

SF1-A SERIES

20mm Beam Pitch

SF1-A
Global Conformance
to Safety Standards

SF1-N
For General Use

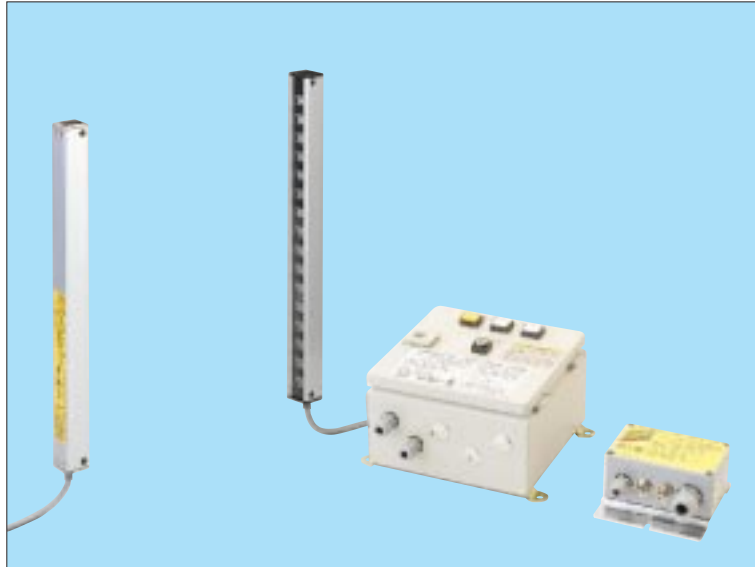
NA40

SF1-S
Fail-safe Design

SF1-F
Individual Beam
Outputs

NA2
Slim Body

NA1-5



World-wide Safety Guard

CE Marked

Conforming to Machinery directive
The SF1-AC2 is being audited now
in Machinery directive category IV

World-wide Coverage of Safety Requirements

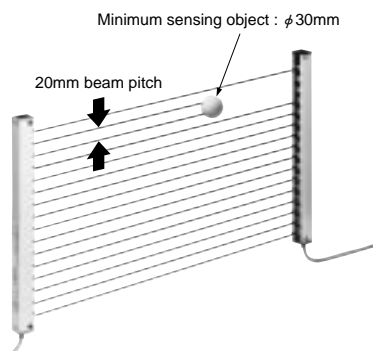
The SF1-A series are UL listed according to UL 491 along with conforming to OSHA 1910.217 safety requirement for press machinery in the U.S., CE marked along the certification by TÜV in compliance with prEN50100-1 European safety requirement, and approved as the CSA (Canadian Standards Association) certified products, and as the products conforming to AS4024-2 Australian standard.

- UL listed with conforming to OSHA
- CE marked with conforming to EN standard Machine directive
- AS standard conformity
- CSA standard conformity

The SF1-AC2 is also UL listed with OSHA conformity, CE marked with prEN50100-1 compliance, and CSA approved.

20mm Beam Pitch/Minimum Sensing Object : ϕ 30mm

The narrow 20mm beam pitch, the half of conventional type, offers the highest performance able to detect a minimum ϕ 30mm opaque object.



Automatic Sensitivity Compensation

SF1-A 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 unsusceptible to any ambient beam such as other sensor's beam, or the glare of welding.

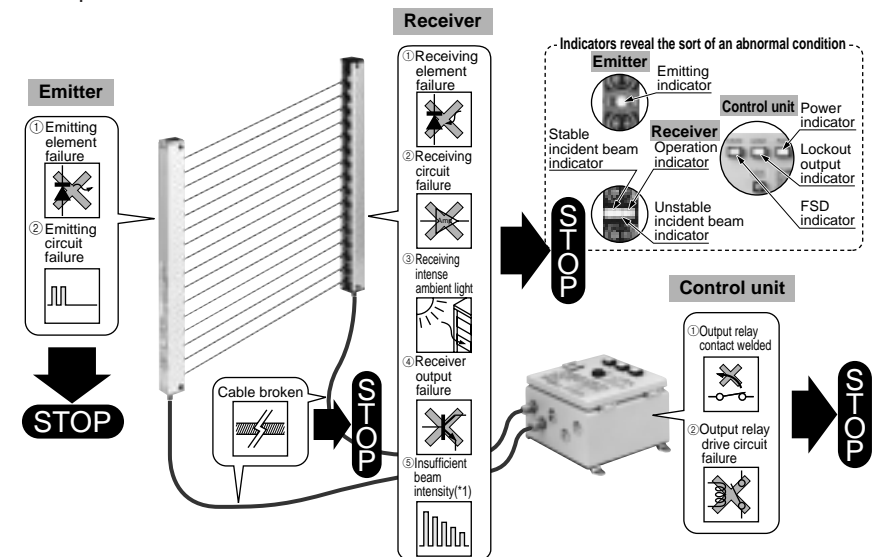
Supreme Fail-safe Design

The SF1-A system always check there is no internal circuit failure, no cable breakage, nor incident ambient light. If any error insists, the system turns the FSD relays 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.

Wide Variation

There are eight types of sensor units 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.

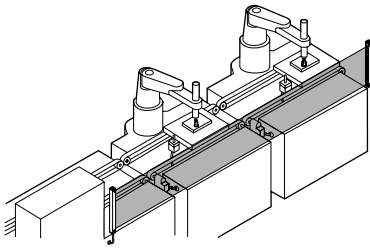
Two types of control units support sensor units, AC power control units SF1-AC and DC power control units SF1-AC2.



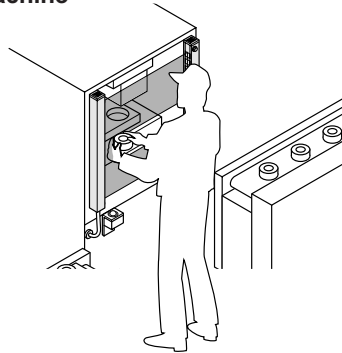
(*1) : The sensor perfects the output operation normally even under the insufficient beam receiving.

APPLICATIONS

Safe guards on assembly machines



Safe guard on miniature injection machine



ORDER GUIDE

Sensor units

Type	Appearance	Sensing range	Model No.	Number of beam channels	Sensing height (mm)
Area sensor		5m	SF1-A8	8	140
			SF1-A16	16	300
			SF1-A24	24	460
			SF1-A32	32	620
			SF1-A40	40	780
			SF1-A48	48	940
			SF1-A56	56	1,100
			SF1-A64	64	1,260
With spatter protection hood		5m	SF1-A8-H	8	140
			SF1-A16-H	16	300
			SF1-A24-H	24	460
			SF1-A32-H	32	620
			SF1-A40-H	40	780
			SF1-A48-H	48	940
			SF1-A56-H	56	1,100
			SF1-A64-H	64	1,260

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

Use the sensor unit and the control unit together.

