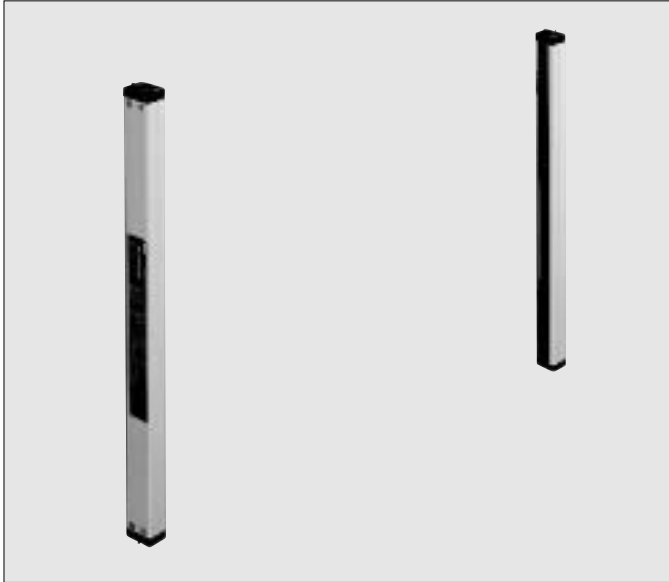


SF2-N

SERIES

Compact Safety Light Curtain



Type 2
20/40mm Beam Pitch



Safety level required by global standards

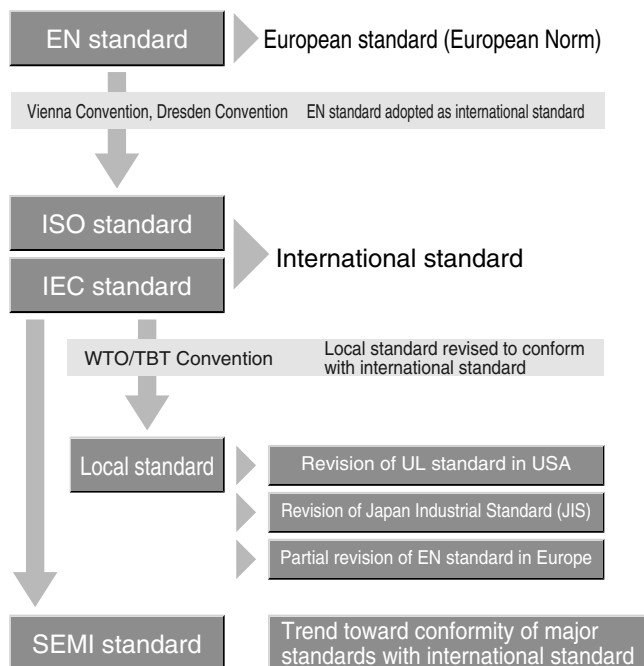
‘Safety’ has joined ‘Environment’ as one of the keywords of the new century. Machinery is one principal area where the importance given to safety issues has been increasing throughout the world, and this has been leading to the global standardization of safety levels.

In 2001 the ISO 12100 international safety standard will be established in line with this trend toward safety standardization. This new standard is based on the EN standards which are in operation in Europe, an area which has been very progressive in promoting safety. At the same time, other countries around the world have been reviewing their own safety standards.

GLOBAL SAFETY STANDARDS



Establishment of Local Standards in Line with International Standard



Application of IEC 61496 (Type 2) Industrial Standard

The **SF2-N** series have the same level of safety built into the sensor body as conventional fail-safe type area sensors, and conform European and North American safety standards. So, they can be used in workplaces throughout the world.

Europe

CE marking based on Machine Directive and EMC Directive has been obtained, so that the sensors can be used in Safety Category 2 equipment.

[Type 2 based on EN (IEC) 61496-1/2 and Category 2 based on EN 954-1]

North America

C-UL listings (IEC 61496-1/2) which are required for use in the United States and Canada have been obtained.



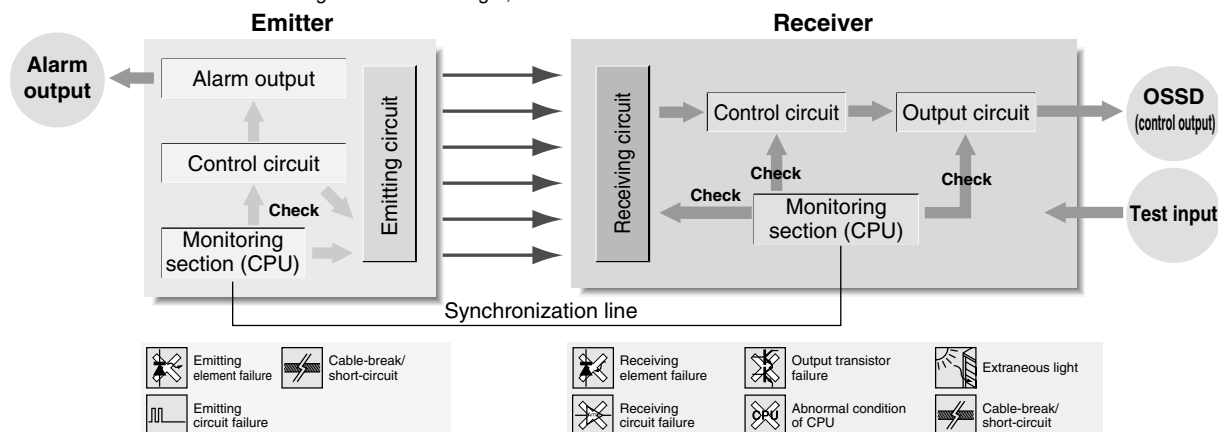
High Level of Safety Achieved

The sensor carries out self-diagnosis when it is turned ON.

The monitoring section (CPU) which is inside the emitter constantly checks the emitting circuit and the control circuit. Furthermore, the receiver also has a monitoring section (CPU) which constantly checks the receiving circuit, control circuit and output circuit, so that a high level of safety is maintained at all times.

Safety design of the SF2-N series

- The sensor switches to the lockout mode when an error occurs, so that the OSSD (control output) and alarm output turn OFF.
- Two output transistors are connected in series to provide duality, so that the sensor also locks out if one of the transistors is short-circuited.
- Self-diagnosis using test input allows detailed checking such as overlapping emission (overcurrent error), light emission strength, etc.



SF2-N

High-performance sensors meeting the needs of workplaces around the world

The SF2-N series of sensors utilize the latest advances in SUNX sensor technology to provide a variety of useful functions while meeting international standards. They combine the level of safety required by such standards with a truly remarkable ease of use. Our newly-developed light curtain, with radically new features, contributes greatly to improved safety at the workplace.

World's Smallest Design, with No Exclusive Controller Required

Compact Design, 28mm Wide and 19mm Thick

The design is compact, with a width of only 28mm and a thickness of 19mm, and no exclusive controller is required, so that minimum space is required for installation. The small amount of space needed allows the sensors to be incorporated into the machinery.



Safety Relay Unit SRB-NA-R-C.17/SX

The optional safety relay unit (SRB-NA-R-C.17/SX) can be used with the SF2-N series to create a basic intrusion detection system (PNP output type only).

- Use is possible up to Category 4 based on EN 954-1 (Category 2 when combined with the SF2-N series) to create a safety system of the highest level.
- Its thin design with a width of 22.5mm takes up less space inside the control panel.
- The unit is constructed from several safety relays, each one of which has a self-protection circuit, so that even if one of the contacts should fuse, the unit can continue to operate safely.
- The unit is equipped with a trailing edge switching function, which prevents unexpected starting which can occur if the start switch becomes fused.



CE UL SA TÜV BIA

* Refer to the SF2-EH series catalog for further details.



