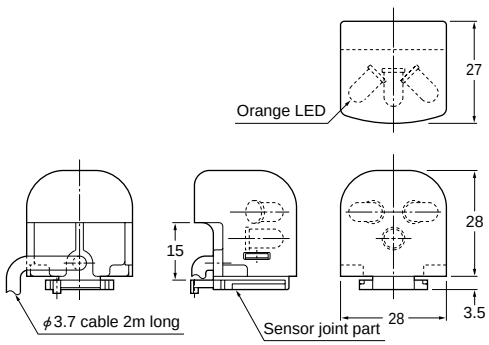


Model No.	A	D	E
SF1-S8(-H)	140	205	219
SF1-S16(-H)	300	365	379
SF1-S24(-H)	460	525	539
SF1-S32(-H)	620	685	699
SF1-S40(-H)	780	845	859
SF1-S48(-H)	940	1,005	1,019
SF1-S56(-H)	1,100	1,165	1,179
SF1-S64(-H)	1,260	1,325	1,339

SF1-SC Controller

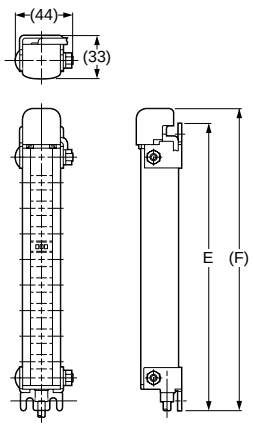


SF-IND Large indicator (Option)



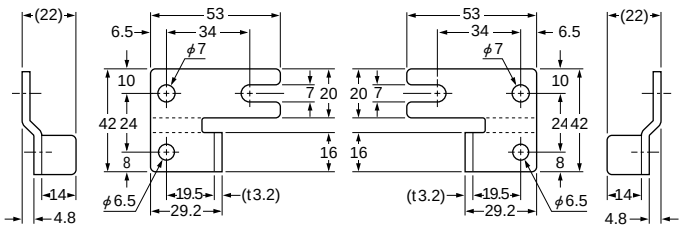
Assembled dimensions

Mounting drawing with **SF1-S□**.
The spatter protection hood type (**SF1-S□-H**) is assembled in the same way.



Model No.	E	F
SF1-S8(-H)	219	232
SF1-S16(-H)	379	392
SF1-S24(-H)	539	552
SF1-S32(-H)	699	712
SF1-S40(-H)	859	872
SF1-S48(-H)	1,019	1,032
SF1-S56(-H)	1,179	1,192
SF1-S64(-H)	1,339	1,352

MS-SF1-P Sensor mounting bracket (Option)



Material : SPCC (Uni-chrome plated)
One package consists of four sets of brackets.