Control units

Type	Appearance	Model No.	Supply voltage
AC power operation		SF1-AC	100 to 240V AC
DC power operation		SF1-AC2	24V DC \pm 15%

Global Conformance to Safety Standards

For General Use
SF1-A
NA40 SF1-N

Fall-safe Design
SF1-S

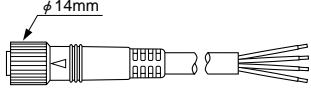
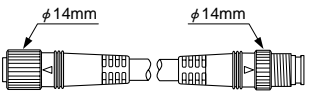
Individual Beam Outputs
SF1-F

Slim Body
NA1-5 NA2

SF1-A

ORDER GUIDE

Mating cables

Type	Appearance	Model No.	Description	
For SF1-AC		SF1-CC3A	Length : 3m Weight : Approx. 600g	Use either set of cables to connect the sensor units to the SF1-AC . • Cabtyre cable with four 0.5mm ² conductors • Outer diameter : ϕ 7mm • With the connector on one end • Two cables a set
		SF1-CC7A	Length : 7m Weight : Approx. 950g	
For SF1-AC2		SF1-CCJ3	Length : 3m Weight : Approx. 600g	Use either set of cables to connect the sensor units to the SF1-AC2 . Each set can be used as extension cables between the sensor units and the SF1-CC□A . • Cabtyre cable with four 0.5mm ² conductors • Outer diameter : ϕ 7mm • With the connector on both ends • Two cables a set
		SF1-CCJ7	Length : 7m Weight : Approx. 950g	
		SF1-CCJ10	Length : 10m Weight : Approx. 1,200g	

Spare parts

• For sensor unit

Designation	Model No.	Description	
Front cover	FC-SF1-8	For 8 beam channels	Protects front lens
	FC-SF1-16	For 16 beam channels	
	FC-SF1-24	For 24 beam channels	
	FC-SF1-32	For 32 beam channels	
	FC-SF1-40	For 40 beam channels	
	FC-SF1-48	For 48 beam channels	
	FC-SF1-56	For 56 beam channels	
	FC-SF1-64	For 64 beam channels	
Sensor mounting bracket	MS-SF1-1	A set of brackets for both the emitter and the receiver	

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

• For control unit

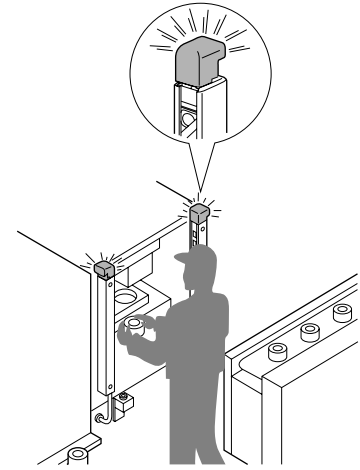
Designation	Model No.	Description
Lockout release key (For SF1-AC)	NA-BC-K3	Two keys a set
Front-cover open key (For SF1-AC)	NA-BC-K2	_____
Test rod	SF1-AC-TL	Beam alignment test piece
System information plate (Attached to SF1-AC)	MEHS-SF1A	"The overall system response time", "The minimum separation distance", and "The appropriate test piece diameter" are shown
Relay replacement circuit board (For SF1-AC)	SF1-AC-RU	SF1-AC relay replacement circuit board
Relay replacement circuit board (For SF1-AC2)	SF1-AC2-RU	SF1-AC2 relay replacement circuit board
Fuse	SF1-AC-F	Control unit fuse

SF1-A
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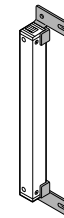
OPTION

Designation	Model No.	Description
Large indicator	SF-IND	<p>With the large indicators put on the sensor unit, the operation is remarkably observable.</p> <p>Specifications</p> <ul style="list-style-type: none"> Supply voltage : 12 to 24V DC \pm 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) <p>I/O circuit diagram</p> <ul style="list-style-type: none"> 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-INDs are needed on both the emitter and the receiver.

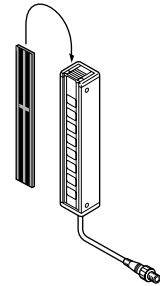
Large indicator



Sensor mounting bracket



Slit mask



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
Designation	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.

Global Conformance to Safety Standards

For General Use
NA40 SF1-N

Fall-safe Design
SF1-S

Individual Beam Outputs
SF1-F

Slim Body
NA1-5 NA2

SF1-A

SF1-N

NA40

SF1-S

SF1-F

SF1-F

NA1-5

NA2

SF1-A

SPECIFICATIONS

Sensor units

Item	Number of beam channels	8	16	24	32	40	48	56	64
	Model No.	SF1-A8	SF1-A16	SF1-A24	SF1-A32	SF1-A40	SF1-A48	SF1-A56	SF1-A64
	With spatter protection hood	SF1-A8-H	SF1-A16-H	SF1-A24-H	SF1-A32-H	SF1-A40-H	SF1-A48-H	SF1-A56-H	SF1-A64-H
Applicable control units		SF1-AC, SF1-AC2							
Sensing height		140mm	300mm	460mm	620mm	780mm	940mm	1,100mm	1,260mm
Sensing range		5m							
Beam pitch		20mm							
Sensing object		Opaque objects of ϕ 30mm or more							
Indicator	Emitter	Emitting indicator : Green LED (lights up under the normal emission, blinks under the emitting circuit failure)							
	Receiver (*1)	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)							
	Protection	IP65 (IEC)							
	Ambient temperature	- 10 to + 55°C (No dew condensation nor icing allowed), Storage : - 10 to + 60°C							
	Ambient humidity	35 to 85%RH, Storage : 35 to 85%RH							
	Ambient illuminance (Extraneous light immunity)	Sun light : 20,000 lx at the light-receiving face, Incandescent light : 3,500 lx at the light-receiving face							
	EMC	Emission • Immunity : prEN50100-1							
	Voltage withstandability	1,500V AC for one min. between all terminals connected and enclosure							
	Insulation resistivity	20M Ω or more at 500V DC Megger between all terminals connected and enclosure							
	Vibration-proof	10 to 55Hz frequency, 1.5mm 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)							
Emitting element		Infrared LED (modulated)							
Material		Protective enclosure : Aluminum, Module case : ABS, Front cover : Acrylic, Lens : Acrylic							
Cable		Cabletyre 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
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							

(*1) : The indicators on the receiver reveal the incident beam intensity level as follows.

Incident beam intensity (%)	Output operation	Indicator operation		
		Stable incident beam indicator (⊕)	Unstable incident beam indicator (⊖)	Operation indicator (Ⓜ)
Much ↑ 125% 100% (ON)	Beam received operation ☀️ Lights up	☀️	☀️	
Little ↓ 0% (OFF)	Beam interrupted operation ☀️ Lights up		☀️	☀️