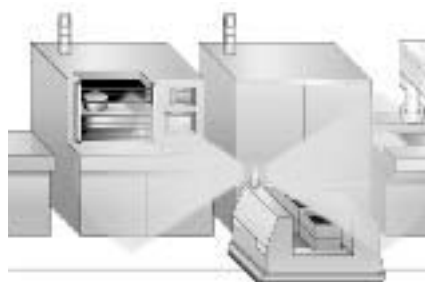
Incorporates an Extraneous Light Checking Function

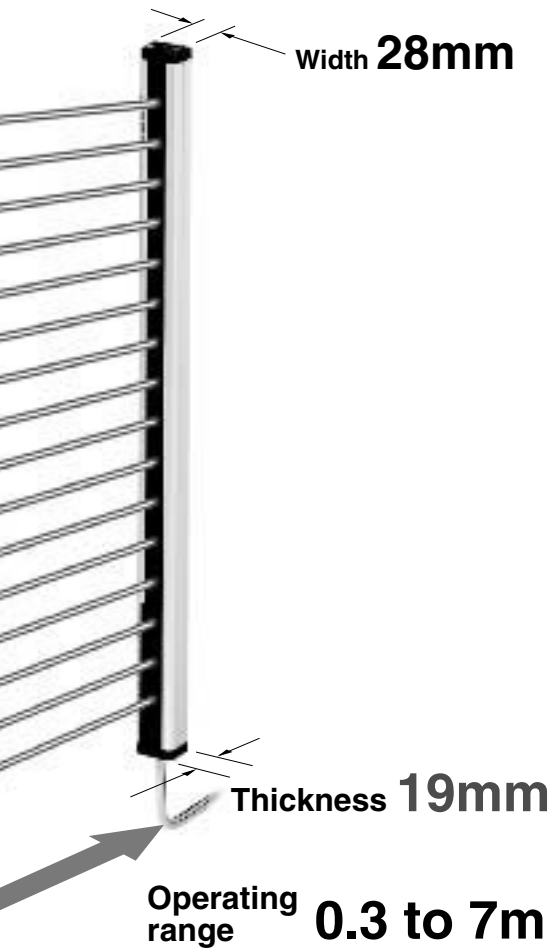
Distinguishes Extraneous Light to Prevent Malfunction

The ELC (Extraneous Light Check) function prevents malfunction due to extraneous light, such as from other nearby passing sensors, AGVs, patrol lights or spatter light.

* What is the Extraneous Light Check (ELC) function?

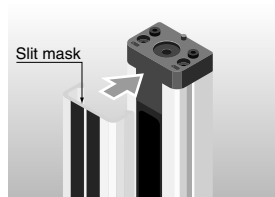
This function distinguishes between light from the sensor itself and light from extraneous sources, and reduces the effect of the extraneous light if it is received by the sensor.





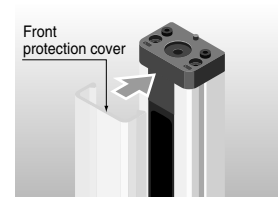
Slit Masks Boost Functionality

By using the optional slit mask (**OS-SF2N-A□**), the amount of beam emitted or received can be restrained to reduce the effect of extraneous light from other sensors, etc.



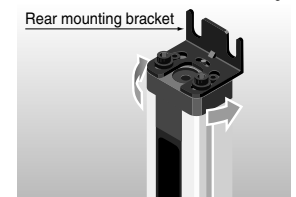
Front Protective Cover Protects the Sensing Surface

The optional front protection cover (**FC-SF2N-A□**) can be fitted to the sensor to protect the sensing surface even when using the sensor in poor environmental conditions.



Mounting Bracket Enables Easy Beam-axis Alignment

The beam-axis alignment is easy since angle adjustment is possible with the enclosed rear mounting bracket (**MS-SF2N-1**). Furthermore, the optional side mounting bracket (**MS-SF2N-3**) can also be used for side mounting.



Wire-saving by Series Connection Covers Even L-shaped and U-shaped Areas

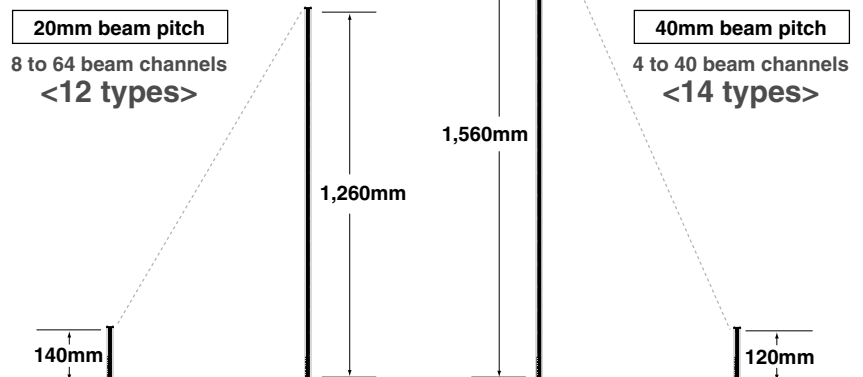
Using the optional serial connection cable, a maximum of 3 sets of sensors with a total of 128 beam channels (for 20mm beam pitch type) or 64 beam channels (for 40mm beam pitch type) can be connected in series. Hence, even L-shaped and U-shaped areas can be easily covered. Previously, separate wiring was required for 3 sets of sensors. But now, wiring equivalent to that for only one set is required, thus saving troublesome wiring and costs.



Wide Variety

Different Types for Different Needs

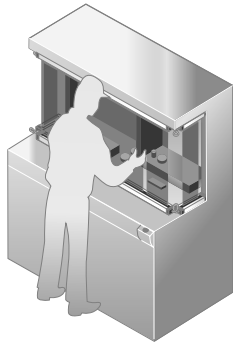
There are 12 models of sensors having an beam pitch of 20mm (detection capability ϕ 30mm) and a protective height ranging from 140mm (8 beam channels) to 1,260mm (64 beam channels). Plus, there are 14 models of sensors having an beam pitch of 40mm (detection capability ϕ 50mm) and a protective height ranging from 120mm (4 beam channels) to 1,560mm (40 beam channels). The sensors can be selected from this wide variety to suit your requirement. PNP output types are also available for all models.



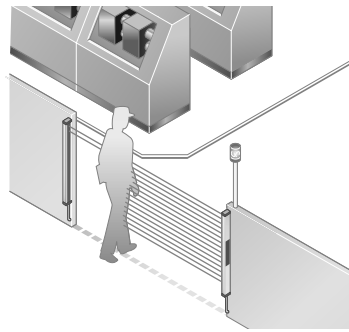
SF2-N

APPLICATIONS

Safeguard for special purpose machine



Detection of entry through the no-entry line



ORDER GUIDE

Sensors

Type	Appearance	Operating range	Model No.		Number of beam channels	Protective height (mm)
			NPN output type	PNP output type		
Light curtain		0.3 to 7m	SF2-NH8	SF2-NH8-PN	8	140
			SF2-NH12	SF2-NH12-PN	12	220
			SF2-NH16	SF2-NH16-PN	16	300
			SF2-NH20	SF2-NH20-PN	20	380
			SF2-NH24	SF2-NH24-PN	24	460
			SF2-NH28	SF2-NH28-PN	28	540
			SF2-NH32	SF2-NH32-PN	32	620
			SF2-NH36	SF2-NH36-PN	36	700
			SF2-NH40	SF2-NH40-PN	40	780
			SF2-NH48	SF2-NH48-PN	48	940
		SF2-NA4	SF2-NA4-PN	4	120	
		SF2-NA6	SF2-NA6-PN	6	200	
		SF2-NA8	SF2-NA8-PN	8	280	
		SF2-NA10	SF2-NA10-PN	10	360	
		SF2-NA12	SF2-NA12-PN	12	440	
		SF2-NA14	SF2-NA14-PN	14	520	
		SF2-NA16	SF2-NA16-PN	16	600	
		SF2-NA18	SF2-NA18-PN	18	680	
		SF2-NA20	SF2-NA20-PN	20	760	
		SF2-NA24	SF2-NA24-PN	24	920	
SF2-NA28	SF2-NA28-PN	28	1,080			
SF2-NA32	SF2-NA32-PN	32	1,240			
SF2-NA36	SF2-NA36-PN	36	1,400			
SF2-NA40	SF2-NA40-PN	40	1,560			

Mating cable is not supplied with the sensor. Please order it separately.

Mating cables

Designation	Appearance	Model No.	Description
Cable with connector on one end		SF2N-CC3	Length: 3m Weight: 400g approx.
		SF2N-CC7	Length: 7m Weight: 870g approx.
		SF2N-CC10	Length: 10m Weight: 1,200g approx.
Cable with connector on both ends		SF2N-CCJ10	Length: 10m Weight: 1,200g approx.

These cables are used for wiring.
7-core (6-core for emitter) shielded cable, with connector on one end, two cables per set
Cable outer diameter: ϕ 6mm
Connector outer diameter: ϕ 14mm max.

This cable is used for cable extension.
7-core (6-core for emitter) shielded cable, with connector on both ends, two cables per set
Cable outer diameter: ϕ 6mm, Connector outer diameter: ϕ 14mm max.

ORDER GUIDE

Mating cables

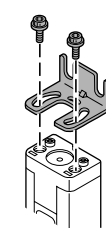
Designation	Appearance	Model No.	Description
Cable for series connection		SF2N-CSL02	Length: 200mm Weight: 40g approx.
		SF2N-CSL05	Length: 500mm Weight: 55g approx.
Bottom cap cable for series connection		SF2N-CB05	Length: 500mm Weight: 60g approx.

Spare parts

Designation	Model No.	Description
Rear mounting bracket	MS-SF2N-1	Used to mount the sensor on the rear surface (set of top and bottom brackets)
U-shaped rear mounting intermediate supporting bracket	MS-SF2N-2	Used to hold the sensor at the intermediate position for protection against vibration (for rear surface mounting) (set for emitter and receiver) (Note)
L-shaped intermediate supporting bracket	MS-SF2N-L	Used to install the intermediate supporting bracket on the wall side, etc. (Note) (set for emitter and receiver)
Test rod	SF2-NH-TR	Used for standard sensing to detect the smallest objects (ϕ 30mm), with 20mm beam pitch.

Note: The number of sets required varies depending on the product. Refer to 'DIMENSIONS' for further details.

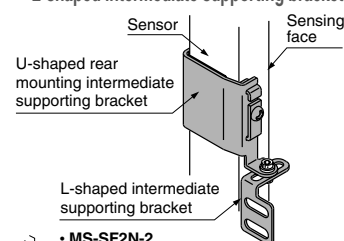
Rear mounting bracket



Four bracket set
Eight M3 (length 5mm) hexagon-socket-head bolts are attached.

U-shaped rear mounting intermediate supporting bracket

L-shaped intermediate supporting bracket



L-shaped intermediate supporting bracket

• **MS-SF2N-2**
Set of 2 Nos. each of U-shaped rear mounting intermediate supporting bracket and retaining plate

• **MS-SF2N-L**

Two L-shaped bracket set

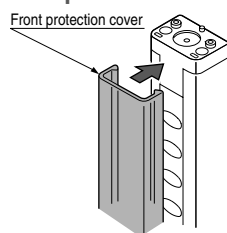
Two M3 (length 10mm) pan head screws, two M4 (length 10mm) hexagon-socket-head bolts and two nuts are attached.

OPTIONS

Designation	Type	For SF2-NH8 / NA4	For SF2-NH12 / NA6	For SF2-NH16 / NA8	For SF2-NH20 / NA10	For SF2-NH24 / NA12	For SF2-NH28 / NA14	For SF2-NH32 / NA16	For SF2-NH36 / NA18	For SF2-NH40 / NA20	For SF2-NH48 / NA24	For SF2-NH56 / NA28	For SF2-NH64 / NA32	For SF2-NA36	For SF2-NA40
	Front protection cover	Model No.	FC-SF2N-A4	FC-SF2N-A6	FC-SF2N-A8	FC-SF2N-A10	FC-SF2N-A12	FC-SF2N-A14	FC-SF2N-A16	FC-SF2N-A18	FC-SF2N-A20	FC-SF2N-A24	FC-SF2N-A28	FC-SF2N-A32	FC-SF2N-A36
Slit mask	Model No.	OS-SF2N-A4	OS-SF2N-A6	OS-SF2N-A8	OS-SF2N-A10	OS-SF2N-A12	OS-SF2N-A14	OS-SF2N-A16	OS-SF2N-A18	OS-SF2N-A20	OS-SF2N-A24	OS-SF2N-A28	OS-SF2N-A32	OS-SF2N-A36	OS-SF2N-A40

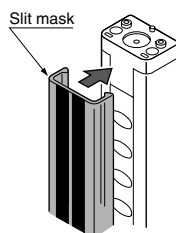
Note: The model Nos. given above denote a single unit, not a pair of units.

Front protection cover



It protects front lens.

Slit mask



The slit mask restrains the amount of beam emitted or received and hence reduces the interference between neighbouring sensors.

However, the operating range reduces when the slit mask is used.

Operating range

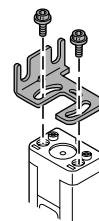
- Slit on the emitter side: 2.6m
- Slit on the receiver side: 2.6m
- Slit on both sides: 1.2m

Designation	Model No.	Description
Side mounting bracket	MS-SF2N-3	Used for side-mounting of sensors. (set of top and bottom brackets)
U-shaped side mounting intermediate supporting bracket	MS-SF2N-4	Used to hold the sensor at the intermediate position for protection against vibration (for side mounting) (Note 1) (set for emitter and receiver)
L-shaped intermediate supporting bracket	MS-SF2N-L	Used to install the intermediate supporting bracket on the wall side, etc. (Note 1) (set for emitter and receiver)
Test rod	SF2-NA-TR	Used for standard sensing to detect the smallest objects (ϕ 50mm), with 40mm beam pitch.
Safety relay unit (Note 2)	SRB-NA-R-C.17/SX	Relay unit for PNP output type • Complies with safety categories up to 4 based on EN 954-1 (Categories up to 2 when it is combined with the SF2-N series)

Notes: 1) The number of sets required varies depending on the product. Refer to the 'DIMENSIONS' for further details.

2) For further details, refer to the SF2-EH series catalog for the safety relay unit.

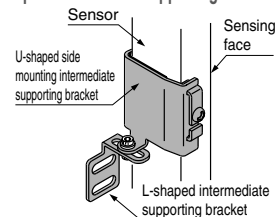
Side mounting bracket



Four bracket set

U-shaped side mounting intermediate supporting bracket

L-shaped intermediate supporting bracket



U-shaped side mounting intermediate supporting bracket

L-shaped intermediate supporting bracket

• **MS-SF2N-4**

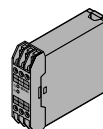
Set of 2 Nos. each of U-shaped side mounting intermediate supporting bracket and retaining plate

• **MS-SF2N-L**

Two L-shaped bracket set

Two M3 (length 10mm) pan head screws, two M4 (length 10mm) hexagon-socket-head bolts and two nuts are attached.

Safety relay unit



SF2-N

SPECIFICATIONS

Individual specifications

Item	Type		20mm beam pitch											
	Model No.	NPN output PNP output	SF2-NH8	SF2-NH12	SF2-NH16	SF2-NH20	SF2-NH24	SF2-NH28	SF2-NH32	SF2-NH36	SF2-NH40	SF2-NH48	SF2-NH56	SF2-NH64
No. of beam channels			8	12	16	20	24	28	32	36	40	48	56	64
Protective height			140mm	220mm	300mm	380mm	460mm	540mm	620mm	700mm	780mm	940mm	1,100mm	1,260mm
Weight			410g approx.	460g approx.	510g approx.	560g approx.	610g approx.	670g approx.	770g approx.	820g approx.	870g approx.	1,000g approx.	1,100g approx.	1,200g approx.

Item	Type		40mm beam pitch													
	Model No.	NPN output PNP output	SF2-NA4	SF2-NA6	SF2-NA8	SF2-NA10	SF2-NA12	SF2-NA14	SF2-NA16	SF2-NA18	SF2-NA20	SF2-NA24	SF2-NA28	SF2-NA32	SF2-NA36	SF2-NA40
No. of beam channels			4	6	8	10	12	14	16	18	20	24	28	32	36	40
Protective height			120mm	200mm	280mm	360mm	440mm	520mm	600mm	680mm	760mm	920mm	1,080mm	1,240mm	1,400mm	1,560mm
Weight			410g approx.	460g approx.	510g approx.	560g approx.	610g approx.	670g approx.	770g approx.	820g approx.	870g approx.	1,000g approx.	1,100g approx.	1,200g approx.	1,300g approx.	1,400g approx.