SPECIFICATIONS

Control units

Item	Type	AC power operation	DC power operation
	Model No.	SF1-AC	SF1-AC2
Applicable sensor units	SF1-A□, SF1-A□-H		
Supply voltage	100 to 240V AC 50 to 60Hz		24V DC ± 15% Ripple P-P 10% or less
Power consumption	24VA or less (including the sensor unit)		
Current consumption			1A or less (including the sensor unit)
Sensing output (FSD1, FSD2)	Relay contact 1a (Two outputs) • Switching capacity : 250V 1.5A AC (resistive load) 30V 3A DC (resistive load) • Electrical life : 100,000 operations or more (rated load, switching frequency 20 cycles/min.) • Mechanical life : 10,000,000 operations or more (switching frequency 180 cycles/min.)		Relay contact 1a (Two outputs) • Switching capacity : 30V 3A DC (resistive load) • Electrical life : 100,000 operations or more (rated load, switching frequency 20 cycles/min.) • Mechanical life : 10,000,000 operations or more (switching frequency 180 cycles/min.)
	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 relays are turned off. (*1)	
	Response time	20ms or less (including sensor's response time)	
Lockout output (SSD)	Relay contact 1a • Switching capacity : 250V 1.5A AC (resistive load) 30V 3A DC (resistive load) • Electrical life : 100,000 operations or more (rated load, switching frequency 20 cycles/min.) • Mechanical life : 10,000,000 operations or more (switching frequency 180 cycles/min.)		
	Output operation	ON (closed) in the normal condition/OFF (open) in the lockout condition (*2)	
	Response time	500ms or less	
Monitor output			Relay contact 1b • Switching capacity : 30V 3A DC (resistive load) • Electrical life : 100,000 operations or more (rated load, switching frequency 20 cycles/min.) • Mechanical life : 10,000,000 operations or more (switching frequency 180 cycles/min.)
	Output operation	ON (open) when all beams are received/OFF (closed) 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 (*3)	
	Response time	20ms or less	
Input	Develop short-circuit with a contact • Lockout release input : Short-circuit between terminals, and the lockout is released • External lockout input : Open between terminals, and the system goes into the lockout condition • External FSD-OFF input : Short between terminals, and FSDs are turned off • Muting input : Short-circuit between terminals on the dual inputs simultaneously (AND circuit), and the system is muted (*4) • Monitor input : The system goes into the lockout condition when MPCEs are not coincident with the status of FSDs (double circuits)		Develop short-circuit with a contact • Test input : Open between terminals, and stop emission • Restart input : Short-circuit between terminals, and sensing output is activated • Monitor input : The system goes into the lockout condition when MPCEs are not coincident with the status of FSDs (double circuits)
	Indicator	Power indicator : White LED (lights up while the power is supplied) Lockout output indicator : White LED (lights up in the lockout condition) FSD operation indicator : Yellow LED (lights up when FSDs are not activated)	Power indicator : Yellow LED (lights up while the power is supplied) Incident beam indicator : Green LED (lights up when the sensing output is activated) FSD operation indicator : Red LED (lights up when the sensing output is not activated) *All indicators light up in the lockout condition
Environmental resistance	Pollution degree	3 (Industrial environment)	
	Protection	IP65 (IEC)	
	Ambient temperature	- 10 to + 55°C (No dew condensation nor icing allowed), Storage : - 10 to + 60°C	
	Ambient humidity	35 to 85%RH, Storage : 35 to 85%RH	
	EMC	Emission • Immunity : prEN50100-1	
	Voltage withstandability	1,500V AC for one min. between AC inputs and DC outputs	1,500V AC for one min. between DC inputs and DC outputs
	Insulation resistivity	20MΩ or more at 500V DC Megger between AC inputs and DC outputs	20MΩ or more at 500V DC Megger between DC inputs and DC outputs
	Vibration-proof	10 to 55Hz frequency, 2G constant, and X, Y, and Z directions each for one hour (unenergized)	
	Shock-proof	100m/s ² acceleration (approx. 10G), and X, Y, and Z directions each for three times (unenergized)	
	Material	Mild iron steel plate	
Weight	Approx. 3.5kg		
Accessories	SF1-AC-TL (Test rod) : 1pc., NA-BC-K2 (Front-cover open key) : 1pc. NA-BC-K3 (Lockout release key) : 1pc., MEHS-SF1A (System information plate) : 1pc.		
			SF1-AC-TL (Test rod) : 1pc., Cable conduit : 1pc.

(*1) : On the following conditions, the FSDs (sensing output) are turned off.
 ① When one or more beams are interrupted. [unless the sensor unit is muted. (SF1-AC only)]
 ② When the sensor unit falls into an abnormal condition. (sensor failure)[unless the sensor unit is muted. (SF1-AC only)]
 ③ When the sensor unit receives an intense ambient light. [unless the sensor unit is muted. (SF1-AC only)]
 ④ When the sensor unit cable or the mating cable is broken or short-circuited. [unless the sensor unit is muted. (SF1-AC only)]
 ⑤ When the external FSD-OFF input is short-circuited (SF1-AC only).
 ⑥ When the test input is opened. (SF1-AC2 only)

(*2) : On the following conditions, the SSD (lockout output) is turned off.
 ① When the system is initiated or reactivated by power-up.
 ② When one FSD relay fails. (e.g.) A relay contact is welded.
 ③ When one MPCE relay fails. (e.g.) A relay contact is welded.
 ④ When the dual circuits in SF1-AC cause different result.
 ⑤ When the external lockout input is opened (SF1-AC only).
 ⑥ When the operation of the MPCEs contradicts with the mode (N.O./N.C.) set with the MPCE mode switch.

(*3) : On the following conditions, the monitor output is turned off.
 ① When one or more beams are interrupted.
 ② When the sensor unit falls into an abnormal condition.
 ③ When the sensor unit receives an intense ambient light.
 ④ When the sensor unit cable or the mating cable is broken or short-circuited.
 ⑤ When the test input is opened. (emission stopped)

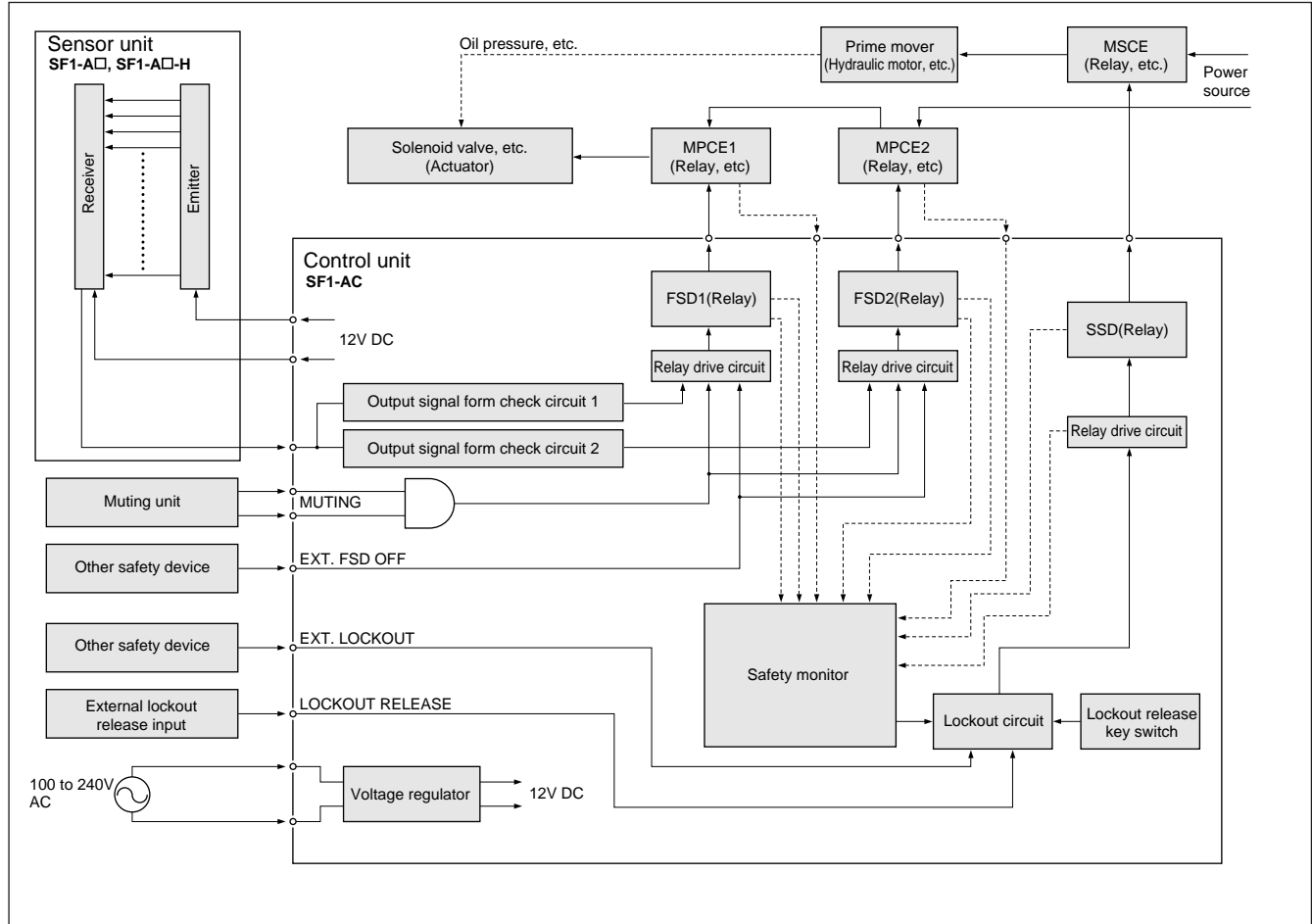
(*4) : The muting input (SF1-AC only) cancels the sensor operation so that any beam interruption can not make the FSD output relays open. This function is used to have the sensor inoperable temporarily for feeding a workpiece into a machine or unfeeding it. The input must be carefully manipulated.