Common specifications

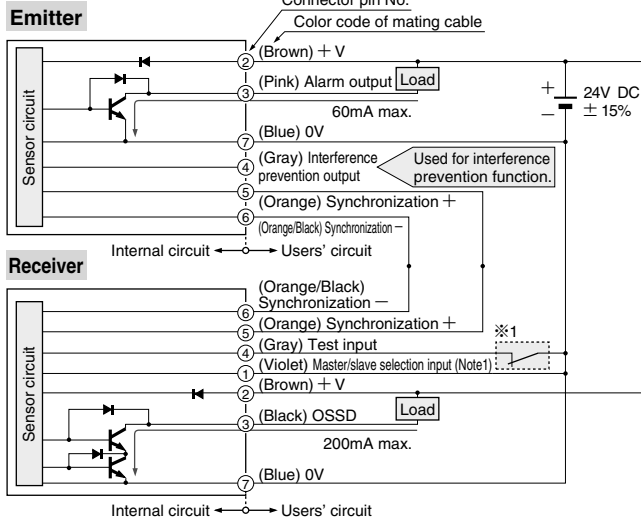
Item	Type		20mm beam pitch					40mm beam pitch				
	Model No.		SF2-NH□(-PN)					SF2-NA□(-PN)				
Operating range			0.3 to 7m									
Detection capability			φ30mm opaque object					φ50mm opaque object				
Effective aperture angle			± 5° or less for a operating range of 3m or more (conforming to IEC 61496-2)									
Supply voltage/Current consumption			24V DC ± 15% Ripple P-P 10% or less / 340mA or less (total with emitter and receiver combined)									
Output (OSSD)			<NPN output type> NPN open-collector transistor • Maximum sink current: 200mA • Applied voltage: 30V DC or less (between OSSD and 0V) • Residual voltage: 2.0V or less (at 200mA sink current)					<PNP output type> PNP open-collector transistor • Maximum source current: 200mA • Applied voltage: 30V DC or less (between OSSD and + V) • Residual voltage: 2.5V or less (at 200mA source current)				
	Operation mode		ON when all beams are received, OFF when one or more beams are interrupted (OFF also in case of any abnormality in the sensor or the synchronization signal)									
	Protection circuit		Incorporated									
Output (Alarm output)			<NPN output type> NPN open-collector transistor • Maximum sink current: 60mA • Applied voltage: 30V DC or less (between alarm output and 0V) • Residual voltage: 2.0V or less (at 60mA sink current)					<PNP output type> PNP open-collector transistor • Maximum source current: 60mA • Applied voltage: 30V DC or less (between alarm output and + V) • Residual voltage: 2.5V or less (at 60mA source current)				
	Operation mode		Normal operation: Alarm output ON, Failure resulting in emission halt, or when test input is applied: Alarm output OFF									
	Protection circuit		Incorporated									
Response time			OFF response: 15ms or less, ON response: 28ms or less (when light received is stable)									
Indicators	Emitter		Beam-axis alignment indicators: 2-color (Red/Green) LED × 4 (light up in red when the each beam area receives light, light up in green when all beams are received), Operation indicator: 2-color (Red/Green) LED (lights up in red when OSSD is OFF, lights up in green when OSSD is ON), Emission halt indicator: Orange LED (lights up when emission halts), Fault indicator: Yellow LED (lights up or blinks if a fault occurs in the sensor)									
	Receiver		Beam-axis alignment indicators: 2-color (Red/Green) LED × 4 (light up in red when the each beam area receives light, light up in green when all beams are received), OSSD indicator: 2-color (Red/Green) LED (lights up in red when OSSD is OFF, light up in green when OSSD is ON), Unstable incident beam indicator: Orange LED (lights up when light received is unstable), Fault indicator: Yellow LED (lights up or blinks if a fault occurs in the sensor)									
Test input function			Incorporated									
Master/Slave selection input			Connection to 0V (Low): master mode operation, Open (High): slave mode operation									
Interference prevention function			Incorporated Series connection: 3 sets max. [SF2-NH□(-PN): total 128 beam channels max., SF2-NA□(-PN): total 64 beam channels max.] Parallel connection: 2 sets max. Series and parallel mixed connection: Series connection of 3 sets max. and parallel connection of 2 sets max. are simultaneously possible. 20mm beam pitch type and 40mm beam pitch type cannot be combined together in series connection.									
Safety category			EN 954-1 Category 2 (IEC 61496-1/2 Type 2)									
Environmental resistance	Degree of protection		IP65 (IEC)									
	Ambient temperature		- 10 to + 55°C (No dew condensation or icing allowed), Storage: - 25 to + 70°C									
	Ambient humidity		30 to 85% RH, Storage: 30 to 95% RH									
	Ambient illuminance		Sunlight: 20,000 lx at the light-receiving face, Incandescent light: 3,500 lx at the light-receiving face									
	Dielectric strength voltage		1,000V AC for one min. between all supply terminals connected together and enclosure (Note 1)									
	Insulation resistance		20MΩ, or more, with 500V DC megger between all supply terminals connected together and enclosure (Note 1)									
Vibration resistance/Shock resistance			10 to 55Hz frequency, 0.75mm amplitude in X, Y and Z directions for two hours each/300m/s ² acceleration (30G approx.) in X, Y and Z directions for three times each									
Emitting element			Infrared LED (Peak emission wavelength: 870nm)									
Material			Enclosure: Aluminium, Front cover: Polyester, Cap: ABS									
Cable			Emitter: 6-core (0.3mm ² × 4-core, 0.2mm ² × 2-core) shielded cable, 0.5m long, with a connector at the end Receiver: 7-core (0.3mm ² × 5-core, 0.2mm ² × 2-core) shielded cable, 0.5m long, with a connector at the end									
Cable extension			Extension up to total 20.5m is possible, for both emitter and receiver, with optional mating cables.									
Accessories			MS-SF2N-1 (Rear mounting bracket): 1 set MS-SF2N-2 (U-shaped rear mounting intermediate supporting bracket): (Note 2) MS-SF2N-L (L-shaped intermediate supporting bracket): (Note 2) SF2-NH-TR (Test rod): 1 No.					MS-SF2N-1 (Rear mounting bracket): 1 set MS-SF2N-2 (U-shaped rear mounting intermediate supporting bracket): (Note 2) MS-SF2N-L (L-shaped intermediate supporting bracket): (Note 2)				

Notes: 1) Surge absorber is connected between the main body enclosure and the supply terminals, to avoid faulty operation due to surge. For this reason, the values for dielectric strength voltage and insulation resistance are given for the condition when the surge absorber has been removed.
2) MS-SF2N-2 (U-shaped rear mounting intermediate supporting bracket) and MS-SF2N-L (L-shaped intermediate supporting bracket) are attached with the following sensors. The number of attached U-shaped rear mounting intermediate supporting brackets and L-shaped intermediate supporting bracket are different depending on the sensor as follows.
SF2-NH36(-PN), SF2-NH40(-PN), SF2-NA18(-PN), SF2-NA20(-PN): 1 set, SF2-NH48(-PN), SF2-NA24(-PN): 2 sets
SF2-NH56(-PN), SF2-NH64(-PN), SF2-NA28(-PN), SF2-NA32(-PN), SF2-NA36(-PN): 3 sets, SF2-NA40(-PN): 4 sets

I/O CIRCUIT AND WIRING DIAGRAMS

NPN output type

I/O circuit diagram



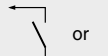
Notes: 1) Refer to P.12 for master/slave selection input.
2) Unused lines must be insulated to ensure that they do not come into contact with lines already in use.

CAUTION

Use a safety control circuit for the load (FSD).

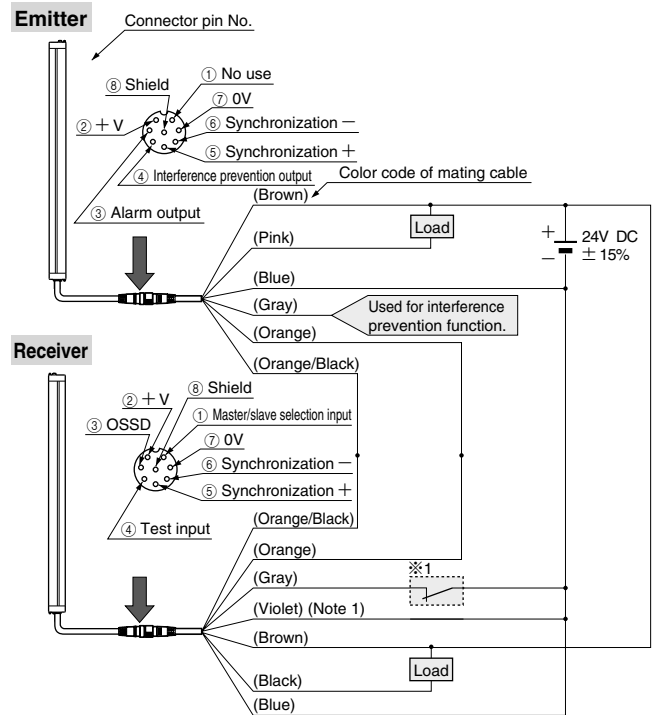
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Non-voltage contact or NPN open-collector transistor



- Test input
- Low (0V): emission
- High (open): emission halt

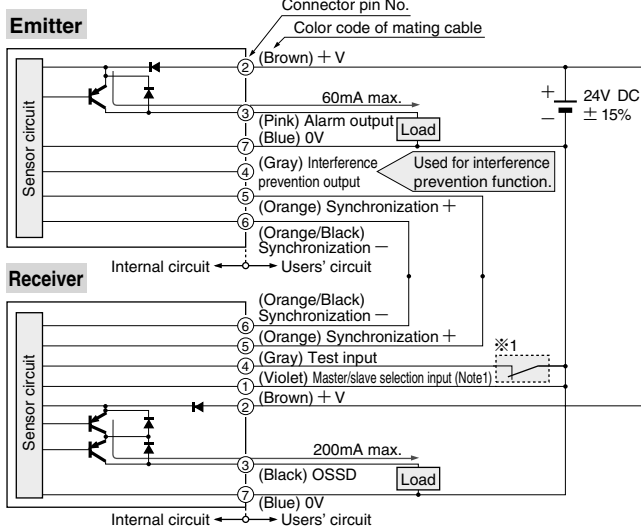
Wiring diagram



Notes: 1) Refer to P.12 for master/slave selection input.
2) Unused lines must be insulated to ensure that they do not come into contact with lines already in use.

PNP output type

I/O circuit diagram



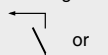
Notes: 1) Refer to P.12 for master/slave selection input.
2) Unused lines must be insulated to ensure that they do not come into contact with lines already in use.

CAUTION

Use a safety relay unit or a safety control circuit having equivalent safety for the load (FSD).

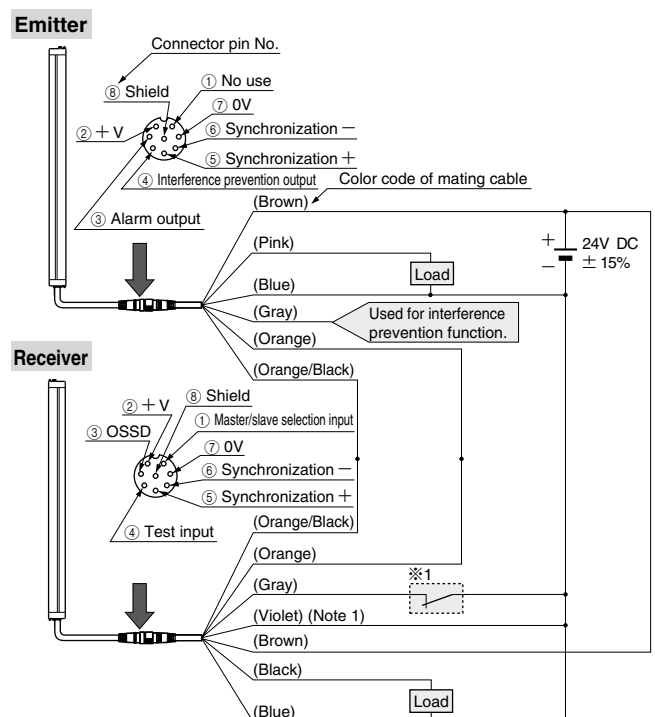
※1

Non-voltage contact or PNP open-collector transistor



- Test input
- Low (0V): emission
- High (open): emission halt

Wiring diagram



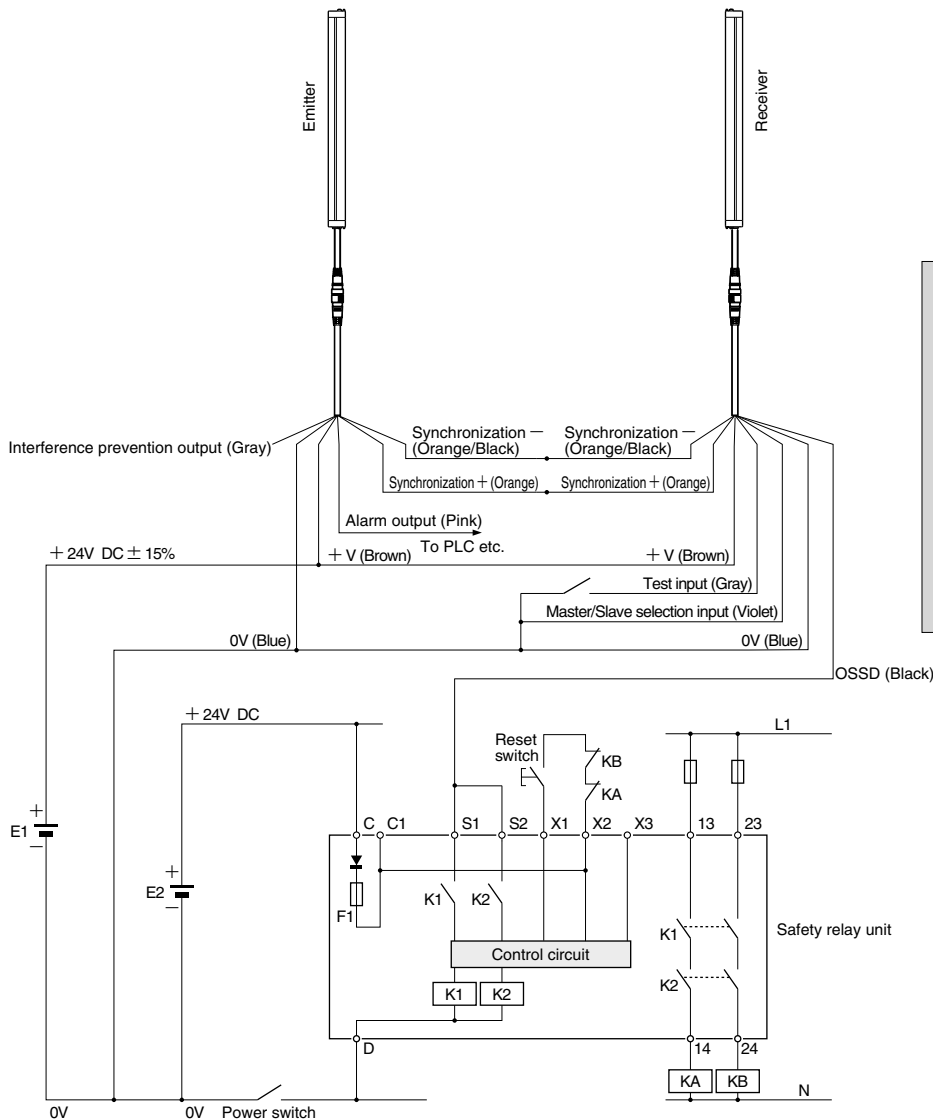
Notes: 1) Refer to P.12 for master/slave selection input.
2) Unused lines must be insulated to ensure that they do not come into contact with lines already in use.

SF2-N

I/O CIRCUIT AND WIRING DIAGRAMS

PNP output type

Example of a connection of safety relay unit (SRB-NA-R-C.17/SX)



In order to comply with safety standards, be sure to use separate power supplies for the safety relay unit power supply E2 and the safety light curtain power supply E1, and also make sure that they are both 0V.

In addition, the input signal (OFF signal) for the safety relay unit (SRB-NA-R-C.17/SX) should be 30ms or more.

Note: When using manual reset, connect terminals X1 and X2 of the safety relay unit as shown in the above diagram. When using automatic reset, short terminals X1 and X3 of the safety relay unit.

PRECAUTIONS FOR PROPER USE

Wiring

- Make sure to carry out the wiring in the power supply off condition.
- Verify that the supply voltage variation is within the rating.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this sensor, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.

Others

- Do not use during the initial transient time (2 sec.) after the power supply is switched on.
- Avoid dust, dirt and steam.
- Take care that the sensor does not come in direct contact with water, oil, grease, or organic solvents, such as, thinner, etc.
- Take care that the sensor is not directly exposed to fluorescent light from a rapid-starter lamp or a high frequency lighting device, as it may affect the sensing performance.

PRECAUTIONS FOR PROPER USE



- Do not utilize this sensor in 'PSDI Mode', in which the sensor is utilized as an activator for machinery.
- This sensor is a Type 2 electro-sensitive protective equipment. It is specified that this sensor be utilized only within systems implementing safety categories 2, 1 and B (safety-related categories for control systems), as determined by European Standard EN 954-1. This sensor must never be utilized in any system that requires the usage of category 4 equipment, such as press machines; nor for systems requiring category 3 equipment.