SF1-A

I/O CIRCUIT AND WIRING DIAGRAMS

SF1-AC

Block diagram



Glossary of terms

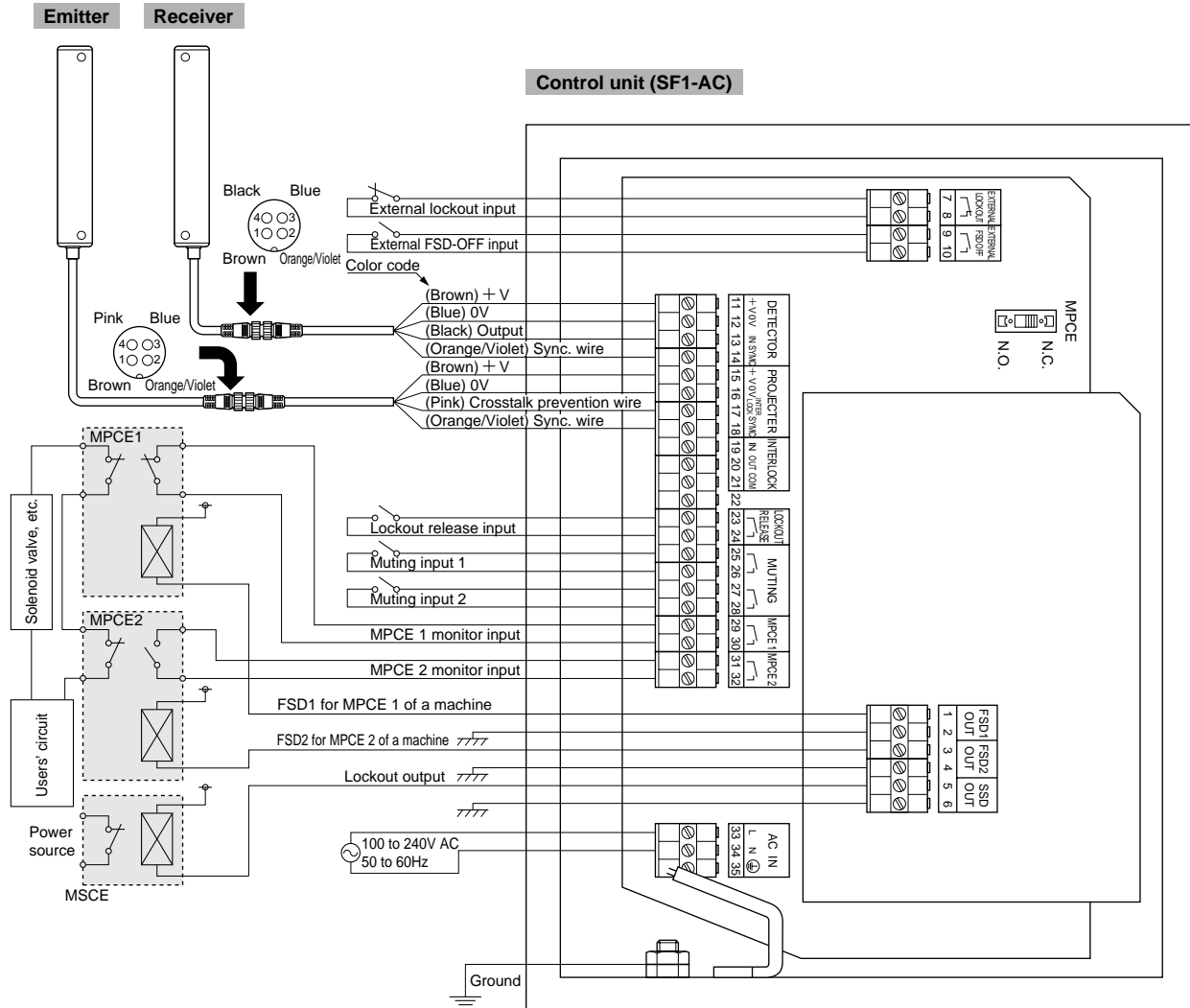
Terms	Description
MPCE (Machine Primary Control Element)	The electrically powered element which directly controls the machine's normal operating motion in such a way that it is last (in time) to operate when motion is initiated or arrested. The SUNX control unit is designed to use two safety relay units as MPCEs.
MSCE (Machine Secondary Control Element)	A machine control element independent of the machine primary control element and capable of removing the source of power from the prime mover of the relevant dangerous parts in an emergency. The SUNX control unit is designed to use one relay as a MSCE.
FSD (Sensing output) (Final Switching Device)	The component of the photoelectric safety system which, when the beam curtain or safety monitoring means are actuated, responds by interrupting the circuit connecting it to a MPCE, machine primary control element. Two relay units are contained in the control unit as FSDs. FSDs are turned off in response to each of the following conditions: ①When one or more beams are interrupted unless the sensor unit is muted. ②When the sensor unit falls into an abnormal condition (sensor failure) unless the sensor is muted. ③When the sensor unit receives an intense ambient light unless the sensor unit is muted. ④When the sensor unit cable or the mating cable is broken or short-circuited unless the sensor unit is muted. ⑤When the external FSD-OFF input is short-circuited.