Refer to the instruction manual enclosed with this product for detailed instructions.

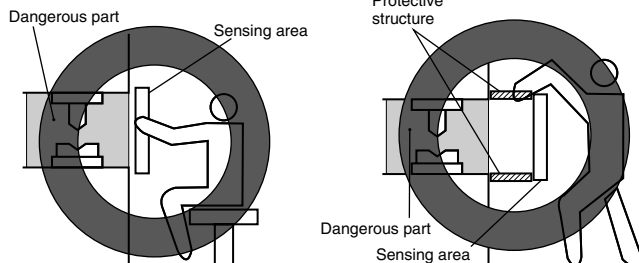
- Make sure to carry out the test run before regular operation.
- This safety system is for use only on machinery in which the dangerous parts can be stopped immediately, either by an emergency stop unit or by disconnecting the power supply. Do not use this system with machinery which cannot be stopped at any point in its operation cycle.

Sensing area

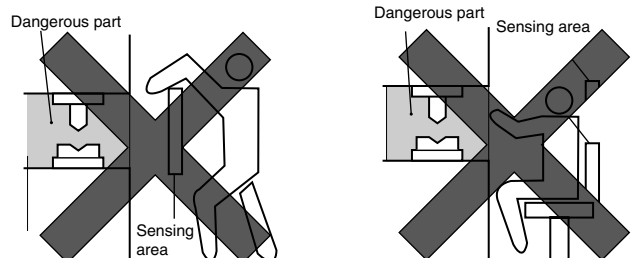


- Make sure to install this product such that any part of the human body must pass through its sensing area in order to reach the dangerous parts of the machinery. If the human body is not detected, there is a danger of serious injury or death.
- Do not use any reflective type or retro reflective type arrangement.

Correct mounting method



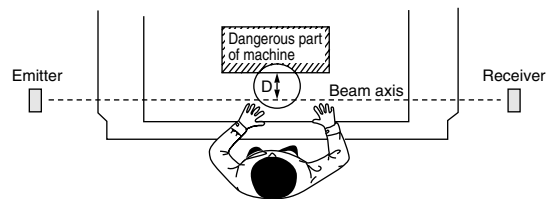
Wrong mounting method



Safety distance



Calculate the safety distance correctly, and always maintain a distance which is equal to or greater than the safety distance, between the sensing area of this sensor and the dangerous parts of the machinery.
If the safety distance is miscalculated or if sufficient distance is not maintained, there is a danger of serious injury or death.



- Safety distance is calculated based on the following equation when a person moves perpendicular (normal intrusion) to the sensing area of the sensor.

For use in Europe (as per prEN 999)

- Equation 1 $D = K \times T + C$
D: Safety distance (mm)
Minimum required distance between the surface of the sensing area and dangerous part of machine.
K: Intrusion velocity of operator's body (hand, finger, etc.) (mm/sec.)
SF2-NH□(-PN): 200mm/s
SF2-NA□(-PN): 1600mm/s
T: Response time of total equipment (sec.)
 $T = T_m + T_{SF2}$
 T_m : Maximum halt time of device (sec.)
 T_{SF2} : Response time of the **SF2-N** series 0.015 (sec.)
C: Additional distance calculated from the size of the minimum sensing object of the area sensor (mm)
Note that the value of C is not 0 or less.
SF2-NH□(-PN): $C = 8 \times (d - 14)$ mm, $d = 30$ mm
SF2-NA□(-PN): $C = 850$ mm
Comment:
When d is more than 40mm and less than 70mm, the standard stipulates that the additional distance is $C = 850$ mm.


For use in U.S.A. (as per ANSI B11.19)

- Equation 2 $D = K \times (T_s + T_c + T_{SF2} + T_{bm}) + D_{pf}$
D: Safety distance (mm)
Minimum required distance between the surface of the sensing area and dangerous part of machine.
K: Intrusion velocity of operator's body (hand, finger, etc.) (mm/sec.)
Normally taken as $63 \text{ (inch/sec.)} \approx 1,600 \text{ (mm/sec.)}$ for calculation.
 T_s : Halt time calculated from the operation time of the control element (air valve, etc.) (sec.)
 T_c : Maximum response time of the control circuit required for functioning the brake. (sec.)
 T_{SF2} : Response time of the **SF2-N** series 0.015 (sec.)
 T_{bm} : Additional halt time tolerance for the brake monitor (sec.)
 $T_{bm} = T_a - (T_s + T_c)$
 T_a : Setting time of brake monitor (sec.)
 D_{pf} : Additional distance calculated from the size of the minimum sensing object of the area sensor (mm)
SF2-NH□(-PN) $D_{pf} = 78.2$ mm,
SF2-NA□(-PN) $D_{pf} = 146.2$ mm
 $D_{pf} = 3.4 \times (d - 0.276)$ (inch)
 $D_{pf} = 3.4 \times (d - 7)$ (mm)
d: Minimum sensing object diameter 1.2 (inch) ≈ 30 (mm)
SF2-NH□(-PN)
Minimum sensing object diameter 2.0 (inch) ≈ 50 (mm)
SF2-NA□(-PN)
Note that the value of D_{pf} is not 0 or less.

SF2-N

PRECAUTIONS FOR PROPER USE

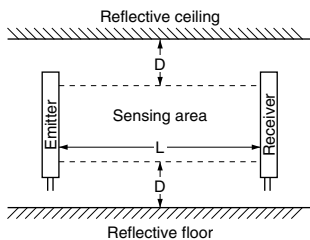
Influence of reflective surface



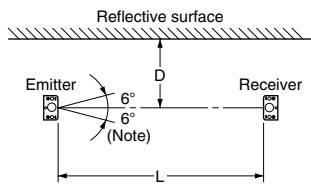
Install the sensor by considering the effect of nearby reflective surfaces and taking suitable countermeasures. Failure to do so may cause the sensor not to detect, resulting in serious injury or death.

- Keep the minimum distance given below, between the sensor and a reflective surface.

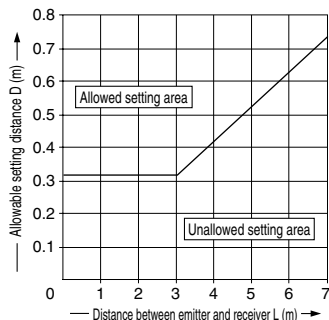
Side view



Top view



Distance between emitter and receiver, L	Allowable setting distance, D
0.3 to 3m	0.31m
3 to 7m	$L \times \tan \theta^\circ \theta = 6$ $= L \times 0.105 \text{ (m)}$



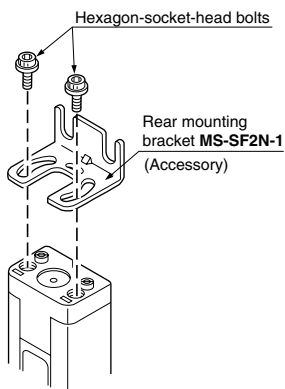
Note: The effective aperture angle for this sensor is $\pm 5^\circ$ (with $L > 3\text{m}$) as required by IEC 61496-2. However, install this sensor away from the reflective surfaces, assuming an effective aperture angle of $\pm 6^\circ$ to provide for misalignment, etc., during installation.

Mounting

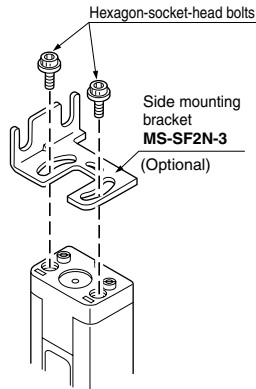
Mounting of sensor mounting bracket (MS-SF2-1/3)

- Choose the sensor mounting bracket based on the mounting direction (side or rear), and temporarily tighten the brackets with two M3 (length 5mm) hexagon-socket-head bolts for adjusting the mounting angle. After the beam-axis alignment, tighten then bolts completely. When mounting the sensor, the tightening torque should be 0.6N.m or less.

<Back mounting>



<Side mounting>

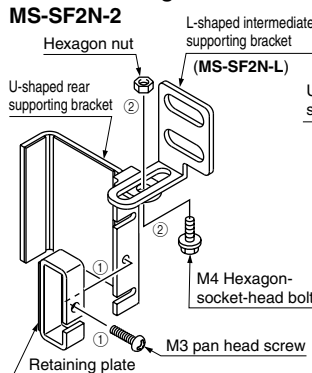


Mounting of intermediate supporting bracket (MS-SF2N-2/4)

- ① Place the retaining plate on the U-shaped rear/side supporting bracket and temporarily tighten them with M3 (length 10mm) pan head screw.
- ② Temporarily tighten the L-shaped intermediate supporting bracket to the U-shaped rear/side supporting bracket with a M4 (length 10mm) hexagon-socket-head bolt.