Terms	Description
SSD (Lockout output) (Secondary Switching Device)	The component of the photoelectric safety system which, in a lockout condition, interrupts the circuit connecting it to the MSCE, machine secondary control element. One relay is built in the control unit.
Safety monitor	The component of the photoelectric safety system which monitors any inconsistency of action among MPCEs, FSDs and SSD.
Muting unit	A facility for automatically switching the safety system into a condition where FSDs, final switching devices, do not respond to an actuation of the sensing unit. The SUNX control unit provides dual terminals for the muting input. The facility has to be prepared by a user if required.

I/O CIRCUIT AND WIRING DIAGRAMS

SF1-AC

Wiring diagram



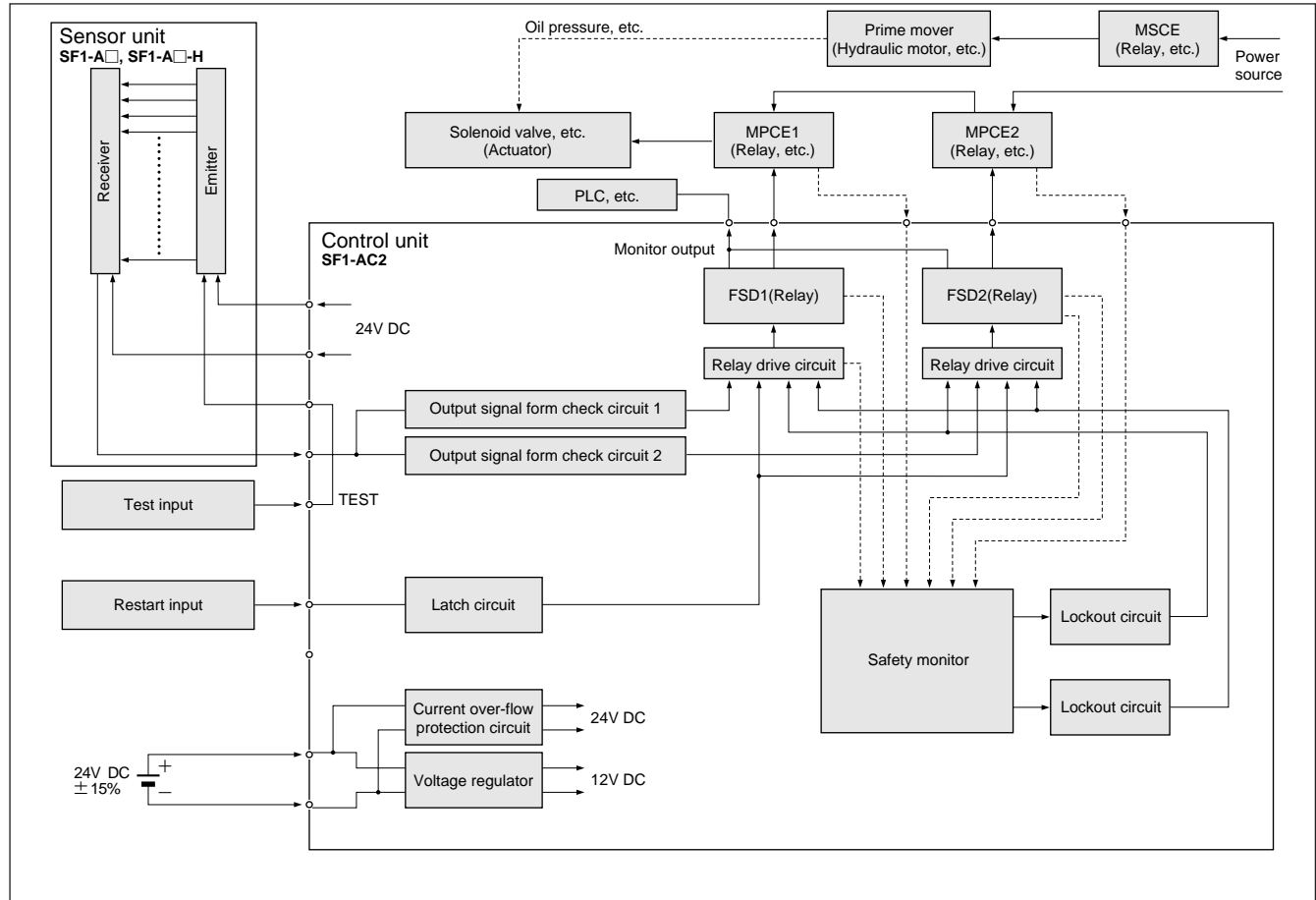
Global Conformance to Safety Standards	SF1-A	
Individual Beam Outputs	SF1-F	SF1-S
Fail-safe Design	NA40	SF1-N
For General Use	NA2	SF1-N
Slim Body	NA1-5	NA2

SF1-A

I/O CIRCUIT AND WIRING DIAGRAMS

SF1-AC2

Block diagram



Glossary of terms

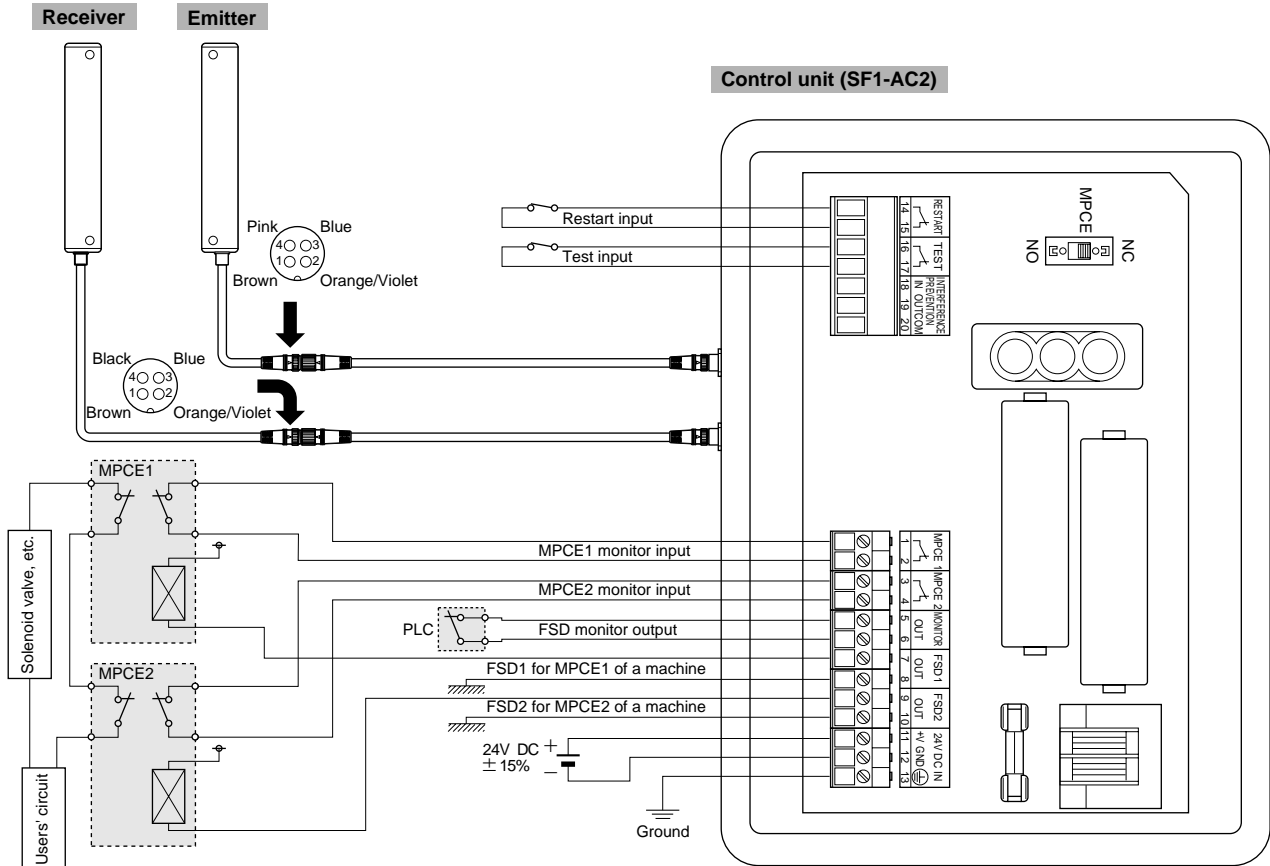
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Terms	Description
Monitor output	1b contacts of FSD relays connected in series that inform of the FSD status to the external device. The operation responds at the same time as FSD's movement in contrast.
Safety monitor	The component of the photoelectric safety system which monitors any inconsistency of action among MPCEs, and FSDs.