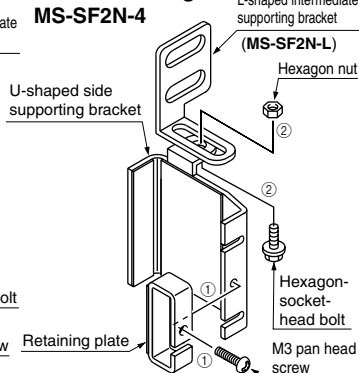
<Back mounting>

MS-SF2N-2



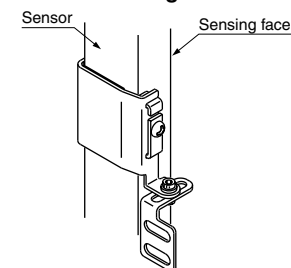
<Side mounting>

MS-SF2N-4

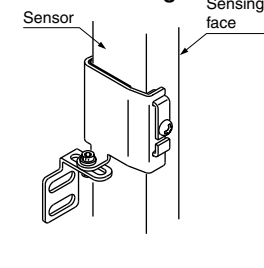


- ③ Clamp the sensor main body with the U-shaped rear/side supporting bracket and completely tighten M3 pan head screw that secures the retaining plate. After the beam-axis alignment, ensure that the M4 hexagon-socket-head bolt, which was used to temporarily attach the L-shaped intermediate supporting bracket to the U-shaped rear/side supporting bracket, is now fully tightened.

<Back mounting>




<Side mounting>



Note: The above illustrations show how to mount the emitter onto the intermediate supporting brackets. Note that the top and bottom orientation will be reversed when mounting the receiver to the supporting brackets.

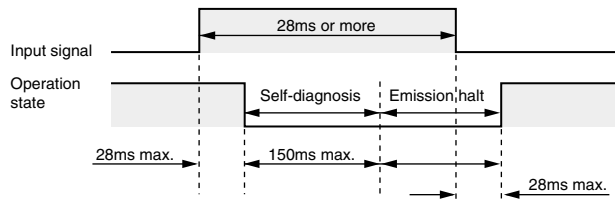
Test input (self-diagnosis function)/ Emission halt function



In order to maintain safety, carry out the self-diagnosis at least once a day.

- If the test input is kept open for 28ms, or more, detailed diagnosis, in addition to the internal self-diagnosis being done during normal operation, is carried out. In case no abnormality is discovered during self-diagnosis, and if the test input is continued to be kept open after that, emission halt state is achieved. In case an abnormality is discovered during self-diagnosis, the device is put in the lockout state at that instant, and the OSSD and alarm outputs are fixed at the OFF state.
- Emission halt state is achieved when no abnormality is detected during self-diagnosis and the test input is continued to be kept open after that. During emission halt, OSSD and alarm output become OFF. By using this function, malfunction due to extraneous noise, or abnormality in OSSD and alarm output, can be determined even from the equipment side.

Time chart



PRECAUTIONS FOR PROPER USE

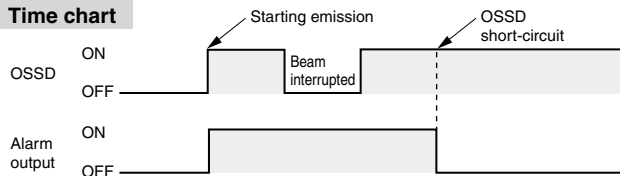
Alarm output



Be sure to use the alarm output.

- Since the occurrence of a fault, such as that due to an external short-circuit, cannot be conveyed to the equipment side by OSSD, the alarm output generates a warning signal. Design a system such that the equipment can be stopped when either OSSD or alarm output is output.

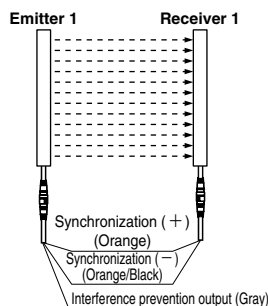
Time chart



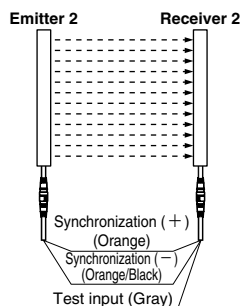
Interference prevention function

- Interference can be prevented between 3 sets max. [128 beam channels max. (SF2-NA□(-PN): 64 beam channels max.)] for series connection, 2 sets max. for parallel connection, and 6 sets max. for series and parallel mixed connection. In this case, connect interference prevention output (gray) of Sensor A (master side) and test input (gray) of Sensor B (slave side).

Sensor A (master side)



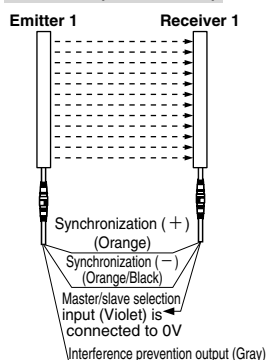
Sensor B (slave side)



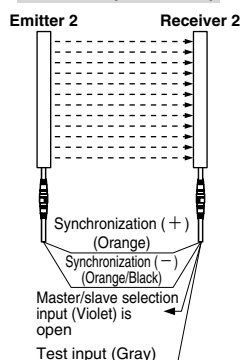
Master/slave selection input

- In case of parallel connection, or series and parallel mixed connection, before switching on the power supply, connect the master/slave selection input (violet) of Sensor A (master side), as master, to 0V and connect the master/slave selection input (violet) of Sensor B (slave side), as slave, to open. The master/slave selection is done only once at the time of switching on of the power supply. If selection is done after switching on of the power supply, it does not change. Further if the master/slave selection input is kept open when the sensor is set as slave, ensure to insulate it.
- In case of series connection or when using 1 set, connect the master/slave selection input (violet), as master, to 0V.

Sensor A (master side)



Sensor B (slave side)



Connection

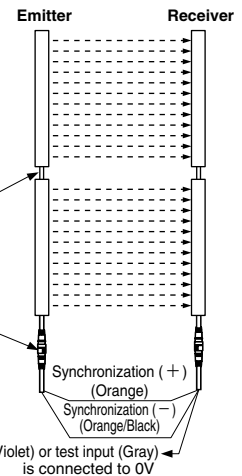
Series connection [3 sets max. (SF2-NH□(-PN): 128 beam channels max., SF2-NA□(-PN): 64 beam channels max.) connectable]

- When the danger region can be approached from two or more directions, multiple sets of emitters and receivers should be connected in series. When a beam of any set is interrupted, the output turns OFF.

Cable for series connection (optional)
SF2N-CSL02 (Length: 200mm)
SF2N-CSL05 (Length: 500mm)

Bottom cap cable for series connection (optional)
SF2N-CB05 (Length: 500mm) (Note)

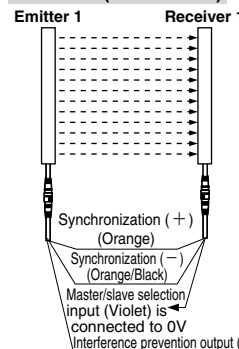
- Note: Bottom cap cables for series connection are required when either 3 sets, or a total of 48 beam channels or more [24 beam channels or more for SF2-NA□(-PN)], are connected in series.



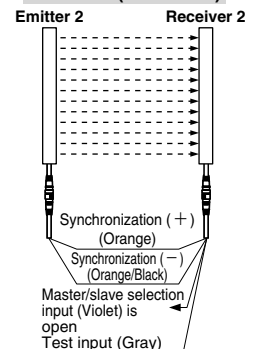
Parallel connection (2 sets max. connectable)

- To use the parallel connection method, two sets of emitters and receivers are connected in parallel. The interference prevention output (gray) from the master side must be connected to the test input (gray) from the slave side. This method can be utilized when there are two danger regions and each of them must be independently monitored. Since each output is separate from the other, if beams from only one pair of sensors are interrupted, the output from the other sensor pair remains unaffected.

Sensor A (master side)



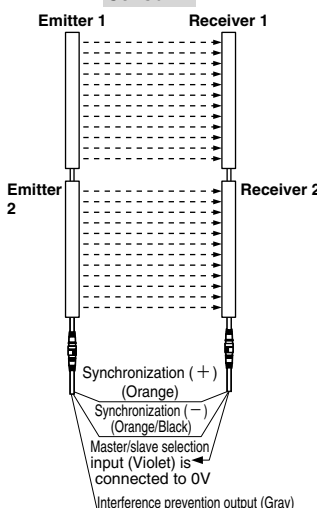
Sensor B (slave side)



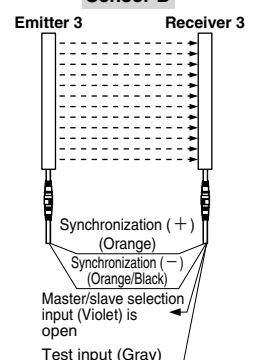
Series/Parallel mixed connection (Series connection: 3 sets, parallel connection: 2 sets connectable)

- The series/parallel mixed connection method supports the use of multiple emitters and receivers, connected in combinations of both series and parallel connections. This method can be utilized when there are two danger regions or more and when there are two entrances or more to the danger regions. For all series connections, outputs will move to the OFF state if beams for any of the beam channels are interrupted. However, as the outputs of the parallel connections are separate, if beams from any pair of parallel sensors are interrupted, outputs from all other parallel sensor pairs remain unaffected.

Sensor A



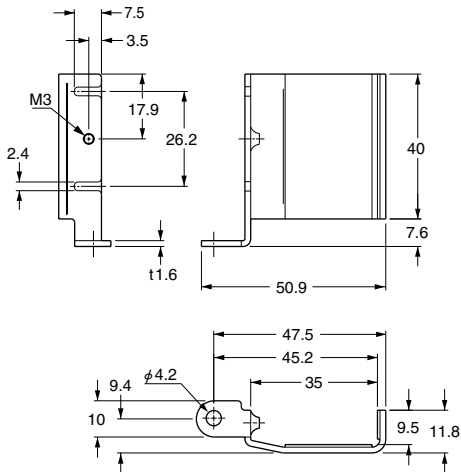
Sensor B



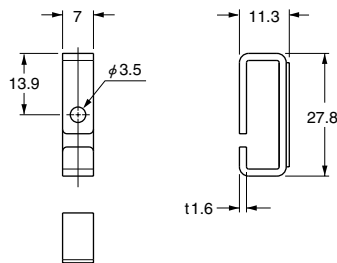
DIMENSIONS (Unit: mm)

MS-SF2N-2 U-shaped rear mounting intermediate supporting bracket (Accessory)

U-shaped rear supporting bracket



Retaining plate



Material: Cold rolled carbon steel (SPCC) (Black chromate)

Set of 2 Nos. each of U-shaped rear supporting brackets and retaining plates (Note)

Note: MS-SF2N-2 (U-shaped rear mounting intermediate supporting bracket) is attached with the following sensors. The number of attached U-shaped rear mounting intermediate supporting brackets is different depending on the sensor as follows.

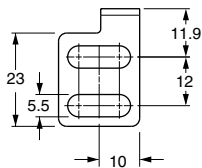
SF2-NH36(-PN), SF2-NH40(-PN), SF2-NA18(-PN), SF2-NA20(-PN): 1 set

SF2-NH48(-PN), SF2-NA24(-PN): 2 sets

SF2-NH56(-PN), SF2-NH64(-PN), SF2-NA28(-PN), SF2-NA32(-PN), SF2-NA36(-PN): 3 sets

SF2-NA40(-PN): 4 sets

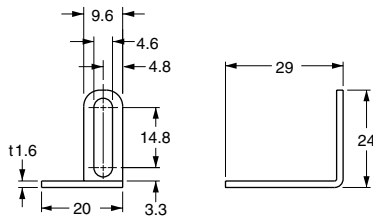
MS-SF2N-L L-shaped intermediate supporting bracket (Accessory)



Material: Cold rolled carbon steel (SPCC) (Black chromate)

Two L-shaped bracket set

Two M3 (length 10mm) pan head screws,
two M4 (length 10mm) hexagon-socket-head
bolts, and two nuts are attached.



Note: MS-SF2N-L (L-shaped intermediate supporting bracket) is attached with the following sensors. The number of attached L-shaped intermediate supporting brackets is different depending on the sensor as follows.

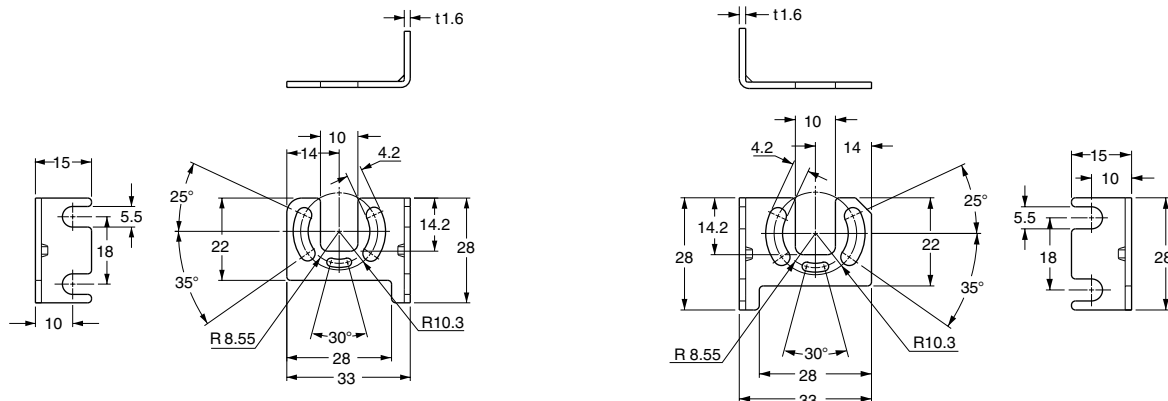
SF2-NH36(-PN), SF2-NH40(-PN), SF2-NA18(-PN), SF2-NA20(-PN): 1 set

SF2-NH48(-PN), SF2-NA24(-PN): 2 sets

SF2-NH56(-PN), SF2-NH64(-PN), SF2-NA28(-PN), SF2-NA32(-PN), SF2-NA36(-PN): 3 sets

SF2-NA40(-PN): 4 sets

MS-SF2N-3 Side mounting bracket (Optional)



Material: Cold rolled carbon steel
(SPCC) (Black chromate)

Four bracket set

Right side-mounting of sensors

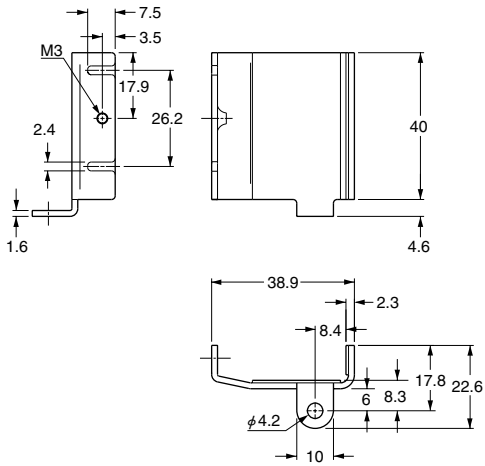
Left side-mounting of sensors

SF2-N

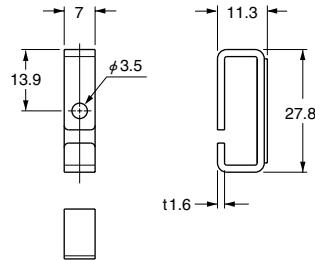
DIMENSIONS (Unit: mm)

MS-SF2N-4 U-shaped side mounting intermediate supporting bracket (Optional)

U-shaped side supporting bracket



Retaining plate



Material: Cold rolled carbon steel(SPCC) (Black chromate)

Set of 2 Nos. each of U-shaped side supporting brackets and retaining plates (Note)

Note: **MS-SF2N-4** (U-shaped side mounting intermediate supporting bracket) is attached with the following sensors. The number of attached U-shaped side mounting intermediate supporting bracket is different depending on the sensor as follows.

SF2-NH36(-PN), SF2-NH40(-PN), SF2-NA18(-PN), SF2-NA20(-PN): 1 set

SF2-NH48(-PN), SF2-NA24(-PN): 2 sets

SF2-NH56(-PN), SF2-NH64(-PN), SF2-NA28(-PN), SF2-NA32(-PN), SF2-NA36(-PN): 3 sets

SF2-NA40(-PN): 4 sets