I/O CIRCUIT AND WIRING DIAGRAMS

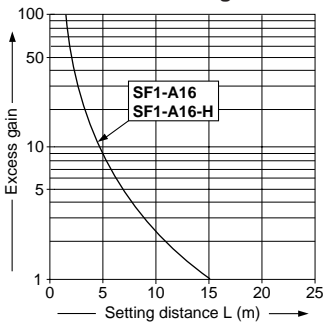
SF1-AC2

Wiring diagram

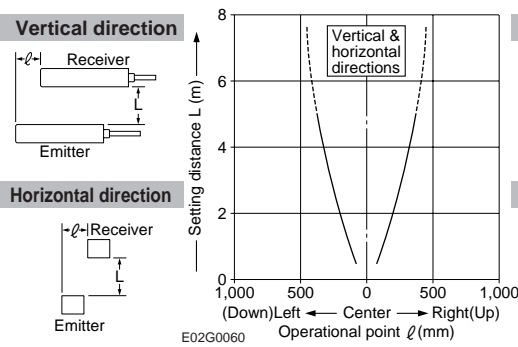


SENSING FIELDS (TYPICAL)

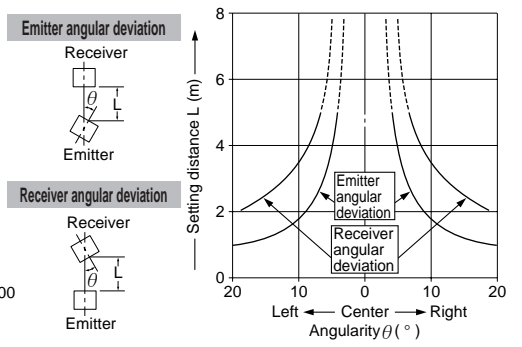
Correlation between setting distance and excess gain



Parallel deviation (All models)



Angular deviation (All models)




Global Conformance to Safety Standards	SF1-A
Individual Beam Outputs	SF1-F
Fall-safe Design	SF1-S
For General Use	NA40
Slim Body	NA2
NA1-5	NA2

SF1-A


PRECAUTIONS FOR PROPER USE

Refer to P.682~for general cautions



• To use this product in the U.S.A., refer to OSHA 1910. 212. 217. for installation, and in Europe, refer to prEN999 as well. Observe your national and local requirements before installing this product.

MPCE



European standard obliges you to use approved safety relays as MPCEs.

SF1-A	SF1-N	NA40	SF1-S	SF1-F	NA2	NA1-5
Global Conformance to Safety Standards	For General Use	For General Use	Fail-safe Design	Individual Beam Outputs	Slim Body	Slim Body

- Make sure to use the sensor units with the exclusive control unit and carry out the test run before operating.
- This safety system is for use only on machinery incorporating dangerous parts that can be stopped immediately, either by an emergency stop unit or by disconnecting of the power source. Do not use this system with certain types of machinery incapable of stopping at any point in its machine cycle.
- Check out the dangerous situation at first. Reactivate the system after eliminating the cause of a failure by releasing the lockout condition.
- Be sure to close the front cover on the control unit before operating. Also, the front cover open key of the **SF1-AC** should always be kept under the supervision of an authorized person.
- The **SF1-AC** system can only be made active by the key switch. The key should always be kept under the supervision of a responsible, and authorized person.

Mounting

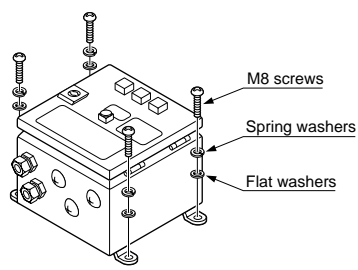
- Use the sensor units with the front cover and the enclosures always. Otherwise, IP protection can not be maintained or a contact failure may occur between modular units.
- The tightening torque of the sensor unit should be 2N·m {20.3kgf·cm} or less. Tighten the control unit at four points as shown below.

- The MPCE response time is expected to be within 100ms after FSD is turned OFF/ON. Use the relay of which response time is 100ms or less.
- Set the MPCE mode switch on the circuit board in the control unit according to the MPCE operation mode.

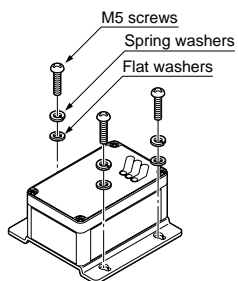
Wiring

- Prepare the other power source, not to use the power source in the **SF1-AC** control unit for auxiliary facilities even connected to it. (such as muting unit, stopping performance monitor or so) .
- Protect cables with a duct (such as a flexible pipe, a wire tube or so) and separate the sensor unit cables from other cable connected to the control unit with respective ducts.
- The **SF1-AC** is incorporated with the external lockout input for another safety device.
- The lockout release input of the **SF1-AC** can act upon several safety devices at one time. Make sure, however, this function is available only when these devices are installed on one machine. Do not use this with several machines.
- Short-circuit the external lockout input terminals of the **SF1-AC** with the attached short bar when it is not used.
- Cable sizes matching cable conduits must be from $\phi 4$ to $\phi 8$ mm and from $\phi 10$ to $\phi 14$ mm.
- The **SF1-AC2** provides two connectors on the bottom, in which the sensor unit are connected.

SF1-AC

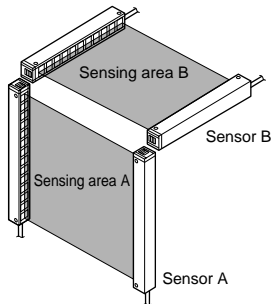


SF1-AC2

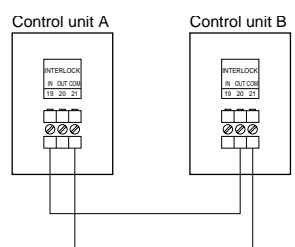


Crosstalk prevention function

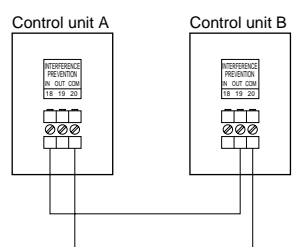
- Complete the wiring shown below to install two sets of sensor units adjacently as the illustration on the right. With the **SF1-AC** control units, connect both INTERLOCK COM. terminals (No. 21) in common, also connect IN terminal (No. 19) of one control unit with OUT terminal (No. 20) of the other control unit. With the **SF1-AC2** control units, connect both INTERFERENCE PREVENTION COM. terminals (No. 20) in common, also connect IN terminal (No. 18) of one control unit with OUT terminal (No. 19) of the other control unit.



SF1-AC



SF1-AC2



PRECAUTIONS FOR PROPER USE

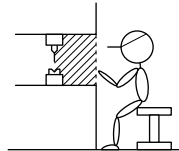
Refer to P.682~for general cautions

Test input (SF1-AC2 only)

- The emission is halted when the test input terminals (No. 16 and No. 17) are opened. As the monitor output, the supplementary FSD output, responds the signal state of the test input, the automatic remote monitoring system can be established to test if the safe guard system is operable or not away from the machine operating circuitry.

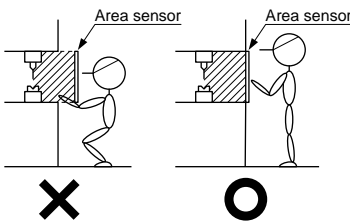
From selection to installation of sensor unit

- Determine the hazardous area, in height and length.

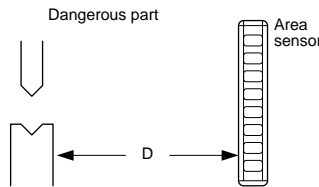


- Determine the protection area with the sensor unit.

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

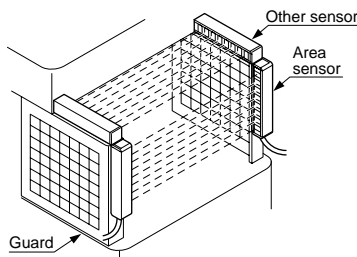


- Obtain the safety distance (D). The safety distance (D) from the sensing field to the point of operation is fully specified in OSHA 1910. 217 (U.S.) or prEN999 (EU). Follow the regulation enforced in your country.

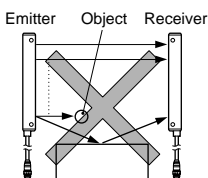


- Determine the defensible height (sensing height) of sensor units as well as the number of beam channels.

- Access 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.



- Install the sensor units where they can not be affected by the beam reflected on a frame of machinery or a work-piece.



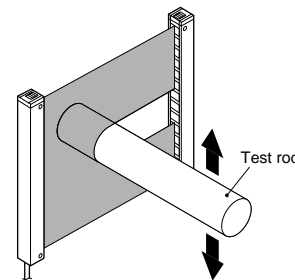
If the reflected beam is received, the beam interruption may not be perfect.

Restart input (SF1-AC2 only)

- While the restart input terminals (No. 14 and No. 15) are short-circuited, the FSD outputs are normally generated. While they are, however opened, the FSD outputs are held in the OFF state once after the beam is interrupted, and not restored by the full beam receiving until the terminals are closed. This function enables a human entering observation system into a dangerous area.

Operation test

- Test the sensor's operation with the accessory test rod as shown below. Make sure the operation indicator (red LED) on a receiver lights up by beam interruption.



Others

- The system delays 500ms to go into the lockout condition. (The delay time of the MPCE relays is concerned.)
- 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. These lights may affect the detectability.
- The set of the sensor unit 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 sensor units.
- Fix the system information plate (**MEHS-SF1A**) on the visible place on a machine permanently after filling the columns of *1 and *2 shown below by a die-stamp. (Not attached to the SF1-AC2)

The overall photoelectric safety system	
1.The overall system response time	<input type="text" value="*1"/> ms
2.The minimum separation distance	<input type="text" value="*2"/> mm
3.The appropriate test piece diameter	<input type="text" value="60"/> mm

*1 : Stamp the overall system response time of the safety system with a die.

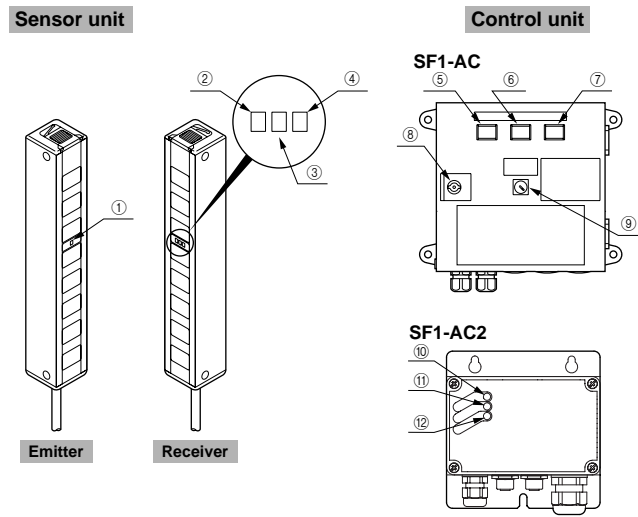
*2 : Stamp the minimum separation distance between hazardous area and sensor units with a die.

SF1-A

PRECAUTIONS FOR PROPER USE

Refer to P.682~for general cautions

Designation and function



	Designation	Description
Sensor unit	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 Unstable incident beam indicator (Yellow LED)	Lights up when one or more beams are received unstably. ③ and ④ blink alternately when the synchronization wire is broken or when the emitting circuit fails.
	④ Operation indicator (Red LED)	Lights up when one or more beams are interrupted and blinks when any ambient light is received.
Control unit	⑤ FSD operation indicator (Yellow LED)	Lights up when the FSDs are not activated.
	⑥ Lockout output indicator (White LED)	Lights up in the lockout condition.
	⑦ Power indicator (White LED)	Lights up while the power is supplied.
	⑧ Front-cover open key	Opens or closes the front cover.
	⑨ Lockout release key	Releases the lockout condition.
	⑩ Power indicator (Yellow LED)	Lights up while the power is supplied.
	⑪ Incident beam indicator (Green LED)	Lights up when the sensing output is activated.
	⑫ FSD operation indicator (Red LED)	Lights up when the sensing output is not activated.

Operation matrix

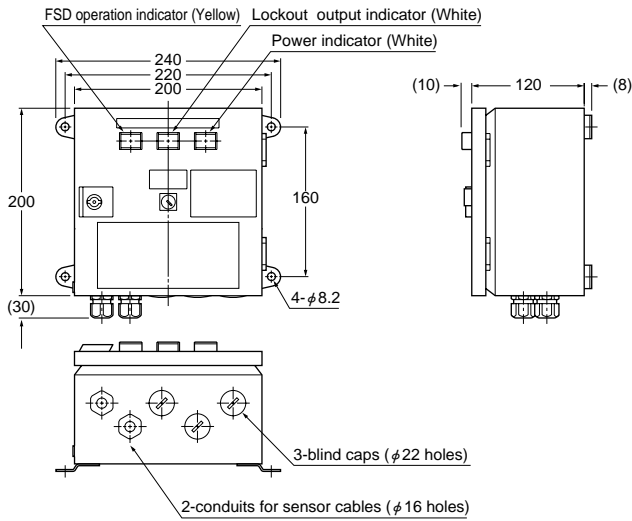
• To acknowledge the operating conditions of the outputs, and indicators on sensor unit and the control unit

SF1-AC ☀ : Lights up ● : Blink ● : Lights off △ : Uncertain state according to situation × : Either state locked up according to failure

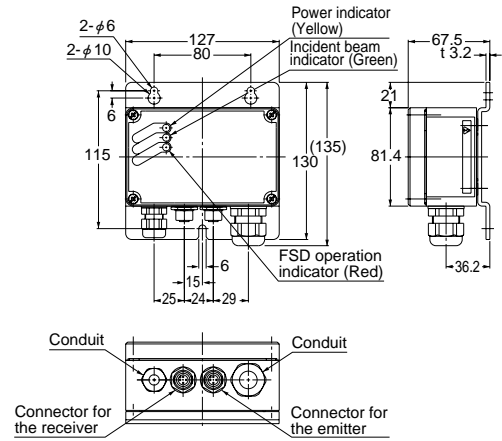
Unit		Emitter	Receiver			Control unit (SF1-AC)						
		Emitting indicator (Green LED)	Indicator		Operation indicator (Red LED)	Indicator			Output relay			
Item			Stable incident beam indicator (Green LED)	Unstable incident beam indicator (Yellow LED)		FSD operation indicator (Yellow LED)	Lockout output indicator (White LED)	Power indicator (White LED)	FSD 1 sensing output relay 1	FSD 2 sensing output relay 2	SSD lockout output	
Normal operation	Stable beam received (All beams)	☀	☀	●	●	●	●	☀	○	○	○	
	Beam interrupted (One or more beams are interrupted)	☀	●	●	☀	☀	●	☀	○	○	○	
Abnormal condition	Sensor unit	Emitting element failure	☀	●	●	☀	☀	●	☀	○	○	○
		Emitting circuit failure	●	●	●	☀	●	☀	○	○	○	
		Receiving element failure	☀	●	●	☀	☀	●	☀	○	○	○
		Receiving circuit failure	☀	●	●	☀	☀	●	☀	○	○	○
		Output circuit failure/Output wire broken	☀	△	△	△	☀	●	☀	○	○	○
	Power wire broken	Receiver	☀	●	●	●	☀	●	☀	○	○	○
		Emitter	●	●	●	☀	●	☀	○	○	○	
	Synchronization wire broken	☀	●	●	☀	☀	●	☀	○	○	○	
	Ambient light check	Faint ambient light	☀	△	△	●	△	●	☀	△	△	○
		Intense ambient light	☀	●	●	●	☀	●	☀	○	○	○
Insufficient beam intensity (Unstable beam received)	☀	●	●	☀	●	●	☀	○	○	○		
Control unit	Output relay contact welded	☀	△	△	△	●	☀	☀	× or ○	× or ○	○	
	Output relay driving circuit failure	☀	△	△	△	●	☀	☀	○	○	○	
	AC power wire broken	●	●	●	●	●	●	●	○	○	○	
External input	MPCE relay contact welded	△	△	△	△	☀	☀	☀	○	○	○	
	Muting	△	△	△	△	●	●	☀	○	○	○	
	External FSD-OFF input short-circuited	△	△	△	△	☀	●	☀	○	○	○	
	External lockout input short-circuited	△	△	△	△	☀	☀	☀	○	○	○	
	Lockout release input	△	△	△	△	△	●	☀	△	△	○	

DIMENSIONS (Unit : mm)

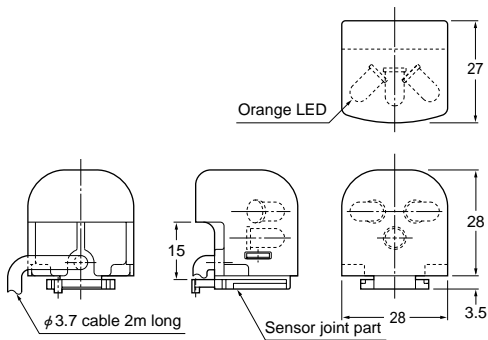
SF1-AC Control unit



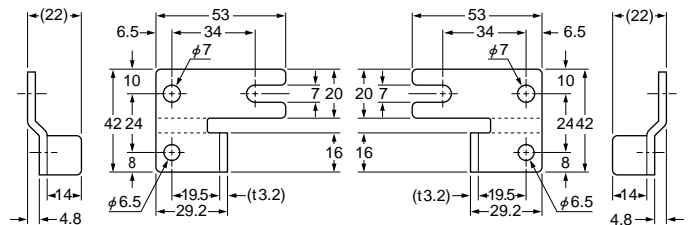
SF1-AC2 Controller



SF-IND Large indicator (Option)



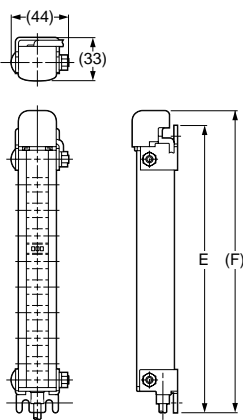
MS-SF1-P Sensor mounting bracket (Option)



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

Assembled dimensions

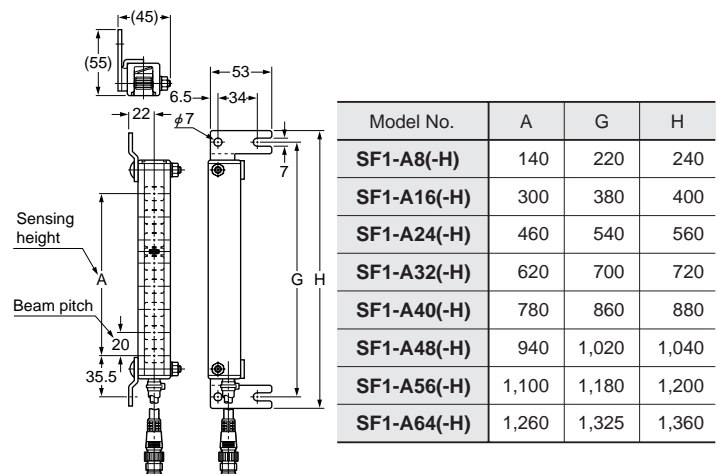
Mounting drawing with SF1-A□.
The spatter protection hood type (SF1-A□-H) is assembled in the same way.



Model No.	E	F
SF1-A8(-H)	219	232
SF1-A16(-H)	379	392
SF1-A24(-H)	539	552
SF1-A32(-H)	699	712
SF1-A40(-H)	859	872
SF1-A48(-H)	1,019	1,032
SF1-A56(-H)	1,179	1,192
SF1-A64(-H)	1,339	1,352

Assembled dimensions

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



Model No.	A	G	H
SF1-A8(-H)	140	220	240
SF1-A16(-H)	300	380	400
SF1-A24(-H)	460	540	560
SF1-A32(-H)	620	700	720
SF1-A40(-H)	780	860	880
SF1-A48(-H)	940	1,020	1,040
SF1-A56(-H)	1,100	1,180	1,200
SF1-A64(-H)	1,260	1,325	1,360